4th INTERNATIONAL CONFERENCE ON

AGRICULTURE AND ANIMAL HUSBANDRY

Advances in Agriculture and Animal Sciences towards Global Food Security

AUGUST 28-30, 2019

UNIVERSITY OF HYDERABAD
HYDERABAD, INDIA

www.endlingconferences.com
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Mrs. Sudha Reddy
Founder and Managing Director

KN Bio Sciences India Pvt. Ltd.
Behind SLI Power Engineers
Bachupally Rd, Industrial Area,
Ameenpur, Miyapur
Hyderabad, Telangana – 502325
Phone: +91 40 2304 5337
E mail: info@knbiosciences.com,
sudhaknbil@gmail.com
On behalf of the Organizing Committee, it is my pleasure to invite you to attend and participate in “International Conference on Agriculture and Animal Husbandry” and be part of explication to global food security.

Inauguration Session : August 28, 2019 (09:30 AM)

**Chief Guest**
Sri Singireddy Niranjan Reddy Garu  
Hon’ble Minister of Agriculture, Govt. of Telangana

**Guest of Honour**
Prof. P. Appa Rao  
Vice Chancellor, University of Hyderabad, Hyderabad

**Distinguished Guest**
Dr. V. Praveen Rao  
Vice Chancellor, PJTSAU, Rajendranagar, Hyderabad

**Distinguished Guest**
Dr. W. R. Reddy, IAS  
Director General, NIRD & PR, Hyderabad

**Distinguished Guest**
Prof. K.P. Singh  
Vice Chancellor, CCS Haryana Agric. University, Hissar

**Distinguished Guest**
Dr. Ch. Srinivasa Rao  
Director, ICAR-NAARM, Hyderabad

**Distinguished Guest**
Dr. S.K. Malhotra  
Commissioner of Agriculture, Govt of India

**Distinguished Guest**
Dr. P.V. Mohan Rao  
Founder & CEO, PASURA, Hyderabad

**Chief Guest**
Sri C. Parthasarathi, IAS  
APC & Principal Secretary (Agric.), Govt. of Telangana

**Guest of Honour**
Dr. S.R. Voleti  
Director, ICAR-IIRR, Hyderabad

**Distinguished Guest**
Dr. Chindi Vasudevappa  
Vice Chancellor, NIFTEM, Haryana
Welcome Remarks by Conference Chairman

Prof. Devi Prasad Juvadi
Director, Centre for Good Governance, Hyderabad
President, Life Science Society, Hyderabad

As Chairman to “International Conference on Agriculture and Animal sciences”, it is a great pleasure to welcome you all to the conference at this magnificent campus of University of Hyderabad.

The theme for the conference “Advances in Agriculture and Animal Sciences towards Global Food security” is selected as it is the global challenge of the century. This challenge is highly dynamic and continually changing in response to a variety of local and global drivers. Examples of these drivers include a global population that is projected to reach 9.8 billion by 2050, as well as improving economies and shifts towards more resource intensive diets. Due to a deeply complex and diverse food system with interlocking local-to-global and short-to-long term elements, it is not surprising that the food security challenge is continually evolving, and solutions may vary from place-to-place and over time. To effectively address the food security challenge, scientists in agriculture and allied sciences are reshaping priorities according to the changing scientific and global landscape and developing concepts and solutions for ecological, economic and socially acceptable food production.

The programme of the conference encompasses plenary sessions, keynote presentations, concurrent technical sessions, poster sessions etc. During the conference, various global events and scientific developments that are likely to significantly change the global food security landscape over the next few years will be discussed. I am certain that presentations by the most qualified researchers in the world, will greatly contribute to global food security. Attending this conference will enable you to access unique, high-quality research, learn about technological advances in plant and animal sciences with awards attributed to various categories of presentations. I am confident and trust that these events would enable participants to draw an agenda for future research.

I quote, Noble Laureate Amartya Sen, “Doing one thing at a time is never particularly good advice when it comes to economic and social policy.” He called, therefore, for all of us to do many different things – together. It is the same appeal that I leave to you today, so that we can transform agriculture to transform our world.

I thank Life Science Society of Hyderabad and Endling Conferences for honouring me to be Chairman of the conference. My grateful thanks to the members of the Organizing Committee for cooperation, constructive comments and support to make the event possible and successful. I wish you a productive and enjoyable conference and comfortable stay in the historic city of Hyderabad, a home of wonderful, friendly and warm people.

Once again, a warm welcome and thank you
Welcome Remarks by Conference Co-Chair

Dr. R. Ratnakar
Consultant, Agricultural Extension
Hyderabad, India

It is my great pleasure to welcome you to the 4th International Conference on Agriculture and Animal Husbandry taking place during 28-30 August 2019 at University of Hyderabad. The event is organized by Endling Conferences in association with Life Science Society of Hyderabad whose members have supported together for engaging programme.

The ICAAH 2019 is one of the flagship conferences of the Endling Conferences. The main goal of this conference is to bring together scientists of agriculture and animal sciences and farmers to exchange their ideas by presenting their research findings and to participate in the deliberations. One of the important components of the event is “Rythu Goshti” to interact with famers and try to find practical approaches and solutions that help to increase farm incomes leading to doubling of farmer incomes by 2022.

We are fortunate to have the support of University of Hyderabad for providing the venue. We are grateful to our sponsors, PASURA…

I sincerely hope you will enjoy the event during the next three days of discussions and networking.

Thank you for your participation.
Remarks by Conference Scientific Advisor

Dr. Brajendra Parmar  
Principle Scientist  
ICAR- Indian Institute of Rice Research  
Rajendranagar, Hyderabad  
Vice-President, Life Science Society, Hyderabad

It is our great delight to welcome you to the ICAAH 2019 being organized by Endling Conferences in association with Life Science Society, Hyderabad. Life Science Society goal is to facilitate the exchange of ideas and collaborations between life scientists including agricultural scientists to sustain a broad view of the current cutting-edge developments in life sciences research.

This revered conference will be focusing on the theme “Advances in Plant and Animal Sciences towards Global Food Security” is expected to help researchers and academia to share views and ideas to improve their knowledge about advanced technologies emerged to increase the productivity in plant and animal sectors. We hope that the conference results in significant contribution to update the knowledge in life sciences.

All honourable participants who are making presentations are kindly encouraged to contribute their full-length manuscripts for publishing in Society Journals.

We extend a warm welcome to 4th International Conference on Agriculture & Animal Husbandry.
MESSAGE

I am happy to know that Life Science Society is organizing 4th International Conference on Agriculture and Animal Husbandry from 28-30 August, 2019 at Hyderabad.

Ensuring food and nutritional security for growing population from declining land and increasing consumption of resources in agriculture, industry and domestic sector in the scenario of climate change is a great challenge. Advances in agriculture and animal sciences is the outcome of research and new technologies particularly in areas of food safety, nutrition, genetics, breeding and per unit production of crops will prove boon in enhancing the income of farmers. There is need to address the challenges related to integrated farming system for improving the farmers income. Critical areas of research and development and resource should be identified both at national and international level.

I am sure the conference will examine the emerging issues and develop a roadmap to secure sustainable food production.

I wish the conference a grand success.

(S.K. Malhotra)
Agriculture Commissioner
## SCIENTIFIC PROGRAM

### DAY 1

**INAUGURAL PLENARY SESSION**

**HALL-1 AUDITORIUM, SCHOOL OF LIFE SCIENCES**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>08:30 - 09:30 am</td>
<td>Registrations</td>
</tr>
<tr>
<td>09:30 - 09:40 am</td>
<td>Inviting guests on to the Dais</td>
</tr>
<tr>
<td>09:40 - 09:50 am</td>
<td>Jyothi Prajwalana (Lighting of the Lamp)</td>
</tr>
<tr>
<td>09:50 - 10:00 am</td>
<td>Welcome Remarks by Prof. Devi Prasad Juvvadi, Conference Chairman</td>
</tr>
<tr>
<td>10:00 - 10:05 am</td>
<td>Address by Prof. Arun Agarwal, Vice Chancellor, UOH, Hyderabad</td>
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<tr>
<td>10:05 - 10:10 am</td>
<td>Address by Dr. V Praveen Rao, Vice Chancellor, PJTSAU, Hyderabad</td>
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<tr>
<td>10:10 - 10:15 am</td>
<td>Address by Dr. W. R. Reddy, Director General, NIRD &amp; PR, Hyderabad</td>
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<td>10:15 - 10:20 am</td>
<td>Address by Prof. K. P. Singh, Vice Chancellor, CCS HAU, Hisar, Haryana</td>
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<td>10:20 - 10:25 am</td>
<td>Address by Dr. Ch. Srinivasa Rao, Director, ICAR-NAARM, Hyderabad</td>
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<tr>
<td>10:25 - 10:30 am</td>
<td>Address by Dr. S. K. Malhotra, Commissioner of Agriculture, Govt. of India</td>
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<tr>
<td>10:30 - 10:35 am</td>
<td>Address by Dr. P. V. Mohan Rao, Founder &amp; CEO, PASURA, Hyderabad</td>
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**Release of Conference Compendium**

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>10:35 - 10:40 am</td>
<td>Address by Cheif Guest Sri Singireddy Niranjan Reddy, Hon. Minister of Agriculture, Govt. of Telangana</td>
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<tr>
<td>10:40 - 10:45 am</td>
<td>Felicitations to Chief Guest and Distinguished Guests</td>
</tr>
<tr>
<td>10:45 - 10:50 am</td>
<td>Vote of Thanks by Dr. R. Ratnakar, Co-Chair of the Conference</td>
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</tbody>
</table>

**NETWORKING & COFFEE BREAK 10:50 - 11:00 am**

**KEYNOTE FORUM**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>11:00 - 11:20 am</td>
<td>Sustainable Agricultural Systems: The Dry Chain a simple, low-cost system to boost food productivity and food safety</td>
</tr>
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<td></td>
<td>Cheryl Harrison, Vivia Foundation, Amsterdam, The Netherlands</td>
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<tr>
<td>11:20 - 11:40 am</td>
<td>Integrated Farming: Key for Enhanced Farmers Income in India</td>
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<td></td>
<td>Dr. Ch. Srinivasa Rao, Director, ICAR-NAARM, Hyderabad</td>
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<tr>
<td>11:40 - 12:00 pm</td>
<td>Circular Bioeconomy of Agrifarms</td>
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<td></td>
<td>Prof. K.P Singh, Vice Chancellor, CCS HAU, Haryana</td>
</tr>
<tr>
<td>12:00 - 12:20 pm</td>
<td>Advances in Agriculture towards Food Security</td>
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<tr>
<td></td>
<td>Dr. V. Praveen Rao, Vice Chancellor, PJTSAU, Hyderabad</td>
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<tr>
<td>Time</td>
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<tr>
<td>12:20 - 12:40 pm</td>
<td>Potentiality of cattle urine commercialization for organic farming</td>
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<td></td>
<td>Dr. A. K. M. Ahsan Kabir, Bangladesh Agricultural University, Bangladesh</td>
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<tr>
<td>12:40 - 01:00 pm</td>
<td>Dr. S.K. Malhotra, Commissioner of Agriculture, Govt. of India</td>
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<td></td>
<td><strong>LUNCH BREAK 01:00 - 02:00 pm</strong></td>
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<tr>
<td>11:00 - 01:00 pm</td>
<td><strong>SEMINAR HALL, SCHOOL OF LIFE SCIENCES</strong></td>
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<td></td>
<td><strong>RYTHU GOSHTI-INTERACTION WITH FARMERS</strong></td>
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<td></td>
<td>Panel of experts in Agriculture and Animal Sciences interact with</td>
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<td></td>
<td>farmers of Telangana and Andhra Pradesh</td>
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<tr>
<td></td>
<td><strong>Chair: R. Ratnakar</strong>, Former Professor, Extension Education, Hyderabad</td>
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<td></td>
<td><strong>Co-Chair: Shashi Vemuri</strong>, Former Professor, PJTSAU, India</td>
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<tr>
<td></td>
<td><strong>Expert Member: Dr. K. Padmaja</strong>, Asst. Director of Agriculture,</td>
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<td>Centre for Good Governance, Hyderabad</td>
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<td><strong>Expert Member: P. Ravindar Rao</strong>, Pasura Crop Care, Hyderabad</td>
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<td></td>
<td><strong>Expert Member: Mrs. Sudha Reddy</strong>, Founder and Managing Director,</td>
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<td>KN BioSciences India Pvt. Ltd.</td>
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<td><strong>Expert Member: Sri Dannapaneni Ashok Kumar</strong>, Ex. ADA and Agricultural</td>
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<td>Consultant, Jagityal</td>
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<td><strong>Co-ordinator: Sri E. Sreenivas</strong>, President, SIRI Foundation,</td>
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<td>Warangal</td>
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<td></td>
<td><strong>LUNCH BREAK 01:00 - 02:00 pm</strong></td>
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<td></td>
<td><strong>TECHNICAL SESSIONS</strong></td>
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<td></td>
<td><strong>HALL-1</strong></td>
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<tr>
<td></td>
<td><strong>AUDITORIUM, SCHOOL OF LIFE SCIENCES</strong></td>
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<tr>
<td></td>
<td><strong>SESSION 1: AGRONOMY AND CROP PRODUCTION</strong></td>
</tr>
</tbody>
</table>
### ISF-1: A high yielding-high oleic Indian safflower cultivar

**Anjani Kammili**, ICAR-Indian Institute of Oilseeds Research, Hyderabad

### Cropping systems for food security vis-à-vis climate change in rain-fed areas

**V. Maruthi**, Central Research Institute for Dryland Agriculture, Hyderabad

### Safety of insecticidal sprays to spider and predatory coccinellids in varied rice cultivation systems

**G. Anitha**, PJTSAU, Hyderabad

### Mineral biofortification of sorghum grains: Factors influencing variability

**Venkateswarlu R**, ICAR-Indian Institute of Millets Research, Hyderabad

### Performance of cluster frontline demonstrations on groundnut (*Arachis hypogaea*) in Andhra Pradesh, India

**B. Malathi**, ICAR- Agricultural Technology Application Research Institute, Hyd

### Toxicity studies on different populations of brown Plant Hopper

**G. Venugopal**, PJTSAU, Hyderabad, Telangana

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**Chair**: Anjani Kammili, ICAR-Indian Institute of Oilseeds Research, India  
**Co-Chair**: V. Maruthi, Central Research Institute for Dryland Agriculture, Hyderabad

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<table>
<thead>
<tr>
<th>Time</th>
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<th>Speaker</th>
<th>Institution</th>
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<tbody>
<tr>
<td>02:00 - 02:15 pm</td>
<td>ISF-1: A high yielding-high oleic Indian safflower cultivar</td>
<td><strong>Anjani Kammili</strong>, ICAR-IOSR</td>
<td>Hyderabad</td>
</tr>
<tr>
<td>02:15 - 02:30 pm</td>
<td>Cropping systems for food security vis-à-vis climate change in rain-fed areas</td>
<td><strong>V. Maruthi</strong>, CRIDA</td>
<td>Hyderabad</td>
</tr>
<tr>
<td>02:30 - 02:45 pm</td>
<td>Safety of insecticidal sprays to spider and predatory coccinellids in varied rice cultivation systems</td>
<td><strong>G. Anitha</strong>, PJTSAU</td>
<td>Hyderabad</td>
</tr>
<tr>
<td>02:45 - 03:00 pm</td>
<td>Mineral biofortification of sorghum grains: Factors influencing variability</td>
<td><strong>Venkateswarlu R</strong>, ICAR-MIR</td>
<td>Hyderabad</td>
</tr>
<tr>
<td>03:00 - 03:15 pm</td>
<td>Performance of cluster frontline demonstrations on groundnut (<em>Arachis hypogaea</em>) in Andhra Pradesh, India</td>
<td><strong>B. Malathi</strong>, ATARI</td>
<td>Hyderabad</td>
</tr>
<tr>
<td>03:15 - 03:30 pm</td>
<td>Toxicity studies on different populations of brown Plant Hopper</td>
<td><strong>G. Venugopal</strong>, PJTSAU</td>
<td>Hyderabad</td>
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</table>

**NETWORKING/COFFEE BREAK 03:30-03:45 pm**

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**Chair**: G. C. Satisha, ICAR-IIHR, Bangalore

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<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Institution</th>
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<tbody>
<tr>
<td>03:45 - 04:00 pm</td>
<td>Synthesis of Zno Nano-particles and its positive effect on Cole crops: A way towards the development of ‘Nano-fertilizers’ to enhance crop production</td>
<td><strong>G. C. Satisha</strong>, ICAR-IIHR</td>
<td>Bangalore</td>
</tr>
<tr>
<td>04:00 - 04:15 pm</td>
<td>Performance of wheat crop under kinnow and eucalyptus based Agri-Silvi and Agri-Silvi-Horti system</td>
<td><strong>Parvinder Kumar</strong>, CCS Haryana Agricultural University</td>
<td>Haryana</td>
</tr>
</tbody>
</table>
### 4th International Conference on
Agriculture & Animal Husbandry

**Advances in Agriculture & Animal Sciences towards Global Food Security**

**University of Hyderabad**

**August 28 - 30, 2019**

<table>
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>04:15 - 04:30 pm</td>
<td>Dwarf oil palm: Breeding to next generation sequencing era – Indian scenario</td>
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<td></td>
<td>B. Kalyana Babu, ICAR-Indian Institute of Oil Palm Research, India</td>
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<tr>
<td>04:30 - 04:45 pm</td>
<td>Effect of botanicals on per cent green gram seed infestation by pulse beetle</td>
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<td></td>
<td>Lalsingh Rathod, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, India</td>
</tr>
<tr>
<td>04:45 - 05:00 pm</td>
<td>Characterization of Nonhost Resistance and Programmed Cell Death in <em>Arabidopsis</em> against Rice Blast</td>
</tr>
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<td></td>
<td>Kalpana Dalei, National Institute of Technology Rourkela, India</td>
</tr>
</tbody>
</table>

**HALL-2**

**SESSION 2: ANIMAL HUSBANDRY**

**LUNCH BREAK 01:00 - 02:00 pm**

**KEYNOTE FORUM**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>02:00 - 02:15 pm</td>
<td>Food-feed crops from Indian perspective</td>
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<td></td>
<td>Y. Ramana Reddy, NIRD &amp; PR, Hyderabad, Telangana</td>
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<tr>
<td>02:15 - 02:30 pm</td>
<td>Role of trace minerals in optimizing reproductive performance in ruminants</td>
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<td></td>
<td>D. Nagalakshmi, PVNRTVU, Telangana</td>
</tr>
<tr>
<td>02:30 - 02:45 pm</td>
<td>Role of Livestock sector in sustainable rural development</td>
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<td></td>
<td>Satish Kumar, Central University of Haryana, India</td>
</tr>
</tbody>
</table>

**TECHNICAL SESSIONS**

**Chair:** M. Balakrishnan, ICAR-National Academy of Agricultural Research Management

**Co-Chair:** Sonu Gandhi, DBT-National Institute of Animal Biotechnology

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>02:45 - 03:00 pm</td>
<td>Database design and development for fodder information resources of Bay Islands</td>
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<tr>
<td></td>
<td>M. Balakrishnan, ICAR-NAARM, Hyderabad</td>
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<tr>
<td>Time</td>
<td>Title</td>
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<tr>
<td>03:00 - 03:15 pm</td>
<td>Proteases as a biomarker for livestock diseases in animals</td>
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<tr>
<td>03:15 - 03:30 pm</td>
<td>Health management competencies of dairy farmers in AP</td>
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<tr>
<td>03:30 - 03:45 pm</td>
<td>NETWORKING/COFFEE BREAK 03:30-03:45 pm</td>
</tr>
<tr>
<td>03:45 - 04:00 pm</td>
<td>An information technology enabled sheep advisory system: Perceptions of sheep farmers and veterinary officials</td>
</tr>
<tr>
<td>04:00 - 04:15 pm</td>
<td>Yeast expressed consensus S1 glycoprotein afforded partial protection against avian infectious bronchitis in the chicken</td>
</tr>
<tr>
<td>04:15 - 04:30 pm</td>
<td>Occurrence of <em>Escherichia coli</em> O157: H7 in Hyderabad &amp; Karnataka region sheep and goats</td>
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<tr>
<td>04:30 - 04:45 pm</td>
<td>Evaluation of the physical characteristics of complete feed blocks containing different binders</td>
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<tr>
<td>04:45 - 05:00 pm</td>
<td>Physiological response to heat stress in crossbred and indigenous cows</td>
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<tr>
<td>05:00 - 05:15 pm</td>
<td>Profile analysis of marathwadi buffalo rearers</td>
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<tr>
<td>05:15 - 05:30 pm</td>
<td>Effectiveness of <em>Lathyrus sativus</em> l. grain as animal feed</td>
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### SESSION 3: HORTICULTURE AND FLORICULTURE

**Chair:** P. D. Kamala Jayanthi, Principle Scientist, ICAR, IIHR, Hyderabad  
**Co-Chair:** Anuburani, Professor, Annamalai University, Tamil Nadu

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Presenter/Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>02:00 - 02:15 pm</td>
<td>Role of semiochemicals for horticultural insect pest management: Unexplored domain</td>
<td>P D Kamala Jayanthi, ICAR-IIHR, Bangalore, Karnataka</td>
</tr>
<tr>
<td>02:15 - 02:30 pm</td>
<td>Effect of organic management techniques on influencing yield and nutrient uptake of radish (<em>Raphanus sativus</em> L.) var. Pusa Chetki</td>
<td>Anuburani, Annamalai University, Chennai, Tamil Nadu</td>
</tr>
<tr>
<td>02:30 - 02:45 pm</td>
<td>Effects of Oxycure and Alovera leaf powder supplementation on gut health of heat stressed Vanaraja birds</td>
<td>B. Swathi, College of Veterinary Science, Hyderabad Telangana</td>
</tr>
<tr>
<td>02:45 - 03:00 pm</td>
<td>Effect of different colour of shadenet and growing media on the chemical characteristics and yield of spinach cultivated by hydroponics</td>
<td>Suchita V. Gupta, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola</td>
</tr>
<tr>
<td>03:00 - 03:15 pm</td>
<td>Potential of different media based and floricultural crops grown horizontal subsurface flow-constructed wetland system for water stress mitigation</td>
<td>Paritosh Kumar, ICAR-National Institute of Abiotic Stress Management</td>
</tr>
<tr>
<td>03:15 - 03:30 pm</td>
<td>Effect Glycerol Monostearate and Carboxy Methyl Cellulose on foaming properties of Guava pulp under foam mat drying</td>
<td>Bhagyashree Patil, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola</td>
</tr>
<tr>
<td>03:45 - 04:00 pm</td>
<td>Identification of QTLs in oil palm (<em>Elaeis guineensis</em> Jacq.) for vegetative traits using SSR markers through association mapping</td>
<td>H. P Bhagya, ICAR-Indian Institute of Oil Palm Research, Pedavegi, AP</td>
</tr>
<tr>
<td>04:00 - 04:15 pm</td>
<td>Evaluation of different chemicals for improving the shelf life of mushrooms</td>
<td>M. Prameela, PJTSAU, Hyderabad, Telangana</td>
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**NETWORKING/COFFEE BREAK 03:30-03:45 pm**
### TECHNICAL SESSIONS

#### SESSION 4: PLANT HEALTH & BIO SECURITY

**Chair:** M V Jagannadham, CSIR-Centre for Cellular and Molecular Biology  
**Co-Chair:** M K Reddy, International Centre for Genetic Engineering and Biotechnology

<table>
<thead>
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<th>Institution</th>
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</thead>
<tbody>
<tr>
<td>10:00 - 10:15 am</td>
<td>Structural and functional studies on membrane vesicles of Bacteria</td>
<td>M V Jagannadham</td>
<td>CSIR-Centre for Cellular and Molecular Biology, Hyd</td>
</tr>
<tr>
<td>10:15 - 10:30 am</td>
<td>Engineering herbicide resistance in crop plants for effective weed</td>
<td>M K Reddy</td>
<td>Intl Centre for Genetic Engineering and Biotechnology, New Delhi</td>
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<td></td>
<td>management in agriculture</td>
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</tbody>
</table>

**Impact of climate change on Agriculture/Food Security**

**Promotion of silk worm Egg production centres – spring board for booming Bivoltine silk production through sustainable farming practices in India**
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</thead>
<tbody>
<tr>
<td>10:30 - 10:45 am</td>
<td><strong>Exogenous based RNAs: A boon for managing biotic stress</strong>&lt;br&gt;<strong>Anita Puyam,</strong> Rani Lakshmi Bai Central Agricultural University, Jhansi, UP</td>
</tr>
<tr>
<td>10:45 - 11:00 am</td>
<td><strong>Evaluation of Insecticides against pod Borers in pigeonpea</strong>&lt;br&gt;<strong>B. Anil Kumar,</strong> PJTSAU, Hyderabad, Telangana</td>
</tr>
<tr>
<td>11:15 - 11:30 am</td>
<td><strong>Monitoring and management of insect pests through manipulation of insect signaling</strong>&lt;br&gt;<strong>Pratap A. Divekar,</strong> ICAR-Indian Institute of Vegetable Research, UP</td>
</tr>
<tr>
<td>11:30 - 11:45 am</td>
<td><strong>Plant Health for Food Security- A Moving Target</strong>&lt;br&gt;<strong>J. Kumar,</strong> G.B.Pant University of Agriculture &amp; Technology, Panthnagar, UK</td>
</tr>
<tr>
<td>11:00-11:15 am</td>
<td><strong>NETWORKING/COFFEE BREAK</strong></td>
</tr>
<tr>
<td>11:45 - 12:00 pm</td>
<td><strong>Genomic approaches for enhancing agronomic traits in sesame</strong>&lt;br&gt;(<strong>Sesamum indicum</strong> L.): Present status and future perspectives&lt;br&gt;<strong>H. H. Kumaraswamy,</strong> ICAR-Indian Institute of Oilseeds Research</td>
</tr>
<tr>
<td>12:00 - 12:15 pm</td>
<td><strong>Sesame</strong> (<strong>Sesamum indicum</strong> L.) genetic improvement approaches: Current status and future perspectives&lt;br&gt;<strong>K.T. Ramya,</strong> ICAR-IIOR, Hyderabad, Telanagana</td>
</tr>
<tr>
<td>12:15 - 12:30 pm</td>
<td><strong>Mapping of brown planthopper</strong> [<strong>Nilaparvata lugens</strong> (Stal)]** resistance gene (bph5)** in rice (<strong>Oryza sativa</strong> L.)&lt;br&gt;<strong>G. Padmavathi,</strong> ICAR-IIRR, Hyderabad, Telanagana</td>
</tr>
<tr>
<td>12:30 - 12:45 pm</td>
<td><strong>Confectionery traits evaluation in advanced breeding lines (abls) of groundnut</strong>&lt;br&gt;<strong>Praveen Kona,</strong> ICAR-Directorate of Groundnut Research, Gujarat</td>
</tr>
<tr>
<td>12:45 - 01:00 pm</td>
<td><strong>Characterization and variability analysis for qualitative and quantitative traits of indigenous and exotic germplasm accessions of rice</strong> (<strong>Oryza sativa</strong> L.)&lt;br&gt;<strong>G. C. Ojha,</strong> Krishi Vigyan Kendra, Chhatarpur, MP</td>
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<td>Time</td>
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<tr>
<td>02:00</td>
<td>Pre-breeding to broaden the genetic base of hybrid rice parental lines to enhance yield heterosis</td>
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<td>Revathi Ponnuswamy, ICAR-IIRR, Hyderabad, Telangana</td>
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<tr>
<td>02:15</td>
<td>Seed priming effect of salicylic acid on antioxidant enzymes in rabi maize (<em>Zea Mays L.</em>) during low temperature Stress</td>
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<td>Preeti Singh, Banaras Hindu University, Varanasi, UP</td>
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<td>02:30</td>
<td>Identification and characterization of miRNAs differentially expressed in rice spikelets based on their spatial location during</td>
</tr>
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<td></td>
<td>Tilak Chandra, Institute of Life Sciences, Bhubaneswar, Orissa</td>
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<tr>
<td>03:00</td>
<td>Rainwater harvesting through on farm reservoirs: A sustainable and profitable climate resilient technology for Semi arid regions of India</td>
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<td></td>
<td>K S Reddy, ICAR-CRIDA, Hyderabad, Telangana</td>
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<tr>
<td>03:15</td>
<td>Geospatial technologies in sustainable agriculture and food security</td>
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<td>P. D. Sreekanth, ICAR-NAARAM, Hyderabad, Telangana</td>
</tr>
<tr>
<td>03:45</td>
<td>Interactive effect of temperature and CO₂ on rice brown planthopper, <em>Nilaparvata lugens</em> (Stal.)</td>
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<td>R. Sunitha PJTSAU, Hyderabad, Telangana</td>
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<tr>
<td>04:00</td>
<td>Novel automated system for extraction of plant genomic DNA for genetic analysis of plant biological systems</td>
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<td>Devanshi Gohil, HiMedia Laboratories Pvt. Ltd, Mumbai</td>
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**LUNCH BREAK 01:00 - 02:00 pm**

**SESSION 6 CLIMATE CHANGE AND MITIGATION**

**KEYNOTE FORUM**

<table>
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<tr>
<th>Time</th>
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<tr>
<td>02:00</td>
<td>Rainwater harvesting through on farm reservoirs: A sustainable and profitable climate resilient technology for Semi arid regions of India</td>
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<tr>
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<td>K S Reddy, ICAR-CRIDA, Hyderabad, Telangana</td>
</tr>
<tr>
<td>03:00</td>
<td>Geospatial technologies in sustainable agriculture and food security</td>
</tr>
<tr>
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<td>P. D. Sreekanth, ICAR-NAARAM, Hyderabad, Telangana</td>
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**TECHNICAL SESSIONS**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>03:15</td>
<td>Interactive effect of temperature and CO₂ on rice brown planthopper, <em>Nilaparvata lugens</em> (Stal.)</td>
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<td></td>
<td>R. Sunitha PJTSAU, Hyderabad, Telangana</td>
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**NETWORKING/COFFEE BREAK 03:30 - 03:45 PM**

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<th>Time</th>
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<tr>
<td>03:45</td>
<td>Novel automated system for extraction of plant genomic DNA for genetic analysis of plant biological systems</td>
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<td>Devanshi Gohil, HiMedia Laboratories Pvt. Ltd, Mumbai</td>
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<tr>
<td>Time</td>
<td>Session</td>
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</table>
| 04:00 - 04:15 pm | Climate resilient sweet sorghum cultivars and agro-technologies for biofuel production in India  
S. S. Rao, ICAR- IIMR, Hyderabad, Telangana |
| 04:15 - 04:30 pm | Climate change vulnerability and farmers suicide: An empirical analysis in indian context  
G. Sridevi, University of Hyderabad, Hyderabad |
| 04:30 - 04:45 pm | Biofuel Production from Indigenous microalgae  
Swarnalatha G.V, Rayalaseema University, Kurnool, AP |
| 04:45 - 05:00 pm | Barriers to adoption of climate resilient rice production practices: A study in Nalgonda District of Telangana State, India  
Amtul Waris, ICAR-IIIR, Hyderabad, Telangana |
| 05:00 - 05:15 pm | Studies on phenophagic thermal requirement of soybean (Glycine max) under varied climatic conditions  
M G Jadhav, Vasantrao Naik Marathwada Agricultural University, Parbhani |

**HALL-2**

**SESSION 7 AGRICULTURE MACHINERY & TECHNOLOGIES**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</table>
| 09:00 - 09:15 am | Food processing machinery and technologies  
D G Rao, CFTRI, Hyderabad |
| 09:15 - 09:30 am | Studies on the impact of Annamalai ring bud technology as source of planting material in SSI method of sugarcane cultivation  
Karthikeyan. A, Annamalai University, Chennai, Tamil Nadu |
| 09:30 - 09:45 am | A tractor drawn right-hand combination offset disc harrow for handling stubble in rice-wheat cropping system  
Hifjur Raheman, Indian Institute of Technology Kharagpur, UP |
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Presenter</th>
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</thead>
<tbody>
<tr>
<td>09:45 - 10:00 am</td>
<td>Strategies for minimization of natural resources by zero tillage technique in agriculture</td>
<td>Bishnu Deo Singh, Krishi Vigyan Kendra, Barh, Bihar</td>
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<tr>
<td><strong>HALL-2</strong></td>
<td><strong>SESSION 8: SOIL HEALTH</strong></td>
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<tr>
<td>10:00 - 10:15 am</td>
<td>Utilization of inland saline soils for aquaculture and reclamation through an innovative integrated approach</td>
<td>A.K. Reddy, ICAR-Central Institute of Fisheries Education, Mumbai</td>
</tr>
<tr>
<td>10:15 - 10:30 am</td>
<td>Understanding and improving phosphate-use-efficiency in crops for sustainable agriculture and food security</td>
<td>Rahul Kumar, University of Hyderabad, Hyderabad</td>
</tr>
<tr>
<td>10:30 - 10:45 am</td>
<td>Consequence of integrated nutrient management on phenotype and nutrient uptake of irrigated groundnut (<em>Arachis hypogaea</em> l.) Var. Vri-2 for sandy loam soils</td>
<td>C. Ravikumar, Annamalai University, Chennai, Tamil Nadu</td>
</tr>
<tr>
<td>10:45 - 11:00 am</td>
<td>Bacterially derived biopolymer for enhancing abiotic stress tolerance and improving soil health</td>
<td>Kamlesh Kumar Meena, ICAR-National Institute of Abiotic Stress Management</td>
</tr>
<tr>
<td>11:15 - 11:30 am</td>
<td>Trace elements in Agro-ecosystems – Relevance to productivity and human health</td>
<td>M.N.V. Prasad, University of Hyderabad, Hyderabad</td>
</tr>
<tr>
<td>11:30 - 11:45 am</td>
<td>Impact assessment of soil health card (shc) scheme on production and productivity and soil health in Bihar</td>
<td>R. K. Sinha, TM Bhag.University, Bhagalpur, Bihar</td>
</tr>
<tr>
<td>11:45 - 12:00 pm</td>
<td>Conservation agriculture for improving the soil health, nutrient use efficiency, cane, water productivity and environmental quality in sugarcane cropping system</td>
<td>Rahul J. Patil, ICAR-National Institute of Abiotic Stress Management</td>
</tr>
<tr>
<td>12:00 - 12:15 pm</td>
<td>Soil protection is a need for tomorrow: Remarkable ways to conserve soil</td>
<td>Rakesh S, ICAR-NAARM, Hyderabad, Telangana</td>
</tr>
<tr>
<td><strong>NETWORKING/COFFEE BREAK 11:00 - 11:15 am</strong></td>
<td><strong>HALL-2</strong></td>
<td></td>
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<tr>
<td>Time</td>
<td>Session</td>
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</tbody>
</table>
| 12:15 - 12:30 pm | Avenues for enhancing profitability, nutritional status and energy efficiency in rice and wheat in different crop establishment methods  
  Shahane Amit Anil |
| 12:30 - 12:45 pm | Organic farming and certification & issues of certification  
  Ramasamy Subbiah, Madurai Kamaraj University, Madurai, Tamil Nadu |
| 12:45 - 01:00 pm | Organic farming and food security: Key issues in the context of hilly regions of north east India  
  Jamkhogin Lhungdim, Central Agricultural University, Imphal, Manipur |
| 02:00 - 02:15 pm | Natural sanctity, food and bio-organic agriculture - A global imperative  
  T. Chakraborty, Visva Bharati University, Santiniketan, West Bengal |
| 02:15 - 02:30 pm | Risk assessment of chemicals in food  
  Shashi Vemuri, PJTSAU, Hyderabad, Telangana |
| 02:30 - 02:45 pm | Biochar production and its use in rain-fed agriculture  
  G Venkatesh, ICAR-CRIDA, Hyderabad, Telangana |
| 02:45 - 03:00 pm | Practicing Agriculture through zero budget natural farming  
  Akash Bhartwaj, NIRD & PR, Hyderabad, Telangana |
| 03:00 - 03:15 pm | System integration of organic certification bodies - With reference to Tq Cert  
  N. Sai Nanda Kalyani, Vishwa Vishwani Institute of System & Management, Hyd |
### 4th International Conference on Advances in Agriculture & Animal Sciences towards Global Food Security

**University of Hyderabad**

**August 28 - 30, 2019**

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**Organic farming and certification & issues of certification**

B. Sneha, Vishwa Vishwani institute of Systems & Management, Hyderabad

**NETWORKING/COFFEE BREAK 03:30 - 03:45 PM**

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**Effect of organic inputs on yield of aloe (Aloe vera L.)**

C. Muruganandam, Annamalai University, Chennai, Tamil Nadu

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**SESSION 10: ANIMAL NUTRITION**

**KEYNOTE FORUM**

**Towards food security through milk and milk products**

Atanu Jana, Anand Agricultural University, Gujarat

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**Effect of dietary inclusion of Condensed Distillers Solubles (CDS) on nutrient utilization in growing calves**

Nagireddy Nalini Kumari, PVNRTVU, Hyderabad, Telangana

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**TECHNICAL SESSIONS**

Chair: Atanu Jana, Anand Agricultural University, Gujarat  
Co-Chair: Nagireddy Nalini Kumari, PVNRTVU, Hyderabad

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**04:30 - 04:45 pm**

**NutrifishIndia and NutriFishIN Database – Important steps towards global food and nutritional security**

Subhash Chand, ICAR-NIAP, New Delhi

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**04:45 - 05:00 pm**

**Therapeutic role of Milk exosomes in Cancer and Viral infection**

Y. Vengala Rao, University of Hyderabad, Hyderabad

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**05:00 - 05:15 pm**

**Effect of different tank colour on skin colour of Clarias magur (Hamilton, 1822) Larvae**

Sharad Raosaheb Surnar, Nanaji Deshmukh Vet. Sci University, Jabalpur
## SCIENTIFIC PROGRAM

### DAY 3

### HALL-1

**AUDITORIUM, SCHOOL OF LIFE SCIENCES**

### KEYNOTE FOURM

### SESSION 11: AGRICULTURAL EXTENSION AND ECONOMICS

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Topic</th>
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<tbody>
<tr>
<td>09:30 - 10:00 am</td>
<td>Chindi Vasudevappa, Vice Chancellor, NIFTEM, Sonipat, Haryana</td>
<td>Advances in Agricultural Extension for Development</td>
</tr>
<tr>
<td>10:00 - 10:20 am</td>
<td>Saravanan Raj, MANAGE, Hyderabad, Telangana</td>
<td>International trade economic analysis for Indian agriculture during WTO regime: Effects on production, exports, imports and poverty</td>
</tr>
<tr>
<td>10:20 - 10:40 am</td>
<td>M.B. Dastagiri, ICAR-NAARM, Hyderabad, Telangana</td>
<td>Innovation of novel technologies for entrepreneurship development in food industry creating generations of healthy India</td>
</tr>
<tr>
<td>10:40 - 11:00 am</td>
<td>D. Baskaran, Tamil Nadu Veterinary and Animal Sciences Univ, Chennai</td>
<td>Usefulness and extent of adoption of Agro Advisories Disseminated through interactive information dissemination system (Annapurna Krishi Prasar Seva) in the State of Telangana</td>
</tr>
</tbody>
</table>

### NETWORKING/COFFEE BREAK 11:00 - 11:15 am

### TECHNICAL SESSIONS

**Chair:** M.B. Dastagiri, ICAR-NAARM, Hyderabad, Telangana  
**Co-Chair:** D. Baskaran, Tamil Nadu Veterinary and Animal Sciences University

<table>
<thead>
<tr>
<th>Time</th>
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<th>Topic</th>
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<tbody>
<tr>
<td>11:30 - 11:45 am</td>
<td>B. Savitha, PJTSAU, Hyderabad, Telangana</td>
<td>Usefulness and extent of adoption of Agro Advisories Disseminated through interactive information dissemination system (Annapurna Krishi Prasar Seva) in the State of Telangana</td>
</tr>
<tr>
<td>11:45 - 12:00 pm</td>
<td>M. Jaya Kumar Jacob, Amrita Sai Institute of Science and Technology, AP</td>
<td>Israeli Kibbutz style of farming techniques for the Agro-ecosystems Sustainability in two telugu states</td>
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<tr>
<td>Time</td>
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<td>Speaker/Institute</td>
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<tr>
<td>12:00 - 12:15 pm</td>
<td>Impact of Agricultural programme of radio and television on awareness of farmers</td>
<td>Bharti, Birsa Agricultural University, Ranchi, Jharkand</td>
</tr>
<tr>
<td>12:15 - 12:30 pm</td>
<td>Promotion of late Kharif onion production technology and market linkages in Washim district of Vidarbha</td>
<td>N. B. Patil, Krishi Vigyan Kendra, Karda, Maharashtra</td>
</tr>
<tr>
<td>12:30 - 12:45 pm</td>
<td>Farmers level of awareness and knowledge of adaptation practices about climate change</td>
<td>Rupan Raghuvanshi, ICAR- NAARM, Hyderabad, Telangana</td>
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<tr>
<td>12:45 - 01:00 pm</td>
<td>A smart phone-based field diagnosis guide for farmers</td>
<td>P. Krishna Reddy, PJTSAU, Hyderabad, Telangana</td>
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<tr>
<td>01:00 - 01:15 pm</td>
<td>Enabling “green jobs” for the youth in India: Insights and Strategies</td>
<td>Aditya Sinha, Bihar Agricultural University, Bhagalpur, Bihar</td>
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<td>Solutions for sustainable Agricultural and animal husbandry development in India</td>
<td>Raja Krishna Murthy Morla, Centre for Good Governance, Hyderabad</td>
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<td><strong>LUNCH BREAK 01:15 - 02:00 pm</strong></td>
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**HALL-1**

**AUDITORIUM, SCHOOL OF LIFE SCIENCES**

**VALEDICTORY SESSION 02:00 -03:30 pm**

<table>
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<tr>
<th>Time</th>
<th>Activity</th>
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<tr>
<td>02:00 - 02:10 pm</td>
<td>Report on Conference by Devi Prasad Juvvadi, Conference Chairman</td>
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<tr>
<td>02:10 - 02:20 pm</td>
<td>Address by S. R Voleti, Director, ICAR-IIRR, Hyderabad</td>
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<tr>
<td>02:20 - 02:40 pm</td>
<td>Address by Chindi Vasudevappa, Vice Chancellor, NIFTEM, Sonipat, Haryana</td>
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<tr>
<td>02:40 - 03:00 pm</td>
<td>Address by Chief Guest Sri C. Parthasarathi, IAS, APC &amp; Principle Secretary (Agriculture), Govt. of Telangana</td>
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<tr>
<td>03:00 - 03:10 pm</td>
<td>Awards and Certificates Presentation</td>
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<tr>
<td>03:10 - 03:30 pm</td>
<td>Vote of Thanks by Brajendra Parmar, Principle Scientist, ICAR-IIRR, Hyderabad, Vice President, Life Science Society, Hyderabad, Telangana</td>
</tr>
</tbody>
</table>
## POSTER SESSIONS: 02:00 - 04:00 pm

**Judge: Dr. Ratnakar R**, Former Professor Extention Education, Hyderabad

<table>
<thead>
<tr>
<th>ICAAH-1</th>
<th>Quality evaluation and storage study of Papaya &amp; Guava fruit bar</th>
<th>A Laxman Kumar, SKLTSHU, Hyderabad</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICAAH-2</td>
<td>Identification, isolation and cloning of flower and pod specific promoter from chickpea for tissue specific expression of transgene</td>
<td>Jagadale Mahesh Vasantrao, Assam Agricultural University, Assam</td>
</tr>
<tr>
<td>ICAAH-3</td>
<td>Expression profiling of SWEET gene family in rice (<em>Oryza sativa L.</em>) roots during early interactions with endophytic Gluconoacetobacter diazotrophicus and Bradyrhizobium japonicum</td>
<td>Amol S. Phule, ICAR-Indian Institute of Rice Research, Hyderabad</td>
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<tr>
<td>ICAAH-4</td>
<td>Biocontrol on rhizome rot of turmeric</td>
<td>B. Anitha, SKLTSHU, Hyderabad</td>
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<tr>
<td>ICAAH-5</td>
<td>Study on genotypic differences in nitrogen use efficiency and yield related traits of rice genotypes at two nitrogen levels</td>
<td>V Aparna, PJTSAU, Hyderabad</td>
</tr>
<tr>
<td>ICAAH-6</td>
<td>Isolation and characterization of deltamethrin degrading bacteria from chilli rhizosphere and assessment of their application in plant growth promotion</td>
<td>Ashutosh Kumar, ICAR-Indian Institute of Seed Science, UP</td>
</tr>
<tr>
<td>ICAAH-7</td>
<td>Genetic diversity analysis in Bt cotton lines</td>
<td>Ashwini N. R. Samak, Tamil Nadu Agricultural University, Chennai</td>
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<tr>
<td>ICAAH-8</td>
<td>De novo whole-genome assembly in Safflower (<em>Carthamus tinctorius L.</em>) and its application to genetic and gene discovery analysis</td>
<td>Usha Kiran Betha, ICAR-Indian Institute of Oilseeds Research, Hyderabad</td>
</tr>
<tr>
<td>ICAAH-9</td>
<td>Solution culture – to study symptoms of plant micro nutrient deficiencies in Gerbera</td>
<td>Ch. Sai Ratna Sharavani, SKLTSHU, Hyderabad</td>
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<td>POSTER SESSIONS</td>
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<td><strong>ICAAH-10</strong></td>
<td>Conversion of biodegradable organic wastes into vermicompost and assessment of its nutritive value</td>
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<td>Nagaraju. S, Bidhan Chandra KrishiViswavidyalaya, West Bengal</td>
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<td><strong>ICAAH-11</strong></td>
<td>Response of soil and foliar application of micronutrients on flowering and fruit characters of sapota Cv. Kalipatti under high density planting system</td>
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<td>Guvvali Thirupathaiah, KRCCH, Karnataka</td>
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<td><strong>ICAAH-12</strong></td>
<td>Comparative effect of Biofertilizers under drip fertigation system on nutrient uptake and yield performance in Greengram (<em>Vigna radiata. L</em>)</td>
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<td>K. Shravani, PJTSAU, Hyderabad</td>
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<tr>
<td><strong>ICAAH-13</strong></td>
<td>Effect of off season ecofriendly soil management practices on growth and yield parameters of Palak (<em>Beta vulgaris var. bengalensis</em>)</td>
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<td>K. Muthumanickam, Annamalai University, Chennai</td>
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<tr>
<td><strong>ICAAH-14</strong></td>
<td>Studies on the effect of different Fertigation levels on flower yield, soil and leaf nutrient status of marigold (<em>Tagetes erecta L.</em>) Cv. Pusa narangi gainda</td>
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<td>Kurakula Divya, SKLTSHU, Hyderabad</td>
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<td><strong>ICAAH-15</strong></td>
<td>Studies on variability, heritability and genetic advance in vegetable amaranth (<em>Amaranthus tricolor L.</em>) genotypes</td>
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<td>N. Tejaswini, SKLTSHU, Hyderabad</td>
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<td><strong>ICAAH-16</strong></td>
<td>Current status of viral diseases of vegetable crops in India; A global constraint to achieve nutritional security</td>
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<td>B Mahesha, Indian Institute of Horticultural Research, Bangalore</td>
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<td><strong>ICAAH-17</strong></td>
<td>Quality seed a need of the hour - National perspective</td>
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<td>Manimurugan C, ICAR-Indian Institute of Vegetable Research, UP</td>
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<td><strong>ICAAH-18</strong></td>
<td>Quality and storability of guava cv. (Khaja) as influenced by packaging materials</td>
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<td>Nagaraju. S, Bidhan Chandra KrishiViswavidyalaya, West Bengal</td>
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<td>ICAAH-19</td>
<td>Effect of pre-treatments on quality attributes of solar dehydrated grape Pomace</td>
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<td>P. Mamatha, SKLTSHU, Hyderabad</td>
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<td>ICAAH-20</td>
<td>Effect Rainfall on Productivity of Cotton</td>
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<td>P. A. Pandya, Junagadh Agricultural University, Gujarat</td>
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<td>ICAAH-21</td>
<td>Study of heat tolerance in tomato (<em>Solanum lycopersicum</em> L.)</td>
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<td>Priyanka T, SKLTSHU, Hyderabad</td>
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<td>ICAAH-22</td>
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<td>Shilpa, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola</td>
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<td>ICAAH-23</td>
<td>Effect of feeding bypass fat and bypass protein on rumen parameters of local goats</td>
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<td>Shweta R. Lende, Nagpur Veterinary College, Nagpur</td>
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<td>ICAAH-24</td>
<td>Standardization of ethylene concentrations and number of pulsings for ripening of Banana Cv. Grand Naine in low cost ripening chamber</td>
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<td>T. Manvitha, SKLTSHU, Hyderabad</td>
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<td>ICAAH-25</td>
<td>Distillers dried grains with solubles and cotton seed meal as alternatives to soybean meal in broiler chicken diet</td>
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<td>T. Srilatha, P.V. Narsimha Rao Telangana Veterinary University, Hyderabad</td>
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<td>ICAAH-26</td>
<td>Halotolerant weed nodule associated -Rhizobium enhances the yield and drought stress tolerance in Fenugreek</td>
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<td>Utkrash M. Bitla, ICAR-NIASM, Maharashtra</td>
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<td>ICAAH-27</td>
<td>Bacterial cell lysate for enhancing drought stress tolerance in coriander (<em>Coriandrum sativum</em> L) crop</td>
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<td>Akash L. Shinde, ICAR-NIASM, Maharashtra</td>
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<td>ICAAH-28</td>
<td>Lab and land assessment of Cymbopogon (lemongrass) for the emerging concept of Sustainable Development</td>
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<td>Siddhartha Mehrotra, CSIR-CIMAP, Lucknow</td>
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<td>ICAAH-29</td>
<td>Advancement of Horticulture through “Robotics”</td>
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<td>Subhrajyoti Mishra, Junagadh Agricultural University, Gujarat</td>
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<td>ICAAH-30</td>
<td>Internet of things (IoT) in the field of Agriculture and Animal Husbandry.</td>
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<td>Yuvaraju Chinnam, Amrita Sai Institute of Science and Technology, AP</td>
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<td>Rohila Raaj, Loyola Academy Degree &amp; PG College, Hyderabad</td>
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<td>ICAAH-32</td>
<td>Gene introduction in “Colored Cotton”</td>
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<td>C. Sai Durga, Loyola Academy Degree and PG College, Hyderabad</td>
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<td>ICAAH-33</td>
<td>Importance of dry chain to minimize the losses in Agriculture</td>
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<td>Balmuri Pavan Kumar, Food and Agriculture Business School, Chevella</td>
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<td>ICAAH-34</td>
<td>The er2 gene resistance against powdery mildew infection is associated with enhanced antioxidative protection and defense gene expression</td>
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<td>Sheetal Madhukarrao Bhosle, University of Hyderabad, Hyderabad</td>
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<td>ICAAH-35</td>
<td>Challenges and opportunities for smallholders livestock and poultry production: An analysis of Andaman &amp; Nicobar Islands, India</td>
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<td>Bimal Prasanna Mohanty, ICAR-CIFRI, West Bengal</td>
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<td>ICAAH-36</td>
<td>Consumer perception towards dairy brands</td>
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<td>B Ajay Kumar, Vishwa Vishwani Institute of Systems &amp; Management, Hyd</td>
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<td><strong>ICAAH-37</strong></td>
<td>Consumer preference towards dairy brands in modern retail outlets</td>
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<td><strong>P. Prathyusha</strong>, Vishwa Vishwani Institute of Systems &amp; Management, Hyd</td>
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<td><strong>ICAAH-38</strong></td>
<td>Physiological and psychophysical characteristics of hand operated rotary maize sheller in akola region</td>
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<td><strong>Kanchana Gaddam</strong>, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola</td>
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<td><strong>ICAAH-39</strong></td>
<td>Identification, isolation and cloning of flower and pod specific promoter from chickpea for tissue specific expression of transgene</td>
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<td><strong>Jagadale Mahesh Vasantrao</strong>, Assam Agricultural University, Assam</td>
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<td><strong>ICAAH-40</strong></td>
<td>Green synthesis of silver nanoparticles using different plant leaf extract for Nagpur mandarin coating - An Ecofriendly approach</td>
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<td><strong>S. D. Deshmukh</strong>, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola</td>
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<td><strong>ICAAH-41</strong></td>
<td>The er2 gene resistance against powdery mildew infection is associated with enhanced Antioxidative protection and defense gene expression</td>
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<td><strong>Sheetal Madhukarrao Bhosle</strong>, University of Hyderabad, Hyderabad</td>
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<td><strong>ICAAH-42</strong></td>
<td>Identification, isolation and cloning of flower and pod specific promoter from chickpea for tissue specific expression of transgene</td>
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<td><strong>K. Shanthi</strong>, Loyola Academy Degree &amp; PG College, Hyderabad</td>
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<td><strong>ICAAH-43</strong></td>
<td>Transcriptomics and Functional Genomics for improving Phosphorus use efficiency in tomato (<em>Solanum Lycopersicum</em> L.)</td>
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<td><strong>Rajat Srivastava</strong>, University of Hyderabad, Hyderabad</td>
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Keynote Forum & Panel Discussion
Chair Prof. Devi Prasad Juvaddi,
Director, Center for Good Governance, India

Co Chair
Dr. R. Ratnakar, India
Prof. P. Appa Rao
Vice Chancellor
University of Hyderabad, Hyderabad India

Biography


Elected Fellow, National Academy of Agricultural Sciences, 2012
Elected Fellow, Association of Microbiologists of India, 2010
Member, DBT Task Force on Bio agents for Agriculture, 2011 onwards
Associate Editor, Australasian Plant Pathology, 2011
Elected Fellow of the National Academy of Sciences, 2007
Honorary Fellow, Association of Biotechnology and Pharmacy, 2007
Outstanding Plant Pathologist award from ISMPP, 2005.
Elected Fellow, Andhra Pradesh Academy of Sciences, 2005
Elected Fellow, Indian Psychopathological Society, 1998
Rajib Goyal Young Scientist Award in Agricultural Sciences, 1998
Dr. Praveen Rao Velchala holds a Ph.D degree in Agronomy with specialization in crop water requirements, micro irrigation scheduling & fertigation solutions of tropical field and orchard crops, and crop yield – water modelling.

Four over three decades Dr. Rao served as Teacher, Researcher, Extension Agronomist and Administrator in various capacities in the Agricultural University viz., Professor & University Head of Agronomy; IFFCO Chair; Director, Water Technology Centre; Registrar, Special Officer. He served as Technical Advisor on Microirrigation to several State Governments and Expert Member on micro irrigation committees in India & abroad; International Micro irrigation Consultant for 5-years in Israel promoting implementation of sustainable water conservation technologies in twenty Asia-Pacific, African and Latin American Countries.

D. Rao was also a recipient of “Meritorious Teacher Award” (1998), Leadership Award for large scale promotion of Microirrigation Technologies in India from Soil & Water Conservation Society of India (2005), Lifetime Achievement Award (2015) from GVK Society, Agra, UP, India for contributions to Water management, Mashav Fellowship by CINADCO, Ministry of Foreign Affairs, State of Israel (1995) and Net Award for knowledge contribution in the field of microirrigation technologies from Netafim Ltd., Israel (2006). Fellow of Telangana Academy of Sciences, Indian Society of Oil Seeds Research etc. He is International Active Member of American Society of Agronomy, Soil Science Society of America, American Society of Agricultural & Biological Engineers, International Society of Horticultural Science, Asian PGPR Society of Sustainable Agriculture.


Dr. Praveen Rao is presently Vice Chancellor of Prof. Jayashankar Telangana State Agricultural University.
Integrated farming systems: Key for enhanced farmers income in India

Indian agriculture has witnessed a great success story in improving food production six folds during past 70 years, besides producing another 300 mt of horticulture produce. The per capita production of milk and egg increased tremendously. Growth in fish production enhanced in recent years. One fourth of world rice is produced in India and wheat production in the current year marked 100 mt. There is huge jump in pulse production in the recent past. These developments have contributed significantly towards national food and nutritional security which are most important in achieving Sustainable Development Goals (SDGs) in India. However, there are emerging challenges of climate change, in the form of droughts, floods, heat wave and coastal salinity besides emerging pests and diseases. Despite of various technological advancements in agriculture, livestock, horticulture, poultry and fishery, it is well understood that the farming in India is not profitable. This is the reason for “Doubling Farmers Income” a call given by honorable Prime Minister of India to draw attention of all the stakeholders on the farmer’s income, and make farming profitable. For enhancing farmer’s income, the cost of cultivation need to be reduced, and at the same time, processing and value addition of agriculture produce to be enhanced. Market development provision of rural cold storage is critical for promoting farmer’s income.

Aggregating field crops, high value horticulture, livestock, poultry and farm pond based fishery resulted in enhanced farmer’s income in several agro-ecosystems of India. In predominant finger millet based agro-ecology of Southern Karnataka under rainfed conditions, integration of livestock along with finger millet and horticulture has resulted into farmer’s gross income of Rs 2.5 lakhs and net income of Rs 1.62 lakhs, with 450 man days’ employment. Similar enhancements have been recorded in Biswanadh district of Assam and Arjia district in Rajasthan. In Anantapur, arid district of Andhra Pradesh, inclusion of sheep and goats along with rainfed horticulture enhanced farmer’s income significantly.
Likewise, location specific integrated farming systems with above components not only enhanced farmers’ income but also brought the stability in livelihoods. Despite of technically viable models available with higher income; key challenges remain to manage in IFS are labor availability and cost besides marketing systems. One of the important opportunity emerging is farmer producer organizations (FPOs) where lands are aggregated and different components of farming viz., field crops, dairy, fishery can be managed successfully with less interference of middle men for inputs and marketing.

**Biography**

Cherukumalli Srinivasa Rao completed B.Sc. Agriculture (1986) and M.Sc. (Ag) from Agricultural College, Bapatla in 1988. He has done PhD from Indian Agricultural Research Institute, New Delhi in 1992. He is Post-Doctoral fellow from Tel-Aviv University, Israel.

He was Scientist, Indian Institute of Soil Science, Bhopal, 1992-98; Senior Scientist, Indian Institute of Pulses Research, Kanpur and Central Research Institute for Dryland Agriculture, Hyderabad, 1998-2006; Principal Scientist, 2006-13 and Project Coordinator, All India Coordinated Research Project for Dryland Agriculture, Central Research Institute for Dryland Agriculture, Hyderabad (CRIDA), Hyderabad, 2013-14; Deputation to International Crop Research Institute for Semi-Arid Tropics, Patancheru, 2006-2008; Director, ICAR-Central Research Institute for Dryland Agriculture, Hyderabad, 2014-17.

He is currently Director, ICAR-National Academy of Agricultural Research Management, Rajendra nagar, Hyderabad.
The Dry Chain is of critical importance for our sustainable food system. For rapidly expanding agricultural economies, the introduction of the Dry Chain addresses the challenges of food security, under-nutrition, food safety, human disease and human health. The Dry Chain can eliminate aflatoxins, molds and other contaminants, which cause immense risks for our food supply.

Globally, dry crops such as grains, pulses, maize, rice and groundnut are common food staples and commodities. Dried fruits, vegetables and fish represent a growing market opportunity to achieve more nutritious foods suitable for domestic consumption and exports of specialty food products with extended shelf life. Value addition crops such as dried spices and herbs can be cultivated and marketed year-round. However, without proper moisture management, all of these crops could go to waste while placing human and animal health in peril.

The Dry Chain is a simple system to improve post harvest moisture management for dry staple crops and seeds, which are cultivated, stored, distributed and consumed. The Dry Chain controls the critical moisture levels throughout these food chains. Once dry food system controls are in place, there are measurable benefits resulting in increased crop productivity, local prosperity, stronger trade economies, with a reduction of food contamination and food waste and losses.

In this session we will explore the basics of how the Dry Chain system works as a simple, low-cost, scalable method suitable for small-holder farmers at the village level. We will
also look at the Dry Chain as a method for improving seed storage, increasing crop yields, controlling post harvest storage, enhancing food processing, expanding food production and market value.

With proven research underway, the Dry Chain system may be used to ensure food safety standards for a diverse and extensive range of dry foods, seeds and dried products. Multi-crop Dry Chain research was developed at the University of California, Davis. The Dry Chain is now being brought into India and surrounding countries by Vivia Foundation and Renuka Bio Farms. The Dry Chain will succeed for the dry food system, if we....“Make it Dry and Keep it Dry”.

**Biography**

Cheryl E. Harrison is a graduate of the University of California, Davis, USA with research expertise in Applied Behavioural Sciences and Environmental Design.

Cheryl develops integrated strategies for the Vivia Foundation’s project initiatives worldwide, specifically in Europe, India and the United States. As a founding director, Cheryl’s major focus is to conceive, develop and implement initiatives guided by the Sustainable Development Goals (SDGs). Cheryl has lead initiatives for many Fortune 500 companies in the agri-food, healthcare, energy, technology, financial and retail sectors; she has worked closely with entrepreneurs, government agencies, research institutions, and non-profit organizations. Typically, she weaves together cause-related programs, social priorities and essential technologies. She cultivates strategic partnerships to accelerate critical impacts – at scale.

Cheryl is a recipient of San Francisco’s Woman Entrepreneur Award, and the UC Davis 2008 Alumni Service Award. Over the past 20 years, she served as a leader and advisor to the University of California, Davis. She was a Trustee for the UC Davis Foundation, and served on the Dean’s Advisory Council as a chairperson for the College of Agriculture and Environmental Sciences Advisory Board, where she received the Award of Distinction. She serves as the Director of Global Partnerships and Steering Committee for the Global Action Platform and its annual Global Action Summit, a university-business alliance which convenes world-renowned thought leaders.

She has been responsible for the launch of new initiatives for companies and organizations including Nike, Nokia, Levi Strauss & Co, McKesson, EY, Bank of America, Williams-Sonoma, Columbia Sportswear, General Mills, Kendall-Jackson, SunWorld, Visa USA, Charles Schwab, Chevron, Shaklee Corporation, AT&T, The Trust for Public Land, Gorbachev Foundation’s State of the World Forum, Metropolitan Transportation Commission (MTC), Chabot Space and Science Center, CDC – California Department of Health Services, Mitsui Chemicals (Japan); and Xinhua Finance Media (China) and ICRISAT (India).
Biography

W. R. Reddy, Director General, NIRD & PR, Hyderabad, Telangana. He has high affinity to agriculture and excited to work in agriculture sector. Personal passion for making the lives of farming community better and enable them to lead respectable lives. He wish to strive for taking the farming activity in developing world to higher orbit of profitable agribusiness activity. Well conversant with lives of farmers, their potential and problems. Also familiar with the policy setting of agriculture sector nationally and internationally. Working in the Ministry of Agriculture, Government of India, an abode of agriculture policy making for the country, had been highly satisfying and got the insights into policy making and execution of various programmes for the betterment of farmers.
Prof. K.P. Singh
Vice Chancellor
CCS Haryana Agricultural University
Hissar, Harayana

Biography

Prof. K.P. Singh, the 22nd Vice-Chancellor of CCS Haryana Agricultural University, Hisar has been given additional charge of the Vice-Chancellor of Haryana State University of Horticultural sciences, Karnal which came into being under Haryana Act. No. 32 of 2016. He took over the charge as Founder Vice-Chancellor of this newly established University on 6th January 2017. An eminent scientist in the field of Biophysics, Prof. K.P. Singh is a person of positive outlook and firm determination.

He has wide exposure to international programmes and also in handling international projects. He is widely travelled and has visited United Kingdom, USA, Slovakia and Croatia. He has been a visiting faculty to National Cancer Institute, USA; Stanford University, USA; Howard University, USA; Cranfield University, UK; Ruder Boskovich, Croatia; and Technical University, Bratislava. He has also participated in several international programmes/seminars/conferences as chairperson of technical sessions, group leader, invited speaker and delegate. He is also recipient of many awards including Young Scientist Award by Uttarakhand Council for Science and Technology, Department of Science and Technology, in 2007.
S. K. Malhotra is the Commissioner of Agriculture, Ministry of Agriculture & Farmers Welfare Government of India, New Delhi. He has experience of 29 years as Scientist & techno-administrator in National Agriculture Research System. Currently providing leadership in agriculture policy planning, prog. development, monitoring and execution of national R & D mission activities. Represented India in 15 international programs. Recent contributions are development of CCFFV, FAO CODEX standards for okra & aubergine whereas potato & date work is in progress.
Administration methods of garlic and neem for safe broiler production

Organic Agriculture is now becoming the mainstream all over the world. During the last two decades, main concerning matter of global community is environmental conservation and safe food production. A simple resource like cow urine can have such remedial powers is unthinkable. It is very effective alternatives to chemical fertilizers by enhancing productivity in long term with maintaining the soil health and enhances the microbial population. Cow urine provides nutrients like nitrogen, potassium, phosphorus and other substances that are beneficial to the plants. It is a cheap input and easy to acquire by the rural producer. It has effect on germination, growth component viz, plant height, number of leaves etc. Through the application of cow urine biochemical contents of plants and productivity of different crops is increased viz. mustard, maize and rice etc. For small scale farmer, there is no other better alternative than involving cattle in farming system. The abundant quantity of cattle urine (6-12 lt/h/d) is available at farm level. It contains 95% water, 2.5% urea and 2.5% mineral salts, hormones and enzymes. Without any cost, this nutrient source is available to farmer. As it is organic in nature it is so eco-friendly and it has no adverse effect on ecosystem and human health thus a study was performed to find out the prospects, constraints, potentials and the procedure for commercialization of cattle urine as bio-fertilizer and/or bio-pesticide. The major constraints are: cattle urine is bulky and difficult to transport; it is hazardous and involved more labor; in the most cases, the floor of cattle house is muddy or not suitable for collection; and for higher demand of foods and availability, farmers usually look profit and more production, less concerned about health and environment. Researchers found that fermented urine contain less nitrogen than fresh urine. 169.17 mg/L. A field trial was performed in six different agricultural crops.
The plant height and yield was recorded. In boro rice, the yield was increased 5.85 ton/hectare in our experimental group compared to 5.15 ton/hectare in our control group (chemical fertilizer and chemical pesticides). Drying is the best method for solving the constraints. In conclusion, cattle urine bio-fertilizer and bio-pesticide are the products that will address on safe food production, environment friendly animal production, climate change, water management, soil health and organic food production and need to do further research for commercialization of this valuable product.

Biography

A.K.M. Ahsan Kabir has completed his PhD on Animal Resource Sciences from the University of Tokyo, Japan in 2012 and after that, did postdoctoral studies in Germany, Japan and China. Dr. Kabir did job as guest scientist at the Institute of Organic farming, Westerau, Germany. He has been promoted to Professor at Bangladesh Agricultural University in 2016. At present, he is the head of the Department of Animal Science, Bangladesh Agricultural University. He has published more than 35 papers in reputed journals and has been serving as Managing Editor of Bangladesh Journal of Animal Science. Prof. Kabir is the author of 2 books written in Bengali published by reputed publishers and a chapter on “Organic Animal Husbandry” in the book Organic farming; New Advances Towards Sustainable Agricultural Systems published by Springer Nature Switzerland AG 2019. He is the Member Secretary of the Global Desk: Office of the International Cooperation and Exchange, Faculty of Animal Husbandry, Bangladesh Agricultural University since 2015. He has organized 6 international seminars/conferences at Bangladesh Agricultural University as Organizing Committee Member Secretary and joined as key note speaker/speaker/invited speaker in Germany, Japan, China, Thailand about 10 times. He is holding positions of different professional organizations both national and international.
Dr. Chindi Vasudevappa, a fisheries Graduate from the College of Fisheries, Mangalore under the University of Agricultural Sciences, Bengaluru (1970-76 in Karnataka). He obtained Doctoral Degree from the Cochin University of Science and Technology in the year 1993. Initially worked as an Extension Specialist in spreading Aquaculture Technology in various districts of Karnataka. Later, as Senior Fisheries Scientist, involved in research and development with funding support from various National and International organization, especially from Indian Council of Agriculture Research, Department of Bio-Technology and European Commission. Through these projects published 74 research papers/chapters in books/short notes etc. Also published 32 books/chapters/bulletins/manual/action plans etc. in the areas of fishery biology, fresh water aquaculture, cage culture, fish processing and transportation, fresh water prawn culture, brackish water and marine shrimp farming etc. Serving as Member of 8 Professional bodies and as reviewer of research papers of three international journals. Contributor in release of AMUR variety of common carp for cultivation in India. He was awarded with, Junior and Senior Fellowship of Indian Council of Agriculture Research, and also received Young Scientist Award in 1987 by Asian Fisheries Society and the Best Extension Worker Award in 1987 by the University of Agriculture Science, Dharwad. Served as Chairman of various National Committees for preparing 12th Action plans, evaluating research programmes, promotion of cage culture in reservoirs, preparation of guidelines for various schemes of Aquaculture, Group Insurance, developing guidelines for release of exotic fish species for culture. Worked as Chief Scientific Officer, Senior Executive Director and Chief Executive of NFDB, Dean of Post Graduate Studies. Vice Chancellor (2014-2017) of University of Agricultural and Horticultural Sciences, Shimoga, Karnataka.
Agriculture is changing with increased public-private- NGO- Civil society stakeholders involvement in agriculture development. Hence, public extension system needs to play an expanded role as regulator, negotiator, facilitator. But along with the increased role, public extension system also should integrate issues like environmental awareness, health and nutrition, general awareness of eGovernance, etc. to build up sustainable agricultural communities. Further, climate change is posing increasing challenge to agriculture. Agricultural extension can play crucial role to increase awareness by working as and training knowledge intermediaries at grassroots level. Working with farmers to increase awareness on climate change is crucial to bring about changes in age old practices and transition to climate smart agriculture. Agricultural extension systems can take key role in training knowledge intermediaries on “Extension for climate Smart Agriculture” and make required technologies accessible. Agricultural extension need to play important role by conducting research on nutrition security and how extension can address the issues; transferring the evidence based knowledge for policy advocacy, and train extension professionals to address nutrition related issues along with the agricultural ones. Technology startups in agriculture have a lot to provide to Indian agriculture in terms of innovation, employment, and income. Agricultural extension need to handhold and mentor agricultural startups that provide a wide range of unique services to the population engaged in agricultural activities – both urban and rural. They not just directly benefit the farmers but also build up a startup ecosystem and develop entrepreneurial culture in rural societies. With increasing pressure of urban population, pollution, and food security, urban agriculture can be a boon to agricultural development and economically backward communities in urban areas. Skill is the most important component of human resource in agricultural extension. Functional and technical skills are equally important for extensionists to be able to seamlessly perform their job roles. But with changing agricultural challenges, the social, management, and technical skills required are also changing. Extensionists need to keep themselves abreast with the changes and update themselves through training programmes and workshops. In the capacity enhancement initiatives, collaboration may play a crucial role as The Universities and major institutions are not the sole custodians of updated information and knowledge anymore but that may come from any and many quarters (including farmers), which can be successfully integrated through collaboration. The ultimate aim for agricultural development is to give better income to the farmers for making production remunerative. Around the world, many interesting extension models and information and communication technologies, digital media and startups created major changes in agricultural sector.
The foundation of international trade is the law of comparative advantage. Economic growth, agriculture, poverty reduction and trade have a very complicated relationship. Trade analysis helps any country to discover profitable opportunities; hence the study has undertaken with these objectives. To analyze agricultural trade growth, responsiveness, stability and estimate the effects on production, exports, imports and poverty and suggest polices for boosting Trade. The major agricultural commodities were selected for the period from 1990-91 to 2015-16. The tools used are CAGR, elasticities, regression and Instability Index. During 1990-91 to 2015-16, wheat export price and rice import price growth rates were more than other cereals. The imports price growth rates of all pulses were more than exports price growth rates indicating India is importing at higher prices. Among the oilseeds crops, Mustard import price (11.05 %) and Sunflower export price (7.85 %) growth rates are more among oilseed crops. The export import quantity growth rate of all cereals, pulses, and oilseeds were found to be positive except rice imports, wheat exports and soybean imports which were negative. Export import prices of all cereals (except maize) and all pulses were found to be unstable. All oilseed crops Import prices were found to be stable except mustard and sesame import prices. The study found that among cereals, pulses and oilseeds, rice (1.24 %), peas (2.36 %) and mustard (0.97 %) have high export elasticities indicating these crops highly responsive to change in international prices. The effect of trade on poverty shows that, production for cereals and pulses, import price for pulses and oilseeds, export price for all the 3 groups have adverse impact on Poverty. Only for oilseeds, production and trade balance have positive and significant effect on poverty. The effect of trade on poverty shows that, export price on all cereals, pulses, oilseeds have adverse impact on poverty. Only for oilseeds, production and trade balance have positive and significant effect on poverty. Thus import prices of cereals, quantity of imports for pulses and export prices of cereals, pulses and oilseeds need to be thoroughly examined and pre-requisite actions as well as policy measures are required. The study advocates that India should design self-reliance policies in pulse production as it is importing pulses at higher prices. India also should design new stable foreign price policy for cereals and pulses as export import prices of all cereals and all pulses were found to be unstable.
Impact of climate change on Agriculture/Food security

The traditional agriculture was soil and climate driven farming systems that encompasses the animal husbandry. It provided socio-economic, food and nutrient security with the healthy food. These were the “Golden Days” in the history of farming. It was an environment-friendly system and was highly successful & sustainable form of agriculture. No pollution, no worry about seeds and fertilizer adulteration as they used good grain as seed and compost of farmyard manure and green manure as fertilizer. This system of agriculture is clouded by the chemical inputs-GM seeds agricultural technologies after 1960s. Under this system of agriculture around 30% of what is produced is going as waste and thus the inputs used to produce that is going as waste. This is a most ineffective system of agriculture practice. Seed adulteration, fertilizer adulteration, food adulteration, water pollution, etc. are growing with the time along with government's incentives/subsidies. Farm sizes are coming down and still around 60% of the cultivated area is at the mercy of “Rain God”. To achieve food security, we need sustainable agriculture system under variable soil and climate conditions wherein the soil is static and the climate is dynamic. Climate is always changing through the natural cycles. What we are experiencing now is part of this system only. Traditionally farmers adapted to this based on their hundreds of years of experiences. The two main climatic parameters that play vital role in agriculture are temperature and precipitation. Temperature presents high seasonal and annual variations. Agriculture is adapted to such variations in temperatures. Since, around the last two decades groups are polluting agriculture research under the disguise of global warming, a component of climate change. However, it is insignificant to influence agriculture. Moisture is the limiting factor for crop growth in tropical warm regions wherein most of the developing countries are located. Moisture availability varies with space and time in association with the natural variability in rainfall & snowfall that forms the principal component of the climate change. Droughts and floods are part of it. That is moisture availability varies with country to country, region to region within the country, and station to station within a region based on the general circulation patterns in association with the climate systems. In such scenarios, studies based on the truncated data sets lead to misleading inferences. These are discussed with reference to India, Andhra Pradesh and Kurnool rainfall data series. Annual rainfall at all-India level follows the 60-year cycle and at Andhra Pradesh level 132 year cycle. Water availability in Godavari River [& northwest Indian rivers] and Krishna River follows these patterns, respectively. For Kurnool the growing period follows the southwest monsoon rainfall pattern of 56-years cycle with drought in 45% of years – 30% and 70% of the years during above and below the average periods. Western Ghats played the major role here.
The incremental trend in the share of Bivoltine silk production in India is a welcome change to reduce dependency on Chinese silk yarn imports besides development of farm-based rural enterprises based on sustainable dry land farming practices in the country. This paper presents a detailed account of various initiatives to introduce Bivoltine silk worm Egg production centres (popularly called Chawki rearing centres—CRCs) in India. CRC concept took its roots in early 2000s and these centres were established with the financial assistance from central silk board (CSB) and technical support from central sericulture Research and Training Institute (CSTRI), Mysore. Success of a CRC depends on good quality and tender mulberry leaf produced from S36, V-1 or G2 mulberry varieties grown on sustainable farming practices in 2-3 acres of land to enable 32 crops per annum to produce 1.6 lakh disease free layings (dfls) required@5000dfls per crop. Silk worm seed production is not economically attractive to small and marginal farmers besides ecologically sustainable. Cost benefit ratio of the enterprise works out to 1:1.64-2.30. Surplus/left out mulberry leaf could be converted into compost and silk worm waste is a good fish feed. Good quality mulberry leaf is best produced with the application of farm yard manure/compost. Farmers producing seed are registered with CSB and can avail incentives under centrally sponsored schemes of Government. There are 1129 registered CRCs in India with Karnataka state topping the list. Due to assured supply of good quality eggs available in the close vicinity of farmers, Bivoltine silk cocoons production increased from 10% to 28% in the last few years. Silk worm Egg production centres India produces 32 crore dfls for production of 6122 metric tonnes of raw silk annually. Productivity in Bivoltine cocoon production increased from 55kg per 100 dfls in 2014 to 65 kg in 2017-18. More than 80% silk production in south India depends on chawki reared worms and attracted new agripreneurs to this field. This has positively impacted the growth of sericulture in southern India quite substantially as obvious in the growth of raw silk production. In this paper, success story of an agripreneur from V. Kota mandal in Andhra Pradesh is discussed in detail to provide in-depth understanding to farmers interested in setting up similar enterprises.
Session 1: Agronomy and Crop Production  
Chair: Anjani Kammili, ICAR-IIOR, Hyderabad, Telangana  
Co-Chair: V. Maruthi, ICAR-CRIDA, Hyderabad, Telangana
ISF-1: A high yielding-high oleic Indian safflower cultivar

Anjani Kammili*, Praduman Yadav and A. Vishnuvardhan Reddy
ICAR-Indian Institute of Oilseeds Research, India

Safflower (Callthamus tinctorius L.) is a multipurpose oilseed crop with world adaptability. Demand for oleic type safflower oil is increasing in oleochemical industry for use in production of several industrial products like lubricants, biofuels, bio-plastics, cosmetics, and pharmaceuticals etc. India is one of the top safflower producing countries in the world. However, safflower oil produced in India is non-oleic type. Oleic acid content in standard safflower oil is 16-20%. For the first time in India, a high oleic safflower cultivar, ISF-1 was developed at ICAR-Indian Institute of Oilseeds Research, Hyderabad with the funding from Marico Pvt. Ltd., Mumbai. It was identified for release for all India cultivation by Central Variety Release Committee in 2018. Oleic acid content in seed oil of ISF-1 was consistently 76-78% across India under both wet and dry conditions, as well under hot and cool climates when tested under All India Coordinated Research Project on Safflower in 2015-2017 and in farmers' fields (38.208 ha). When demonstrated in farmers’ fields in Maharashtra, Karnataka, Chhattisgarh and Telangana in 2017-18, ISF-1 gave 8.2 q/ha and 10.29 q/ha seed yield as against 8.84 q/ha and 9.39 q/ha seed yield of non-oleic acid type leading variety, PBNS-12 under rainfed and irrigated conditions, respectively. It had 30% oil content while PBNS-12 contained 28% oil. The average oleic acid yield of ISF-1 in farmers’ fields was 219 kg/ha as against 51 kg/ha oleic acid yield of PBNS-12. ISF-1 would certainly increase oleic acid oil production in India once grown in large area and reduce the burden of high oleic acid oil imports in the country to a great extent.
Cropping systems for food security vis-à-vis climate change in rain-fed areas

Central Research Institute for Dryland Agriculture, Hyderabad

Rising area under sole cropping systems especially in rainfed areas and the gradual disappearance of intercropping systems lately, is due to labour scarcity, mix of cereal and legume crops needing different types of herbicides and non-availability of suitable implements etc. Further the intra-seasonal rainfall variations in rainfed areas are certain and the probability of occurrence of rain events beyond September is also increasing. Therefore, in order to bring all the above-mentioned situations to the farmers’ advantage, an experiment was conducted in CRIDA Farm, Hyderabad during 2013 and 2014 with test crops sorghum and pigeonpea in 4:4 strip intercropping with sequence horsegram crop in the harvested sorghum strips and compared with the performance of 2:1 additive series intercropping system. The yields from 4:4 strip system was 22% higher than the 2:1 system and the pulse needs were sufficient for 3 months for a family of five and cereals for about 545 days as compared to 2 months pulse sufficiency and a year cereal availability from 2:1 system. Besides yields, 4:4 system also supported herbicide usage independently, capitalization of extended monsoon even though there were dry spells during the SW monsoon period and realized high cropping intensity. Enhanced yields (22%) not only encourage re popularization of intercropping systems for risk neutralization (both adaptation to and mitigation of climate change), but also maximize rainwater use efficiency. Further with the 41.3% world’s dryland area (UN, Environment Management Group, 2011), any small improvement less than 22% would result in big enhanced yields ensuring global food security.
*Department of Entomology
*** Department of Plant Pathology, College of Agriculture, India
** Indian Institute of Rice Research, India
+ Nichino India Private Ltd, India

A study was conducted to understand the impact of insecticides on spiders and predatory coccinellids in different cultivation systems of rice. The experiment was laid out in the College Farm, College of Agriculture, Rajendranagar in Kharif seasons of 2014-15 and 2015-16 in a split plot design, where rice crop was grown in the form of three main modules with three different methods of establishment viz., transplantation, broadcasting and drumsown rice with three sub-modules under each main module viz., organic protection, farmers’ practices and ‘no protection’. Data on spiders and predatory coccinellids was taken from a month after transplantation to harvest. Results revealed that significantly higher predator numbers were observed in ‘no protection plots’ > organic protection plots > farmers’ practices in both the years of study. Chemical insecticides were found to have adverse effects on predator population, since they not only show direct toxicity but also poison the food chain which is detrimental for them.
Mineral bio fortification of sorghum grains: Factors influencing variability

Venkateswarlu R, Hariprasanna K, Niharika G, Chapke RR, Ratnavathi CV, and Tonapi V A
ICAR-Indian Institute of Millets Research, Hyderabad, India

Minerals are essential as cofactors for metabolic enzymes, electron transporters and as structural components of tissues like bone and teeth. Apart from these functions, minerals like Iron play an important role in transport of oxygen. Deficiency of Iron is by far the most common cause of anemia in developing countries with important public health implications. WHO estimates 10.8 million child deaths a year of which 2 million (19%) due to Iron, Zinc and Vitamin A deficiency. Mineral content in diet and its bioavailability determines the mineral status of a person. Iron and Zinc content in food materials differs significantly due to their inherent nature and the type of processing they are subjected to. Certain staple grains like polished rice contain hardly 10 ppm of Iron i.e., 1.0 mg of Iron in 100 g dry matter. Although, Iron requirement of human beings is 1.0 mg per day, its bioavailability from diet is only 5-10%. Hence, one approach is to fortify the grains with Iron salts. However, this is difficult due to enormous logistics requirement to perform and monitor fortification. One practical approach is bio fortification by crop breeding.
India is amongst the largest producer and consumer of vegetable oils in the World. Presently, annual oilseeds are grown on an area of 24.51 million ha with 31.46 million tonnes production and productivity of 1284 kg/ha. Despite being one of the largest cultivator of oilseeds in the world, India imports about 60% of its requirements owing to the life style changes in dietary pattern and increasing per capita income. The growth in the domestic production of oilseeds has not been able to keep pace with the growth in the demand of the country. To achieve the targeted production the Government of India has initiated Cluster Front Line Demonstrations on Oilseeds under National Mission on Oilseeds and Oil Palm (NMOOP). Accordingly, the ICAR- Division of Agricultural Extension planned to organize Cluster FLDs on Oilseeds during Rabi 2015-16 through Krishi Vigyan Kendras in the country and subsequently supported conduct of CFLDs on oilseeds under the National Food Security Mission (NFSM) during 2018-19. ICAR-Agricultural Technology Application Research Institute, Hyderabad has implemented about 2780 cluster frontline demonstrations on groundnut in 1308 ha area through Krishi Vigyan Kendras (KVKs) of Andhra Pradesh during 2016-17, 2017-18 and 2018-19 to showcase the production potential of newly released varieties with improved package of practices like seed treatment, sowing methods, use of micro nutrients, bio-fertilizers, resource conservation, weed management, pest and disease management practices under irrigated and rainfed conditions on farmer’s fields in cluster approach. Demonstrations with improved groundnut variety Dharani (TCGS-1043) resulted in an average yield of 20.30q/ha against check yield of 17.50q/ha with 15.95 per cent increase in yield. The net returns recorded were Rs. 57075 under demonstration compared to Rs. 41009 in check with benefit cost ratio of 2.29 and 1.86. The results indicated that the improved variety of groundnut along with recommended package of practices and regular monitoring of scientists under cluster frontline demonstration program me increased the yields and net returns of the farmers and can bridge the yield gap by 13.75 per cent in Andhra Pradesh state.
Toxicity studies on different populations of brown planthopper

G. Venugopal and V. Shashi Bhushan
PJTS Agricultural University, India

Toxicity studies of insecticides were carried out by collecting field populations of brown planthopper as nymphs and adults from different locations Mandapeta, Tanuku, Nellore, Maruteru and Karimnagar. The insects were reared to F1 generation in the laboratory on rice seedlings. The different chemicals used for toxicity studies were Thiamethoxam 25WG, Imidacloprid 70WG, Buprofezin 25SC, Dinotefuran 20SG, Fipronil and Fenobucarb 50EC. Toxicity studies were carried out as rice-stem dipping method. Three replicates were maintained for each dose of insecticides with water treated control. Third instar nymphs were used for conduction of the test. The treated insects were maintained at room temperature and the mortality was recorded at 1DAT, 2DAT, 4DAT and 5DAT. The nymphs were considered dead if they were unable to show movement after gentle prodding with a fine brush. All the field populations differed in their susceptibility to insecticides. In general, Maruteru and Mandapeta populations were more susceptible to insecticides compared to Karimnagar, Tanuku and Nellore populations. In all the chemicals which were tested, the Fenobucarb has shown the highest percent of kill of brown planthopper within 1DAT for all the populations. This is followed by neonicotinoids (Thiamethoxam and Imidacloprid), Fipronil, Dinotefuran and chitin synthesis inhibitor like Buprofezin in the order of percent kill of BPH. At higher concentrations of Thiamethoxam, Imidacloprid and Fipronil gave quick and high mortality of BPH.
Synthesis of ZnO Nano-particles and its positive effect on Cole crops: A way towards the development of ‘Nano-fertilizers’ to enhance crop production

G. C. Satisha
ICAR-IIHR, Bengaluru, India

Introduction:
Zinc is the most important essential micronutrient for humans, animals and plants. In biological systems, zinc plays significant role in various metabolic processes and considerable increase in yield was also demonstrated worldwide (Tandon, 1995, Graham et al., 1992). Zinc deficiency is now known to be widespread in soils, plants and humans. Application of zinc containing fertilizers would become essential for the plant growth and development and to contribute better zinc nutrition for crop plants and higher dietary intake of zinc in human population. Recently, applications of nanoparticles have received considerable attention due to its high surface area to volume size ratio, exhibit improved uptake by plants and have potential to boost crop production. The present investigation aimed at synthesis of zinc oxide nanoparticles (ZnO NPs) and its effect on growth and yield of cabbage.

Methodology:
Nanoscale zinc oxide particulates (ZnO NPs) were synthesized using a modified oxalate decomposition method and characterized for confirmation of size, shape, stability, surface structure and crystalline nature using transmission electron microscopy (TEM), scanning electron microscopy (SEM), photon collision spectroscopy (dynamic light scattering techniques) and zeta potential analyzer. The synthesized ZnO NPs (at 150 and 250 ppm) were used as source of zinc fertilizer to study its effect on cole crops on overall growth and translocation of zinc along with bulk ZnSO₄ (a common source of Zn supplement) and control.
Field experiment was conducted at Research Area, Department of Forestry, CCS HAU, Hisar. Eucalyptus seedlings of clone 2045 were transplanted at a spacing 6×6 m following randomized block design during the last week of November, 2010. Kinnow plants were transplanted alone (6×6m) and in combination with eucalyptus during mid September, 2011. Among different treatments, an average increase in height of 1.3 m was recorded. In the current growing session; maximum CAI (2.7) was observed for basal diameter in eucalyptus followed by dbh which indicated that trees achieved sufficient biomass during 7th year of growth. The fruiting in kinnow plants started from the last two years and it was moderate during this year. The fruit yield varied from 2.7 t/ha in agri-silvi-horti system (kinnow+eucalyptus+wheat) to 4.2 t/ha in agri-horti system (kinnow+wheat).

The sowing of wheat was done during second fortnight of November, 2017 in agri-horti, agri-silvi-horti and control. The significant variation in plant population was recorded among agri-horti, agri-silvi-horti and control. Significantly higher plant height was observed in case of agri-horti system as compared to agri-silvi-horti system at 30, 60, 90 and 120 DAS of wheat. The yield attributing parameters of wheat varied significantly under different agroforestry systems. Significantly higher yield attributing parameters of wheat were observed in case of agri-horti system as compared to agri-silvi-horti system. Significantly higher grain and straw yield of wheat was observed in case of agri-horti system as compared to agri-silvi-horti system. An increase of 21.0 and 29.1% in straw and grain yield, respectively of wheat was recorded under kinnow+wheat system as compared to kinnow+eucalyptus based agroforestry system.
Oil palm (*Elaeis guineensis* Jacq.) is a perennial crop, belonging to the family *Arecaceae*, and is the major source of edible vegetable oil of the world (53.3 Mt. followed by Soybean oil, 43.4 Mt). It has 16 pairs of chromosomes with a genome size of 1.8 Gb. In oil palm, harvesting of fruit bunches after the age of 20–25 years is a major problem due to their tallness. Oil palm genotypes with less height increment are one of the possible ways to migrate the above problem. Genotypes with less height increment even after 20–25 years of age facilitates oil palm growers with more income and less human drudgery. Conventional breeding approaches takes more time in identification of less height increment oil palm genotypes, since breeding cycle is more. Hence, molecular marker technology plays important role in identification of markers linked to short stature (less height increment). Genome-wide association study (GWAS) of African oil palm germplasm using single-nucleotide polymorphisms (SNPs) by genotyping by sequencing (GBS) method for height increment identified five significant quantitative trait loci (QTLs) on chromosome 6, 7, and 9. Interestingly, three QTLs located on chromosome 7, while one each on chromosome 6 and 9 at a P value of < 0.00001. Out of the five QTLs, qtlH7.1 on chromosome 7 was found to be highly significant which explained a phenotypic variance of 15% at a P of $2 \times 10^{-4}$. The blast results of qtlH7.1 showed that it was found to be more similar to oil palm B3 domain containing protein (LOC 105043719) transcript variant X3, mRNA. The B3 domain containing proteins consisted of families like auxin response factors (ARFs) and abscisic acid insensitive 3 (ABI3). These results showed that qtl H7.1 might be playing an important role in stem height increment.
An experiment was conducted to test the efficacy of botanicals against pulse beetle in stored green gram at the laboratory of AICRP on PHET and Seed Technology Research Unit (STRU), Dr. Panjabrao Deshmukh Krishi Vidyapeeth (MS) during the month of June to January in the year 2016-17. Eight treatments including untreated control, comprising of clove powder (3g/kg grain), tulsi leaf powder (3g/kg), black pepper powder (3g/kg), Acorus calamus rhizome powder (10g/kg), sesame oil (5ml/kg), soybean oil (5ml/kg), castor oil (5ml/kg) were used against adult pulse beetle, *Callosobruchus chinensis* on green gram seed. All the botanicals recorded minimum per cent seed infestation than the untreated control over the six months of storage period. Among all the treatments *Acorus calamus* rhizome powder @10g/kg seed and Black pepper powder @ 3g/kg seed was found significantly superior over the rest of treatments in respect to recording minimum per cent seed infestation. However, while taking the avoidable per cent seed infestation, along with the economics in consideration, soybean oil @ 5ml/kg seed and castor oil @ 5ml/kg seed were found effective and cheaper in respect of management of pulse beetle in stored green gram than other botanicals.

**Effect of botanicals on per cent green gram seed infestation by pulse beetle**

Lalsingh Rathod¹, Pragati Tangle², AR Sasane³ and PK Rathod⁴  
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.), India

An experiment was conducted to test the efficacy of botanicals against pulse beetle in stored green gram at the laboratory of AICRP on PHET and Seed Technology Research Unit (STRU), Dr. Panjabrao Deshmukh Krishi Vidyapeeth (MS) during the month of June to January in the year 2016-17. Eight treatments including untreated control, comprising of clove powder (3g/kg grain), tulsi leaf powder (3g/kg), black pepper powder (3g/kg), *Acorus calamus* rhizome powder (10g/kg), sesame oil (5ml/kg), soybean oil (5ml/kg), castor oil (5ml/kg) were used against adult pulse beetle, *Callosobruchus chinensis* on green gram seed. All the botanicals recorded minimum per cent seed infestation than the untreated control over the six months of storage period. Among all the treatments *Acorus calamus* rhizome powder @10g/kg seed and Black pepper powder @ 3g/kg seed was found significantly superior over the rest of treatments in respect to recording minimum per cent seed infestation. However, while taking the avoidable per cent seed infestation, along with the economics in consideration, soybean oil @ 5ml/kg seed and castor oil @ 5ml/kg seed were found effective and cheaper in respect of management of pulse beetle in stored green gram than other botanicals.
Kalpana Dalei  
National Institute of Technology-Rourkela, India

Rice is the primary staple food crop and 90% of it is grown in Asia where 60% of the world’s population live (Khush et al., 1997). The three leading crops rice, wheat and maize supplies more than 42% of total calories consumed by human worldwide. The rice intake contributes to more than 20% of daily calories of 3.5 billion people. Thus, sustainable rice production is crucial to avoid worldwide famine in near future. Although the yield potential is quite higher, average harvest of rice declines due to biotic and abiotic stresses. Rice blast, caused by the non-obligate, hemibiotrophic filamentous ascomycete fungus *Magnaporthe oryzae*, is an important disease affecting rice production worldwide that can cause ~30% loss yearly. The CDCP has recently recognized the disease as a significant biological weapon which destroys production of rice that can feed 60 million people yearly. All of the plant disease management strategies and techniques that have been generated through research against rice blast yielded limited success. In complement to the above scenario, use of systemic fungicides should be avoided as it develops disease-resistant population of fungi and also have detrimental effect on environment. Rice blast has been controlled by genetic mechanisms encoded by major resistance (R) genes. However, new pathogenic races evolve constantly which can express new effectors to mask the race specific resistance mediated by R-genes. Though breeding for resistant rice varieties is an on-going practice, it's rather costly, time consuming, less durable and not applicable to provide broad spectrum disease resistance. Disease resistance in all members of a plant species to all genetic variants of non-adapted pathogen species is the most common form of plant immunity, which is termed non-host resistance (NHR) (Lipka et al., 2008; Heath 2000). NHR offers strong, broad, and permanent protection from all isolates or races of a nonhost phytopathogen. The NHR mechanism results in hypersensitive reactions like oxidative burst and programmed cell death (PCD) at the site of infection that restricts further spreading of the disease to adjacent cells. The *Arabidopsis pen2* mutant show compromise in penetration resistance at pre-haustorial level marked by single cell death and does not allow further spreading of the pathogen. The exact mechanism of NHR and PCD are not understood well yet and may be achieved by screening and identifying genes responsible for both pre and post-haustorial resistance in *Arabidopsis*. To study this, the *pen2* *Arabidopsis* seeds compromised in pre-haustorial resistance were further mutated using ethyl methane sulphonate (EMS) at 0.6%, screened for susceptibility and identified the gene/s underlying the susceptible phenotype at post-haustorial level marked by the entry of the pathogen into the adjacent cells (neighbouring empanelled epidermal as well as subsidiary cells). They identified a gene (*AT1G61180*) which codes a LRR and NB-ARC domains-containing protein might be the putative NHR gene that provides resistance at pre and post haustorial level in *Arabidopsis against M. oryzae*. Incorporation of NHR gene in rice might help in enhanced disease resistance against rice blast and increase in rice production to meet the food crisis of world’s expanding population in 21st century.
Scarcity of feed resources is one of the main reasons for livestock yield gaps in India. Feed base data revealed that there is a shortage of 42 percent crop residues, 53 percent greens and 81 percent concentrates. Feed shortage in terms of protein (digestible crude protein) and energy (total digestible nutrients) is estimated to be 50 and 61 percent, respectively. Assessment of feed composition of the ruminant diet in India divulged that crop residues constitute about 71 percent of the ruminant diet. The advantage of crop residue based feeding system is no competition with food grains and do not require any additional allocation of natural resources such as land and water for their production. The importance of crop residues is going to increase in the future due to dwindling of traditional feed resources (pasture/fallow/forest/waste lands) and increased demand for animal sourced foods both of which increase the gap between demand and supply of feed resources. Hence, targeting improvement crop residues both quantitatively and qualitatively is the only alternative for enhancing feed resource base and nutrient availability for improved livestock production. Attempts were made to improve the utilization of crop residues by physical, chemical and biological means, but the uptake of the technologies by the livestock keepers was poor. This failure paved the way for alternate multidimensional crop improvement program through plant breeding for improving the quantity and quality of crop residues without compromising on grain yields. ICRISAT-ILRI led multidimensional crop improvement program in collaboration with ICAR research institutes resulted in the identification of superior cultivars of food-feed crops with higher grain/pod yields as well as higher quantity and quality of crop residues.

Quality sorghum stover with five percentage units' higher digestibility (IVOMD) fetched 30% premium price in the market. Value addition to high quality sorghum stover (52% digestibility) through fortification and densification increased the milk production by 5 kg in peri-urban commercial dairy farm compared to low quality stover (47% digestibility). Increasing the digestibility of stover of one hectare land (stover yield 4 t/ha with 90% dry matter) by 3 percentage units (45 to 48%) and feeding it to dairy animals for milk production will realize an additional amount of Rs. 16,173/- to the farmer by
selling milk. Improving the digestibility of stover by five percentage units (47 to 52%) save natural resources such as land and water to an extent of 9-10 percent under similar energy production conditions besides reducing methane (GHG) emissions by 40 kg, CO$_2$ equivalent of 960 kg. Hence, the opportunity lies with the multidimensional crop improvement program which needs to be carried further to the next level by the plant, animal scientists so as to increase the feed resource base and to meet the future demands of animal sourced foods in low and middle income countries like India.
Role of trace minerals in optimizing reproductive performance in ruminants

D. Nagalakshmi
Department of Animal Nutrition, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, India

Trace minerals have a great role to play in animal reproductive physiology by maintaining membrane integrity, involvement in hormone production and maintenance of strong immune system. The important trace minerals having a role in reproduction are zinc, copper, selenium, manganese, iron, chromium, cobalt. The imbalances, deficiencies and toxicities of these minerals cause various problems leading to lowered reproductive efficiency and therefore monetary loss to livestock farmers. Subclinical trace mineral deficiencies are quite common in all livestock in India as forages and the feed ingredients are mostly deficient in most of these trace minerals. However, animals in a subclinical or marginal deficiency status are often difficult to identify and is a cause of lower production and reproductive efficiency in field. Thus, strategic supplementation of trace minerals is required to enhance the animal reproductive efficiency. Supplementation of minerals should be based upon the supply of minerals from the basal feed ingredients and as per the needs of the animal. Hence the mineral supplementation should be area-specific as the mineral status in animals or mineral associated reproductive problems in animals varies from one region to another region. More practical and cost-effective method is to supplement only the deficient minerals in required quantities through formulation of area specific mineral mixture (ASMM) for the region. On-farm trials conducted in Telangana and Andhra Pradesh region indicated reduction (P<0.05) in days of post-partum estrous and service period in buffaloes with ASMM supplementation developed for these regions. In field conditions, generally these minerals are supplemented in diets from inorganic sources and with large safety margin to avoid deficiency marginal deficiency of minerals and to minimize associated productive/reproductive problems. But, due to interaction (antagonism) between minerals, excess supplementation of one mineral may adversely affect the absorption and utilization of other mineral. To overcome this problem chemically inert, more stable and highly bioavailable organic trace minerals (OTM) were developed. Hence, the OTM could lower the requirement of the minerals in animals compared to inorganic minerals and could also reduce its excretion and environmental pollution. Based on this concept, series of experiments were conducted on rats and buffalo heifers to evaluate the effect of replacing inorganic source of Zn (ZnSO₄/ZnCO₃) with various organic sources.
Replacement of 12 ppm inorganic Zn (ZnCO₃) with 12 ppm organic Zn (Zn-nicotinate) improved (P<0.05) antioxidant status, and reproductive efficiency in rats, while the reproductive performance was not adversely affected by reducing the Zn supplementation by 75% (9 ppm). In buffalo heifers, it was observed that 100% substitution of inorganic Zn (140ppm) with organic source (Zn-proteinate) resulted in better (P<0.05) antioxidant status with more number of large size follicles having greater diameter in ovaries. Further, ovarian follicular development was comparable between 80 ppm Zn as Zn-proteinate and 140 ppm as ZnSO₄. In another experiment in buffalo heifers, supplementation of 80ppm Zn as combination of inorganic and organic form (Zn-proteinate) in ratio of 25:75 had higher medium size follicles with greater diameter and replacing 50% of inorganic Zn had no further beneficial effect.
Session 2: Animal Husbandry

Chair: M. Balakrishnan, ICAR-National Academy of Agricultural Research Management
Co-Chair: Sonu Gandhi, DBT-National Institute of Animal Biotechnology, India
The Andaman and Nicobar Islands comprise a chain of more islands in addition to a number of islets and rock outcrops in the Bay of Bengal. Perishable commodities, such as vegetables, fruits, and animal products (milk, meat, and egg) have to be procured from mainland India and are always in short supply. In the livestock sector, the major constraints are less population, poor germplasm, and poor productivity due to shortage of feed and fodder resources. The dairy animals, especially the local cows and buffaloes, yield on an average 1.5 and 2.0 l/day of milk, respectively. The reasons for this low productivity are ‘desi’ or non-descript breeds; local climatic factors conducive for disease and parasites and above all there is lack of assured round the year availability of fodder in ample quantities. However, there are about 112 species of fodders have been documented in A & N Islands. Before chalking out the possible strategies and plans, information on current status of local grasslands and pastures; local natural resources including vegetation, soil, land and climate; inherent constraints of geographical remoteness, geological past, socio-economic setup, weather elements all must be born in mind. The present attempt is to summarize all such related information at one place, so as to facilitate planning processes. Based on the empirical observations on the performance of various types of exotic and indigenous fodder resources, under local rainfed conditions over last many years, a comprehensive fodder information resources database has been designed and developed. This database design is user friendly and provides all the information about fodder resources for the end user viz. research, academic, development and administrative departments. This database can be updated on a regular basis, so that it would provide current status about the fodder resources of A&N islands.
Proteases as a biomarker for livestock diseases in animals

Sonu Gandhi$^{1,2}$, Hamed Arami$^1$, Eric M Teeman$^1$ and Kannan M. Krishnan$^1$

$^1$DBT-National Institute of Animal Biotechnology (DBT-NIAB), India
$^2$Materials Science and Engineering Department, University of Washington, USA

Proteases are specifically expressed by malignant cells and useful in the diagnosis and prevention of many livestock related diseases such as mastitis; the former can be cooperatively acted as diagnostic tool based on radioisotopes or fluorescence. The major drawbacks are health hazards and quenching instigated by radionuclides and fluorescent probes.

In view of drawbacks they develop a novel method for detection of proteases by magnetic particle spectrometry (MPS) of monodisperse iron oxide nanoparticles (IONPs). The crucial step is to design specific and tailored peptides that can act as active nanosensor when present with IONPs. The designed peptides possess selective recognition sites that are susceptible to cleavage by specific proteases, N– and C– terminals are labeled with biotin. When NeutrAvidin functionalized IONPs are added, nanoparticles aggregate, that result in well-defined changes in the MPS signal. Conversely, these peptides are cleaved at predetermined sites in the presence of proteases redispersing IONPs, and returning the MPS signal(s) close to its pre-aggregation state. These changes observed in all aspects of the MPS signal (peak intensity, its position as function of field amplitude, and full width at half-maximum – when combined, these three also eliminate false positives), help to distinguish specific proteases, relying only on the changes in magnetic relaxation characteristics of the functionalized IONPs.
Livestock developmental programs have been implemented in Andhra Pradesh by Government NGOs and other private agencies with the ultimate aim of improving the livestock production and thereby the socio-economic condition of livestock farmers. Besides these efforts by various agencies, sustainability of the farm depends upon efficient management of dairy animals by the farmers which ultimately depends on the farmers’ socio-economic situation along with knowledge and attitude towards the recommended practices. Many studies revealed that disease out-breaks cause major losses to the dairy farmers and hence, preventive animal health care practices play major role in safeguarding the farmer against such losses. This has obvious implications for dairy farmers to raise the need for improved diagnosis and early detection of diseases along with greatly increased awareness and management competencies to deal with disease patterns and vaccination programmes that are manifestly changing. With this background, the study was undertaken in Andhra Pradesh state to know the level of specific health management competencies of dairy farmers. A sample of 240 dairy farmers were interviewed through pre-structured interview schedule. The results revealed that two third of respondents had medium level of specific health management competencies. Among the components of specific health management competencies, maintenance of animal health and well-being stands first followed by checking of animals for presence of external parasites. Thus concluded as increase the availability of milk to human population through scientific disease management of livestock...
Mastanbi Shaik
Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh.

Rural communities and small-scale agricultural producers are deeply affected by global, economic, environmental and political forces. The gap between the information rich and information poor is getting wider. However, the existing extension personnel can take advantage of the modern communication technologies to improve the transfer of technology process. With this background, the study was undertaken in Andhra Pradesh state to study the perception of sheep farmers (120) and veterinary officials (30) on the developed information technology enabled Sheep Advisory System (SAS). Sheep Advisory System was developed using Macromedia Director on selected dimensions of sheep farming. Both the groups expressed that SAS had great message components and technical components. It also possessed good utility and usability. This computer based module will help to impart scientific knowledge of sheep farming in local language to the end users.
Yeast expressed consensus S1 glycoprotein afforded partial protection against avian infectious bronchitis in the chicken

Saravanan Ramakrishnan
ICAR - Indian Veterinary Research Institute, India

Avian Infectious Bronchitis (IB) is an economically important, acute contagious viral disease of poultry. We studied the protection potential of consensus S1 glycoprotein against IB. A consensus sequence was derived out of 67 S1 glycoprotein gene sequences of IB virus and synthesized commercially. The gene was cloned in yeast expression vector, transformed and expressed in Saccharomyces cerevisiae cells. The recombinant S1 glycoprotein (rS1 GP) produced was purified and confirmed by Western blot. Specific pathogen free (SPF) chicks (n=50) were randomly divided into five groups (n=10/group) namely, rS1 GP (100µg/bird), rS1 GP plus adjuvant (rS1 glycoprotein 100µg plus Montanide ISA 71 R VG), inactivated IBV vaccine, live IBV vaccine and unvaccinated control. The birds were vaccinated at two weeks of age and a booster was given two weeks later. The yeast expressed rS1 induced significantly higher antibody response (P<0.01) as well as resulted in higher stimulation index of lymphocytes (P<0.05) evaluated by ELISA and lymphocyte transformation test, respectively compared to the unvaccinated control group. All the vaccinated groups showed significantly higher (P<0.01) CD4+ as well as CD8+ T cells than that of the unvaccinated control group. The adjuvant enhanced antigen specific humoral as well as cellular immune responses induced by rS1 GP. The experimental birds were challenged with Massachusetts standard challenge virus (104 ELD50 per bird through ocular instillation) two weeks post booster immunization and representative birds (n=6/group) were sacrificed to collect the trachea on day 5 post-challenge for assessing the protection by ciliostasis test. The live IBV vaccine afforded 71.7% protection, while the protection was only 40 and 45% in the rS1 GP and rS1 GP plus adjuvant groups, respectively. In conclusion, the consensus rS1 GP conferred partial protection against IB in the chicken, though it induced antigen specific humoral as well as cellular immune responses.
Occurrence of *Escherichia coli* O157:H7 in Hyderabad Karnataka Region sheep and goats

Pralhad* and Basavaraj Awati  
ICAR-Krishi Vigyan Kendra, Raichur  
University of Agricultural Sciences, Raichur India

*E. coli* O157:H7 is an emerging food borne pathogen having zoonotic importance. Though the primary reservoir of the serotype is cattle; sheep and goats are also considered as main reservoir for *E. coli* O157:H7, which act as asymptomatic carriers. Conventional biochemical methods and cultural are time consuming to detect *E. coli* O157:H7 in food borne outbreaks and have less specificity and sensitivity. Latex agglutination test (LAT) tends to be specific, more rapid and reliable. In the present study, faecal samples collected from sheep (n=517) and goats (n=450) from different farms across North Eastern Karnataka during June 2016 to August 2017 were analysed. The samples were processed and analysed for the cultural isolation, biochemical characterization and LAT. In this study, LAT was taken as confirmative diagnostic test and the results obtained by cultural isolation and biochemical characterization were compared with that of LAT to estimate the sensitivity and the specificity. The percent of sheep and goats that showed shedding of *E. coli* O157 in the faeces was 3.67% (19 out of 517) and 2.88% (13 out of 450) respectively. The prevalence is more in male (9.95% in sheep and 7.35 % in goat) than female (5.79% in sheep and 4.87 % in goat) also in yearlings (14.58% in sheep and 10.11 % in goat) than lambs and kids (10.73% in sheep and 8.45 % in goat) and adult sheep and goat (3.67% in sheep and 4.68 % in goat). The prevalence of *E. coli* O157:H7 varied between seasons with the highest prevalence occurring in summer (11.11 % in sheep and 10.37 % in goat) followed by monsoon (7.07 % in sheep and 4.84 % in goat) and winter seasons (4.89 % in sheep and 3.33% in goat). The results obtained show that LAT is a rapid, highly sensitive, species-specific and reliable method for the detection of the pathogenic *E. coli* O157:H7 and could be used for identification and molecular characterization of *E. coli* O157:H7 in suspected food and water borne outbreaks, disease investigations and routine analysis.
Evaluation of the physical characteristics of complete feed blocks containing different binders

B Vidya¹*, M Venkateswarlu², D Nagalakshmi², N Nalini Kumari¹ and A Sarat Chandra²
1. College of Veterinary Science, Korutla, Jagtial
2. College of Veterinary Science, P V Narsimha Rao Telangana University, Hyderabad

A n experiment was conducted to study the effect of various binders on the physical characteristics of the complete feed blocks. The complete feed with sorghum stover (Roughage to concentrate ratio 50:50) is formulated to contain 10.5% CP and 55% TDN based on ICAR 2013 requirements using different binders such as molasses, guar meal, and condensed distillery soluble at different levels @ 6%, 8% and 10%. The complete feed mixtures were densified into blocks in horizontal feed block-making machine at 3000 psi for a dwell time of one minute. The feed blocks were stored for 48 hr to dry and evaluated for the physical characteristics such as bulk density, durability, Post compression expansion and drying characteristics such as initial and final moisture content. The bulk density of sorghum straw blocks varied from 0.48 to 0.57 g/cm³. There is a significant difference in bulk density between the blocks containing 6% molasses with the other blocks but there is no significant difference between the M-8, M-10, GM-6 GM-8 and GM-10 blocks. Durability % varied from 4.12 to 36.54. Post compression expansion % 8.52 to 22.50. GM-8 blocks had higher bulk density but less durable than the other feed blocks. Durability and bulk density of GM-10 blocks were comparable with M-8 feed blocks but Post compression expansion of GM 10 blocks is 18.5% higher than the M-8 blocks. Condensed Distillery Solubles when included at 6, 8 or 10% as a binder, the blocks could not be prepared.
One of the greatest challenges faced by livestock keepers around the world is heat stress. Heat stress occurs when any combination of environmental factors cause the effective temperature to be higher than the animals Thermo Neutral Zone. Under thermal stress, a number of physiological and behavioral responses vary in intensity and duration in relation to the animal genetic make-up and environmental factors through the integration of many organs and systems viz. behavioral, endocrine, cardio-respiratory and immune system. The degree to which an animal resists change in body temperature varies with different species because of differences in their heat regulating mechanisms. Heat stress in dairy cattle can be measured because there is a change in metabolic rate of normal equilibrium in response to change in ambient temperature. The specific manifestations of the stress, such as change in body temperature, heart rate and respiration can be measured because the animal responds functionally to maintain homeostasis.

The present study was conducted to observe the effect of seasons on thermoregulation responses. A total of 74 Crossbred cows and 24 Sahiwal cows were selected from the Military dairy farm, Secunderabad and Livestock farm complex, College of Veterinary Science, Rajendranagar. The changes in respiration rate, rectal temperature and Heat tolerance coefficient (HTC) were observed in summer and winter seasons in crossbred and indigenous cows. The magnitude of increase in respiration rate, rectal temperature and Heat tolerance coefficient were found to be higher during summer compared to winter season in both Sahiwal and crossbred cows. It was observed that Sahiwal cows were less sensitive and are better able to regulate body temperature in response to heat stress than crossbred cows.

Genetic differences in thermo tolerance at the physiological and cellular levels are documented by number of studies on Bos indicus and Bos taurus cattle breeds. During genetic adaptation, indigenous cattle (Bos indicus) have acquired thermo tolerant genes to protect cells from the deleterious effects of high temperature, and therefore, have a higher degree of thermo tolerance compared with Bos taurus. Therefore, indigenous cattle are better able to regulate their body temperature in response to heat stress than European cattle breeds (Bos taurus).
Profile analysis of Marathwadi buffalo rearers

J. M. Deshmukh¹ and K. D. Bande²
College of Agriculture - Latur, India

The present study was conducted in Latur district, in Marathwada region, of Maharashtra State with specific objective to study profile of Marathwadi buffalo rearers and also to know their constraints in rearing Marathwadi buffalo. From Latur district Ausa, Nilanga and Udgir tahsils were selected for study. From each tahsil, four villages were selected which were having the considerable population of Marathwadi buffalo and from each village ten respondents were selected. The results of the study portray that majority of the buffalo rearers under study were from medium level of farm experience. Most of them were educated in primary, having medium size of family, buffalo rearing+ farming occupation, having medium herd size, medium annual income, having medium land holding, medium social participation, medium economic motivation and medium use of source of information. The important constraints reported by buffalo rearer is constraint of availability of fodder throughout the year and also in the rainy season, shortage of grazing land.
Session 3: Horticulture and Floriculture

Chair: P. D. Kamala Jayanthi, ICAR-IIHR, Hyderabad, Telangana
Co-Chair: Anuburani, Annamalai University, Tamil Nadu
Role of semiochemicals for horticultural insect pest management: Unexplored domain

P. D. Kamala Jayanthi
ICAR-Indian Institute of Horticultural Research, India

The increasing complexity of pest management in horticultural crop ecosystems stresses the need for sustainable pest management strategies. However, IPM programs are falling short of powerful environment-friendly components that can make them sustainable in long run. The increasing global awareness about eco-friendly pest management paved way for non-chemical methods, which advocate the use of natural processes and mechanisms against insect-pests. Out of several natural processes available for insect-pest management, phyto-semiochemicals viz., kairomones, pheromones are not much-exploited in spite of their enormous ability to strengthen our IPM programs. Learning the chemical language of plants-insect pests and their natural enemies in an agro-ecosystem elucidate the role and origin of info chemicals that are crucial in insect-plant interactions and to locate the trophic level at which they are active. This will aid to formulate end-to-end pest management programs and bring out viable behavioural cues that can be incorporated into current IPM programs our studies on phyto-semiochemicals in insect-plant interactions of major horticultural pests led to the identification of potential cues that elicit behavior modification in target pests. The scope of isolation and identification of phyto-semiochemicals for their potential use in the management of horticultural crop pests will be discussed.
Effect of organic management techniques on influencing yield and nutrient uptake of radish (Raphanus sativus L.) var. Pusa Chetki

A. Anburani and Anu P. Mani
Annamalai University, Tamil Nadu, India

Field investigations were carried out to study the effect of organic management techniques on influencing yield and nutrient uptake of radish in the farmer’s field, Nainarpalayam, Chinnasalem Taluk, Villupuram District, Tamil Nadu. The investigation was conducted in two experiments. The first experiment was done to study the effect of organic nutrient management and mulching on yield and nutrient uptake of radish with eighteen treatments in three replications in randomized block design. The organic manures, viz., FYM @ 25 t ha\(^{-1}\), vermicompost @ 5 t ha\(^{-1}\), enriched manure @ 1 t ha\(^{-1}\) and consortium of bio fertilizer @ 2 kg ha\(^{-1}\) were applied in the soil as basal application. The biostimulants like effective microorganism inoculum @ 1:1000 dilution ha\(^{-1}\) and butter milk solution @ 5 l ha\(^{-1}\) were given as foliar spray at 10 days intervals as three sprays. The yield and nutrient uptake viz., root length, root girth, root weight, shoot: root ratio per plant\(^{-1}\) and yield per plot were recorded and analysed. The results of the experiment revealed that organic nutrient management the yield parameters viz., the highest root length, root girth, root weight, shoot: root ratio per plant\(^{-1}\) and yield per plot highest nitrogen, phosphorus and potassium uptake were recorded with the treatment application of EM @ 1 t ha\(^{-1}\) + CBF @ 2 kg ha\(^{-1}\) + EMI. The second experiment on “Effect of mulching on growth and yield of radish was conducted by selecting the best performing treatment from the first experiment. The experiment was carried out in RBD with six treatments in four replications. Different type of mulching materials viz., paddy straw, biodegradable mulch, sugarcane trash, grass clippings, saw dusts were tested. An un mulched plot was kept as control. The yield and nutrient uptake parameters were recorded and analysed. The results revealed that the highest root length, root girth, root weight, shoot: root ratio per plant\(^{-1}\) and yield per plot were recorded the highest with the application of biodegradable plastic mulch of 15 micron thickness, whereas the highest nitrogen, phosphorus and potassium uptake were recorded in the same treatment. Hence, it can be concluded that application of enriched manure @ 1 t ha\(^{-1}\) combined with consortium bio fertilizer @ 2 t ha\(^{-1}\) and foliar application of EMI @ 1:1000 dilution along with sugarcane trash mulch was adjudged as the best treatment combination in enhancing growth and yield of radish var. Pusa Chetki.
Effects of Oxycure and *Aloe Vera* leaf powder supplementation on gut health of heat stressed Vanaraja birds

¹Department of Physiology, College of Veterinary Science, India

A total of 180 birds of 8 weeks old were divided into 6 groups (6 Replicates × 5 Birds). Group (G): I was fed with basal diet (BD) alone, while, G: II & III were supplemented with Oxycure (a Vitamin and mineral supplement) and *Aloe Vera* leaf powder to BD. G: IV V & VI were subjected to heat stress (HS) and were fed with either BD alone (or) supplemented with Oxycure and *Aloe Vera* pd respectively. At the end of trial (12th Week) duodenal and ileal segments were collected by sacrificing 6 birds from each group for histo morphometry and gut microbiology. Birds fed on either *Aloe Vera* (or) Oxycure supplemented feed had significantly (p≤0.01) greater duodenal and ileal villi heights and villi height-crypt depth ratios than those fed on basal diet alone both in HS and control birds. While crypt depth in duodenal and ileal segmentes was significantly lower in supplemental groups than their corresponding control groups. HS increased the number of harmful bacteria (*E. coli* and *Salmonella*) and decreased the number of Probiotic bacteria (*Lactobacillus*) in the intestine and *Aloe Vera* supplementation has relatively improved the gut microflora. Hence, it may be concluded that HS has negative impact on gut health of Vanaraja birds and dietary supplementation of Oxycure and *Aloe Vera* had ameliorative effect.
Effect of different colour of shadenet and growing media on the chemical characteristics and yield of spinach cultivated by hydroponics.

Suchita V. Gupta¹, Sanjivani. C. Karne², Bhagyashree N. Patil³
1. Head, Department of Farm Structures, CAET, Dr. PDKV, India
2. M-tech Student, Department of Farm Structures, CAET, Dr. PDKV, India
3. Assistant Professor, Agricultural Process Engineering, CAET, Dr. PDKV, India

The experiment was conducted during summer season at the field of Department of Farm Structures, Dr. Panjabrao Deshmukh Krishi Vidyapeeth and Akola. The experimental site was fairly uniform and levelled. Hydroponic structure was designed for the cultivation of leafy vegetables by different hydroponic methods. The dimensions of portable hydroponic structure were 1375 mm high x 925 mm long and was made from locally available materials. The structure was made up of mild steel hollow pipes of size 25.4 mm which were bended and welded together to form a Quonset-type structure. Cultivation of spinach by using two different hydroponic methods was carried out under controlled atmosphere and on the open field. Solid media culture and liquid hydroponics were used and in solid media three different types of media were used such as cocopeat, soil rite and 50% cocopeat and 50% soil rite. Various chemical characteristics like iron content and chlorophyll content determined of spinach were in Green and white portable hydroponic structure and open-field. All the observations were analyzed by Design expert version 9.0.2.0 software to analyze the result using response surface methodology (RSM). Maximum iron content was found 351.306 ppm and maximum chlorophyll content was found 36.794 mg/gm. Yield of spinach was found greater in the green colour hydroponic structure in between 150-210 q/ha. Yield inside the white colour hydroponic structure was found between 120-200 q/ha and in the open field it was found between 50-80 q/ha.
Water scarcity is one of the major challenges facing the whole world including India. Climate change, environmental degradation and pollution are affecting the available water resources both in terms of quality as well as quantity. Since agriculture is the largest consumer of water and so, world research has focused on the various adaptation and mitigation strategies viz. developing genetically improved drought-resistant crop varieties, developing techniques for less water consuming agricultural practices, decreasing water losses, increasing water storage as well as research on additional water sources. Now a day's, wastewater agriculture became a worldwide adopted phenomenon. In absence of freshwater resources, many farmers in Peri-urban areas already using wastewater for growing crops, vegetables, fish culture etc. Therefore, wastewater seemed an additional water resource and research has started for developing techniques for low cost, less energy-intensive and sustainable treatment technologies. In this line, a research was conducted at ICAR-National Institute of Abiotic Stress Management, Baramati and used different growing media viz. gravel, coco peat, charcoal, spent mushroom compost along with media less control based horizontal subsurface flow constructed wetland system (HSSF-CWs) for treating Septic tank wastewater. In these media-based systems; different flowering crops viz. chrysanthemum, marigold, sweet basil, aster, tuberose and gladiolas were grown with the aim to integrate water treatment systems with floriculture industry and develop a business model for Peri-urban farmers. Various physico-chemical-microbial water quality parameters of both untreated and treated waters were tested like Biochemical Oxygen Demand (BOD), pH, EC, carbonate, bicarbonate, chloride, Ca + Mg, fluoride, nitrate, phosphate, Sulphate, sodium, potassium, heavy metals, total coliform, faecal coliform, Escherichia coli etc. These treated waters are using further in aquaponics system grown with spinach and Pangasius fish after passing through a 25 watt UV sterilization unit. Among different flowering crops sweet basil grown on spent mushroom compost and marigold grown on charcoal has performed the best and seemed to be used for sustainable water treatment option with additional profit and could supplement in various mitigation strategies to circumvent the global water scarcity.
**Effect glycerol monostearate and carboxy methyl cellulose on foaming properties of guava pulp under foam mat drying**

Arti S. Sapkal¹, Bhagyashree N. Patil¹, P. A. Borkar¹ and S. V. Gupta²  
Department of Agricultural Process Engineering, Dr. PDKV, India  
Department of Farm Structures, Dr. PDKV, India

Guava (*Psidium guajava* L.), which belongs to the *Myrtaceae* family, is a native of tropical America. Guava fruit has a characteristic flavor, to which its acidity (pH 4.0 to 5.2). It is rich in vitamin C (260 mg/100g) and a fair source of calcium, phosphorus, iron and vitamin A. Foams were prepared from guava pulp by adding foaming agent i.e. Glycerol mono stearate (0.1 – 0.5%), Carboxy Methyl Cellulose (1 - 5%) and whipping time for 5 – 25 min. Box-Behnken design (BBD) under RSM was employed for optimization of foaming treatment especially whipping time. The initial moisture content (wb) of foamed and non-foamed guava pulp was found to be 83.25% and 86.90%. The optimized condition was selected for GMS concentration 0.5%, CMC 3% whipping time 22.95 min for maximum foam expansion 14.83%, minimum foam density 0.89 g/cm³ and maximum foam stability 98.174% with desirability 0.887. The foamed and non-foamed guava pulp was dried at different drying methods i.e. sun (temp. 30-32°C and RH-40%), tray (60°C) and microwave (360 W power). The final moisture content (db) of dried foamed and non-foamed guava pulp powdered was in the range of 5.88 – 9.27%. The drying rate was found to be as in the range 2.46 - 38.01 g/min. The drying time was found to be as in the range of 64 - 570 min.
Identification of QTLs in oil palm (*Elaeis guineensis* Jacq.) for vegetative traits using SSR markers through association mapping

Bhagya, H.P., Kalyanababu, B., Ravichandran, G and Anitha, P
ICAR-Indian Institute of Oil Palm Research, Andhra Pradesh

Oil palm (*Elaeis guineensis* Jacq.) is high oil yielding crop (4-6 t/ha) as vegetable oil source. There is a wide scope for increasing the oil yield by selecting elite planting material for breeding programme in germplasm evaluation, characterization and utilization. In the present investigation a diverse range of 150 oil palm genotypes were characterized using 12 quantitative variables with 54 genomic microsatellite markers collected from different parts of India. Wide variation was observed for the studied morphological traits among indigenous populations. In mapping study, GLM approach revealed that thirteen markers were linked to twelve traits at a significant threshold (P) level of ≤0.01 and ≤0.001 and MLM approach reported eight markers were linked to nine traits at a significant threshold (P) level of ≤0.01. These identified QTLs can be further used in breeding programme.
Evaluation of different chemicals for improving the shelf life of mushrooms

Prameela M
Professor Jayashankar Telangana State Agricultural University, Hyderabad

Since mushrooms are perishable and delicate in nature these cannot be kept fresh for more time, after the maturity of the fruiting body the deterioration starts with the formation of brown coloration and hence the quality deterioration and loss of marketability. Hence in this connection studies had been taken up for improving the shelf life of oyster mushrooms using different chemicals like 125 ppm Ethylene diamine tetra-acetic acid, 5% H2O2, 2% Sodium chloride and 0.1% Ascorbic acid and sources of ascorbic acid like Lemon extract, Moringa leaf extract, Papaya extract and Amla powder. The results showed that the mushrooms soaked for 5 minutes and 10 min. in 2 per cent Sodium chloride and placed in refrigerated conditions did not develop any browning on mushroom fruiting bodies for about 10 days in refrigerator conditions followed by 0.1 per cent Ascorbic acid and 5 per cent H2O2. Among different sources of ascorbic acid used 10 per cent and 15 per cent lemon extract did not develop any browning on mushrooms for about 6 days in refrigerator conditions followed by 10 per cent and 15 per cent papaya extract for 4 days.
Evaluation of growth, development and economic cocoon parameters of Eri Silkworm

Samia cynthia ricini Boisduval on new hosts

Babita Kumari
Banasthali University, India

The growth, development and economic cocoon parameters of eri silkworm, Samia cynthia ricini Boisduval on new hosts are summarized in the study. Jack fruit, fountain tree, banyan tree, Indian almond and carrot leaves are the new host plants of eri silkworm. Out of 23 plant species the five plant species have been by the eri silkworm accepted good feeding response and survivability fountain tree, banyan tree and Indian almond moderately on and carrot leaves whereas only one plant species showed slight feeding response and survivability on jack fruit leaves. The new host plants significantly influenced the weight of chawki worms. The maximum larval weight of 0.018, 0.477 and 1.609 were recorded on castor during I, II and III instars which on par with carrot leaves 0.017, 0.469 and 1.553 g during I, II and III instars respectively and in late age worm also similar trend was noticed. The highest mature worm weight (4.55 g) was registered on castor which was on par with fountain tree (4.45 g). The maximum larval weight recorded was during November-December (4.35 g).Significantly shortest larval period (21.50 days) was registered on castor which is on par with carrot (22.25 days) leaves fed throughout the larval period. During November December minimum larval period (25.10 days) was recorded. Larval survivability was maximum on castor (99.17) which was on par with fountain tree (98.84). ERR and growth index was maximum on castor (96.50% and 4.444, respectively) followed by fountain tree (96.25% and 4.414, respectively). Dead eggs were minimum on castor (4.55) followed by fountain tree (6.17), hatchability was maximum on castor (95.18%) followed by fountain tree (93.72%).With respect of all drainage parameters like maximum fertile egg (290.74), minimum unfertile eggs (15.79), minimum dead eggs (6.47) and maximum hatching per cent (92.73%)were recorded during November- December 2018. The eggs laid in first three days was maximum (171.31, 130.11 and 32.08) on castor which was on par with (170.73, 127.68 and 31.09,) on fountain tree respectively. Fecundity was maximum (339.50) on castor which is on par with fountain tree with. With respect to rearing season, significantly maximum eggs were laid (158.73, 123.97 and 30.30) were recorded at I, II and III days during November-December 2018.Adult wing expanse of male and female was maximum (10.98 cm and 11.98 cm) on castor which was on par with fountain tree (10.95 cm and 11.98 cm).
The method for preparation of instant mango powder from different varieties of mangoes via; Dasher, Amrapali, Mallika and Seedling /In-situ mangoes by using foam mat drying technique was standardized. Fruit pulp was turned into stable foam by using carboxy methyl cellulose (CMC) as foaming agent (0-2%) followed by drying in tray drier for preparation of instant mango powder. Initially, the extracted mango fruit pulp was analyzed for various physico-chemical parameter viz. pulp yields, TSS, moisture, titratable acidity, sugar content and carotene. The pulp after foaming was dried in dehydrator at temperature of 60±5 0C to a moisture content of about 5%. Out of different combinations, use of 2% carboxy methyl cellulose in each variety was found the most appropriate for foaming of mango pulp on the basis of foaming properties. The drying time required for foamed mango pulp was recorded lower than non- foamed pulp. The pulp with 2% CMC of cultivars Dasher, Mallika, Amrapali and In-situ mango contained foam density (0.686 g/cm³, 0.865 g/cm³, 0.686 g/cm³ and 0.698 g/cm³) foam expansion (15%, 14.99%, 15% and 13.99%) respectively with 100% foam stability in all cultivars. Foaming of pulp reduced the drying time appreciably in comparison to drying of un foamed mango pulp. Chemically, this Mallika variety powder contained 80 o Brix, TSS, 4.9 pH and 14mg/100gm ascorbic acid, Dasher variety powder contained 76 o Brix TSS, 4.7 pH and 13mg/100gm ascorbic acid, Amrapali variety powder contain 80 o Brix TSS, 4.8 pH and 17 mg/100gm ascorbic acid and In-situ mango powder contain 74 o Brix TSS, 4.1 pH, 25mg/100gm ascorbic acid. Thus, mango pulp can be utilized for the preparation of instant mango powder using foam mat drying technique.
Refrigeration storability of crude HearNPV infesting polyphagous pest *Helicoverpa armigera* (Hubner)

Divya Chandran and D. M. Jethva  
*Junagadh Agricultural University, India*

The total larval mortality caused in 3rd instar due to crude HearNPV in different periods (1 to 14 months) of storage ranged from 53.33% to 100.00% with an average of 82.78%. The rate of larval mortality declined steadily over months showing that the stored crude HearNPV under domestic refrigerator (6.0 to 7.50 C) for 14 months, without hampering their virulency in succeeding months of storage. It can also be recommended to farmers to collect HearNPV infected larvae from field and that can be stored under refrigerator condition (6.0 to 7.50C) up to 14 months without hampering their virulence and can be used for management of respective pest in the current and next season of the crop or mass production of NPV in laboratory.
Session 4: Plant Health & Bio security

Chair: M V Jagannadham, CSIR-CCMB, Hyderabad, Telangana
Co-Chair: M K Reddy, ICGEB, New Delhi, India
Outer membrane vesicles (OMVs) are released from *Pseudomonas syringae* pv. Tomato T (PstT1) during their normal growth. These extracellular compartments are comprised of a complete set of biological macromolecules that includes proteins, lipids, lipopolysaccharides, etc. It is evident from proteomics analyses the OMVs of Pst T1 contain membrane- and virulence-associated proteins. In addition, OMVs of this organism are also associated with phytotoxin, coronatine.

Therefore, OMVs of Pst T1 must play a significant role during pathogenicity to host plant. It was demonstrated that that the vesicles infect tomato leaf. In order to understand the role of vesicles a Gram positive bacterial vesicles were also prepared and studied their interaction with host cells. Studies on the membrane vesicles of *Listeria monocytogenes* revealed that they contain virulence factors such as Lis Listeriolysin O (ILO), internalin B (InlB), autolysin, P60, NLP/P60 family proteins and several other proteins. Computational prediction of host-MV interactions revealed a total of 1841 possible interactions with the host involving 99 vesicle proteins and 1513 host proteins. The possible path way that mediate the internalization MVs to the host cells and subsequent pathogenesis mechanisms were identified. The in vitro infection assays showed that the purified MVs could induce cytotoxicity in Caco-2 cells. Using endocytosis inhibitors, it was demonstrated that MVs are internalized via actin-mediated endocytosis. These results suggest that *L. monocytogenes* MVs can interact with host cells and contribute to the pathogenesis of *L. monocytogenes* during infection. These studies highlight that bacterial vesicles are playing an important role in host–pathogen interactions.
Engineering herbicide resistance in crop plants for effective weed management in Agriculture

M K Reddy
International Centre for Genetic Engineering and Biotechnology, Hyderabad

Weeds are the most serious biological constraints in agriculture. Manual weed control over large areas is not feasible from the point of labor availability and monetary costs. In such a scenario chemical weed control is extremely important in agriculture. However chemical weed control does not offer sufficient selectivity to be harmless to the crop plants. The aim of our group is to engineer the rice crop so as to be resistant to more than one herbicide. Our strategy entails, systemic rotation of the application of these herbicides with different modes of action to prevent the development of herbicide tolerant weed population. We have selected two broad-spectrum non-selective systemic herbicides viz. sulfonylurea for pre-emergent application and glyphosate for post-emergent application. Sulfonylurea and glyphosate are strong inhibitors of two important phytoenzymes involved in amino acid synthesis viz Acetolactate synthase (ALS) and 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase (EPSPS). We made use of herbicide target sites modification strategy to introduce selective amino acid substitutions in ALS and EPSPS of rice that selectively interfere with ability of herbicide binding without compromising their biological functions. We cloned both mutated rice ALS and EPSPS and transformed them into rice and the transgenic lines showed significant tolerance to glyphosate and sulfonylurea without any fitness cost. We have also developed another strategy to control the weeds by applying phosphite. This strategy is based on the fact that plants which, use phosphate for their growth and development, cannot metabolize phosphite. We have developed transgenic rice plants over expressing phosphite dehydrogenase that can oxidize phosphite into phosphate. The highlights of this strategy are (a) phosphite can act as a fertilizer for the transgenic rice and (b) simultaneously act as herbicide for the weeds and (c) also act as a pesticide to prevent several fungal and bacterial diseases. Currently we are evaluating these transgenic lines for herbicide based weed management in rice cultivation.
RNAi molecules have been studied for their applicability to silence the pathogenic genes in a range of pathogens to fight the biotic stress. Numerous diseases have been reported to be control by using RNAi gene silencing. But the applicability is a matter of concern in today’s era. The idea of new generation strategies to manage the biotic-stress is effectiveness and eco-friendly nature. RNAi is one of the most impressive and attainable strategy to explore as one of the miraculous molecule to deal with the pathogenic stress without any residual effects. However, their durability, applicability in the field, availability, and effectiveness in the field is a matter of concern. Delivering RNAi gene silencing in the field in a most convenient way for managing the plant diseases in a most practical way for the farmers is one of the most important challenges in world-wide adoption of this technology. Many companies in association with the research institutes are working hard to function this technology as sprayed based molecules that can induce gene silencing.
Evaluation of insecticides against pod borers in Pigeon pea

B. Anil Kumar*, M. Prameela, A. Padmasri, K. Bhanu Rekha and M. Venkataiah
Professor Jayashankar Telangana State Agricultural University, Hyderabad

Pigeon pea is a valuable grain legume grown in semi-arid tropical and sub-tropical areas of the world. Pod borers of pigeon pea viz., Helicoverpa armigera, Exelastis atomosa, Maruca vitrata, Etiella zincknella and Pod fly, Melanagromyza obtusa are causing considerable economic loss to the crop. The pod borers are the major pests at flowering and pod development stage. Pod borers cause heavy damage to pods resulting in extensive loss in the grain yield. Hence, management of these pests is essential for successful production of pigeon pea. Spraying effective chemical prevents yield loss, reduces cost of cultivation and increases farm income. Thereby, a field trial was conducted in Randomized Block Design with nine treatments and 3 replications during consecutive 3 kharif seasons at Regional Agricultural Research Station, Jagtial. A total of 3 sprayings were given at an interval of 10 days and data on damage by pod borers viz., Helicoverpa armigera and Maruca vitrata, seed damage by Melanagromyza obtusa were recorded on pod and grain basis. All the tested insecticides were found significantly superior to control in reducing the pod borers damage. The maximum pod borer's damage and pod fly damage were recorded in untreated control.

Mean per cent pod damage by pod borers: The pod damage by pod borers varied significantly among the treatments. The mean per cent pod damage due to Helicoverpa ranged between 7.36% (Spinosad 45 SC @ 0.75 ml/l) and 23.66 per cent (acephate 75 SP @ 1.5 g/l) in different treatments as against 30.57 per cent in the control. The treatment Spinosad was most effective and significantly superior to the rest of the treatments followed by Emamectin benzoate 5 WSC with 7.36 per cent and 9.21 per cent pod damage respectively. Similar trend was noticed with regards to the mean per cent pod damage by Maruca vitrata registering a mean per cent pod damage of 3.49 and 5.11 in Spinosad and Emamectin benzoate. The mean per cent pod damage ranged between 3.49 and 19.82 in different treatments as against 24.50 in the control.

Mean per cent seed damage by Melanagromyza obtusa: Among all the treatments, Spinosad recorded least mean per cent seed damage i.e., 20.63 per cent followed by indoxacarb 14.5 SC i.e., 26.03 per cent. The mean percent seed damage ranged between 20.63 per cent (Spinosad) and 54.46 per cent (lambda cyhalothrin 5 EC @ 1 ml/l) in different treatments as against 59.99 per cent in the control.

Yield: The treatment Spinosad recorded highest grain yield of 1739 kg/ha followed by Emamectin benzoate with 1596 kg/ha. Minimum grain yield (862 kg/ha) was obtained from untreated control followed by the treatment, acephate (1060 kg/ha).
Monitoring and management of insect pests through manipulation of insect signaling

Pratap A. Divekar
ICAR-IIVR, Regional Research Station, India

Communication may be defined as the exchange of information between sender and receiver via signals transmitted through a medium, be it solid, gaseous, or liquid. “True” or “honest” communication, as determined by benefits for both sender and receiver, includes intraspecific sexual and social signals as well as some types of interspecific signals directed towards predators, competitors, or mutualist species. Eavesdropping is the process whereby a receiver exploits signals intended for another individual, and which benefit the receiver with no benefit, or negative consequences, to the sender. Thus, predators and Parasitoids frequently eavesdrop on the communications of their hosts as an effective method of locating potential hosts. Most practical applications of insect signaling have focused on the exploitation of signals intended for long-range use, because these signals can be used to draw insects in to the source of the signal. It is more difficult to visualize methods of exploiting short-range or contact signals, and such types of signals have been less widely used in insect control, unless they have been combined with a long-range attractant. The practical applications of long-range signals have focused on the manipulation of a single species, for example, by attraction of conspecifics with a species-specific pheromone. Long-range communication in insects most commonly involves chemical and/or mechanical signals, although some insects do indeed use long-range visual signals (e.g., wing patterns of diurnal butterflies, or flashing of nocturnal fireflies). Acoustic signals transmitted through substrates have now been described in numerous groups of insects, and these signals are essential mediators of insect behaviours. The acoustic signals are relatively short range, being restricted to one plant or to two or more plants that are in direct contact with each other. These acoustic signals, alone or in concert with signals of other modalities, enable efficient and precise mate location and recognition in a complex environment over distances of several meters. The substrate-borne acoustic communication in insects represents a virtually untapped field for both basic research and for practical applications in insect control.
Productivity in agriculture is not accelerating fast enough to meet the expected agricultural demand by 2050 through sustainable practices. Under the situation, ensuring plant health gains immense significance. Pests, weeds and diseases are a major cause of yield and crop quality loss, and farm income reduction. Insect pest damage leaves the plant open to secondary attack from damaging fungal, viral and bacterial diseases. Furthermore, due to increasing global trade and a changing climate, plant pests and diseases pose a greater threat to food security than ever before. Without effective pest control 40-50% of the food we have today would not exist. Poor control of pests and diseases in the field will result in additional losses in storage. Animal Health is also affected by pests and diseases. In addition to chemical crop protection, biochemical and biological control agents are essential to meet our food security challenge in ecological IPM “toolbox”. The intensification of crop production necessary to meet the increasing demand for food through enhanced productivity per unit area might be impossible without a concomitant intensification of pest control through sustainable means.
Session 5: Plant Breeding and Genetics

Chair: H. H. Kumaraswamy, ICAR-IIOR, Hyderabad, Telangana
Co-Chair: K. T. Ramya, ICAR-IIOR, Hyderabad, Telangana
Genomic approaches for enhancing agronomic traits in sesame
(Sesamum indicum L.): Present status and future perspectives

H. H. Kumaraswamy, K.T. Ramya and A. Vishnuvardhan Reddy
ICAR-Indian Institute of Oilseeds Research, India

Sesame (Sesamum indicum L.) is not only an ancient oilseed crop but also has significant oil content with unique keeping quality. It has been playing an important role in nutrition and medicinal needs of mankind since the ancient past, with archaeological evidences found not only in eastern but also western centres of civilization. Presently, its utility in food, feed, medicine and industry reflects on its demand in national as well as international markets. Therefore, there is a greater need to support farm families as well as vegetable oil industries, through enabling science and technology, to boost sesame oil economy of the world. Towards this end, primary focus remains on solving farm producers’ problems by enhancing desirable agronomic traits of sesame, not forgetting the industrial need of value addition and quality enhancement. Though several conventional approaches have been attempted for long, genomic approaches, holding key for an integrated approach founded on molecular principles of heritable traits, have become the subjects of recent concern in sesame. Now, draft genome sequence is available for sesame, several kinds of markers have been developed, a few genetic linkage maps have been developed, etc. There is a need to develop trait specific markers/genes; isolation, characterization and validation of genes governing or associated with specific agronomic traits. With this background, we embarked upon developing genetic and genomic resources in Indian sesame.

In the present paper, we bring to the readers a comprehensive knowledge on genomic resources and approach perspectives for enhancing agronomic traits in sesame.
Sesame (Sesamum indicum L.) genetic improvement approaches: Current status and future perspectives

K.T. Ramya, H.H. Kumarswamy, J. Jawaharlal and A. Vishnuvardhan Reddy
ICAR-Indian Institute of Oilseeds Research, India

Sesame (Sesamum indicum L.), belonging to genus Sesamum and family Pedaliaceae, is an important oilseed crop with Indian origin and grown in tropical and sub-tropical ecosystems. It is a high value oilseed crop cultivated for its high quality edible oil and direct confectionery uses. India not only has a rich diversity of cultivated sesame; but, also its domestication took place in Indian subcontinent. Sesame is the fourth largest oilseed crop cultivated in India after soybean, rapeseed-mustard and groundnut. The major sesame growing states in India are: Madhya Pradesh, Uttar Pradesh, West Bengal, Rajasthan, Gujarat, Tamil Nadu, Karnataka, Andhra Pradesh, Telangana, Maharashtra, and Odisha. There is a wide diversity: in terms of season of cultivation, seed coat color, seed size and oil content. There is a high export demand for white seed coat sesame, used in confectionery and bakery; which is predominantly grown in Northern states of the country. By 2017, India stood the world’s largest sesame seeds producer, significantly contributing to world sesame oil economy. It is since the last quarter of 20th century that researchers have been endeavoring to understand the crop in terms of its genetic variability; correlating and identifying traits associated with the seed yield. However, even today, seed yield stagnation is a major objective of sesame improvement projects. Genetic potential needs to be systematically investigated and unleashed to overcome the yield barrier: for which, several attempts have been, and are being, made across the globe including India. With this backdrop, we undertook breeding experiments for genetic enhancement of yield and oil content in Indian sesame.

In the present paper, the attempt is to bring a comprehensive knowledge of present status of sesame genetic improvement research and also throw light on future perspectives in the settings of interdisciplinary strategy and multidisciplinary approaches to achieve the desired goals of not only breaking yield barrier but also overcoming the challenges of biotic and abiotic stresses: all that is needed to secure food and nutrition for never receding human population; and, in ever changing climate of the earth.
Mapping of brown planthopper (*Nilaparvata lugens* (Stal)) resistance gene (bph5) in rice (*Oryza sativa* L.)

G. Padmavathi*, Ram Deen, K. Ramesh, B. C. Viraktamath and T. Ram  
ICAR-Indian Institute of Rice Research, Hyderabad

Brown planthopper (BPH) is the most dreaded pest of rice threatening rice production worldwide. Under severe infestation popularly known as “hopper-burn” 100% yield loss occurs in susceptible cultivars as noticed in the past few decades. In spite of chemical measures for controlling BPH, the crop damage is intensifying day by day. Therefore it is essential to identify BPH resistance gene(s) from donors for utilization in breeding resistant rice cultivars.

ARC 10550, an Indian land race is reported to carry a resistance gene bph5 effective against Indian biotype 4. But its chromosomal location and mechanism of resistance is not known till now. ARC 10550 showed broad spectrum resistance over the years which may be due to the presence of QTLs along with major gene, bph 5. Hence in the present study, we analysed the QTLs associated with resistance in ARC10550 for developing durable resistant rice cultivars.

A population of 255 F2:3 families from the cross Taichung Native 1/ARC10550 was used to map BPH resistance with 106 polymorphic simple sequence repeat markers. The inheritance pattern of different traits suggested that the resistance is controlled by poly genes/QTLS instead of a single recessive gene. The quantitative trait loci (QTLs) for BPH resistance were analysed for nine phenotypic traits governing non preference, antibiosis and antixenosis mechanisms of resistance.

QTL analysis revealed that five major loci were associated with resistance, one for damage score (qBphDS6) on chromosome 6, two for nymphal preference at 48 and 72 h (qBphNp(48h)-1 and qBphNp(72h)-12) on chromosome 1 and 12 and two for days to wilt (qBphDw(30)-3 and qBphDw(30)- 8) on chromosome 3 and 8 explaining the phenotypic variance of 24.23%, 8.69%, 7.66%, 4.55% and 10.48% respectively. These QTLs jointly explained 55.6% of the phenotypic variance for BPH resistance. The donor parent, ARC 10550 contributed resistance alleles. Fine mapping of the identified QTLs may lead to a successful transfer of QTLS into other elite backgrounds for the development of resistant varieties through Marker assisted selection program.
Groundnut is considered as an important oil seed throughout the world and having a unique nutritional composition. According to the utilization pattern groundnut can be categorized into oil and confectionary types. Among the physical quality requirements for confectionery groundnuts size, shape, high sound mature kernel (>80%) are important. Chemical qualities like low (<1%) free fatty acid (FFA), high sugars (> 5%) and high protein (>30%) along with nutritional qualities like high O/L, and low oil (<45%) are preferred traits for confectionery groundnuts. Hence a study was undertaken with an objective to evaluate the advanced breeding lines of different crosses for confectionery traits. One hundred and fifty advanced breeding lines in both Spanish and Virginia botanical varieties were evaluated for the confectionery traits with four checks under Augmented Design during kharif 2018. The genotype, PBS 29163 recorded highest shelling percentage (76.51%). Two genotypes viz., PBS 29079 B and PBS 29069 were larger in size (>70 g hundred kernel weight) and found superior over checks. The genotype, PBS 19015 recorded highest pod yield /plant (19.19 g) followed by PBS 29082 (18.60g) and PBS 19013 (17.34g). The kernel length (KL) was varied from 1.24cm (PBS 29206) to 1.98cm (PBS 29079 B) whereas kernel width (KW) was in a range of 0.75cm (PBS 29070) to 1.05cm (PBS 29153). Kernel length was longer in PBS 29079 B (1.98cm) genotype and larger kernel width was in PBS 29153 (1.05cm) genotype. The oil content varied from 40.64% (PBS 29196) to 52.51% (PBS 29163) and protein content varied from 25.78 (PBS 29201) to 33.67% (PBS 29213). Eleven genotypes viz., PBS 19013, PBS 19015, PBS 19018, PBS 29079 B, PBS 29082, PBS 29124, PBS 29167, PBS 29196, PBS 29197, PBS 29212 and PBS 29219 had good confectionery quality traits viz., large seediness (KL: >1.5cm and KW: >0.7cm), high protein (>30%), high sugar (>5 %), moderate oil (42- 48%), uniform pod size and shape, high pod yield per plant (> 10g) and good shelling percentage (>60%). After further validation for these traits, promising genotypes can directly be released as a variety or can be used as donor parents in hybridization programmes for improving confectionery qualities in groundnut.
Characterization and Variability Analysis for Qualitative and Quantitative Traits of Indigenous and Exotic Germplasm Accessions of Rice (*Oryza sativa* L.)

G. C. Ojha¹*, A.K. Sarawgi² and Niharika Ojha³
1 Krishi Vigyan Kendra, Chhatarpur
2 Department of Genetics and Plant Breeding, IGKV, Raipur (Chhattisgarh)
3 Krishi Vigyan Kendra, Seoni

Rice (*Oryza sativa* L.) is an imperative and staple food crop which feeds over half of the world’s population and provides essential elements to human kind. Undomesticated crops species acquire huge possible and most precious gene which can be successfully utilized in crop improvement to develop high yielding rice varieties. The agro-morphological and quality characterization of rice accessions are the basic criteria to provide fundamental information for crop improvement programme. The investigation was conducted with an objective to characterize 1376 accessions of rice including seven checks viz. Jaya, NDR97, Annada, Pusa Basmati, Swarna IR64 and Karma Mahsuri. The experimental materials received from the National Bureau of Plant Genetic Resources (NBPRG), New Delhi and planted in Augmented Design at Research cum Instructional farm, IGKV, Raipur (Chhattisgarh). The agro-morphological characterization of rice accessions were studied for assessment of genetic variability and yield and its attributing traits. Significance differences were found among the qualitative traits, due to anthocyanin colouration, which might be used as marker for identification of genotypes.

The qualitative traits showed remarkable differences in their distribution and amount of variations within them observed due to pigmentation on basal leaf sheath colour, auricle colour, stigma colour, node, sterile lemma, hull and kernels colour etc. The significant genetic variation were observed in quantitative traits viz. time of heading (very early to very late), plant height (very short to very long) and panicle length (very short to very long), number of tillers (few to many), thousand grain weight (very low to very high), grain length (very short to very long), grain breadth (very narrow to very broad). These traits are showing high magnitude of variation among the accessions which can be extensively utilized in crop improvement programme.
Pre-breeding to broaden the genetic base of hybrid rice parental lines to enhance yield heterosis

Revathi Ponnuswamy*, Jagadale Mahesh, Soujanya T, Edukondalu, Arun Kumar Singh, Sandeep G and Sundaram RM
Indian Institute of Rice Research, India

Hybrid-rice technology has the potentiality to further increase the rice production through enhanced productivity. The yield improvement in recently released hybrids in India is negligible over the varieties indicating yield stagnation in the hybrids. This could be due to very narrow genetic diversity among the parental lines. Pre-breeding aims to generate new base populations for breeding programs and also assist in identifying heterotic patterns for hybrid programs. Utilizing the huge variability available within wild species of rice and identification and transfer of superior alleles to cultivated species has emerged as a novel option so as to enhance the productivity traits. Marker assisted backcross breeding (MABB) and AB-QTL mapping to identify yield enhancing heterotic QTLs from wild species to develop pre-breeding material to widen the genetic base of parental lines is under progress at IIRR. A popular cultivated rice mega variety Swarna and parental lines of restorers and maintainers were crossed with wild species O.rufipogon and F1s were produced. Superior F1s of non-weedy types were back crossed with recurrent parents to produce BC1F1s. Selected plants were back crossed to produce BC2F1s and BC2F1s plants were selfed to produce BC2F2s. In BC2F2 population genotyping is under progress to map QTLs of yield and yield component traits by AB-QTL mapping and also by trait phenotyping. The wild introgression lines were crossed with WA based CMS lines viz., APMS 6A, CRMS 32 A and IR 68897A and F1s were produced. The F1s are under evaluation for heterosis and combining ability to identifying heterotic yield QTLs. The identification and mapping of heterotic loci (HLs) from wild rice could lead to a novel strategy for improving heterosis in rice.
Seed priming effect of salicylic acid on antioxidant enzymes in Rabi maize (Zea mays L.) during low temperature stress

Preeti Singh*, Varsha Singh and Vijai Pandurangam
Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University, India

A field experiment was carried out during the Rabi season at Agricultural Research Farm, Banaras Hindu University, Varanasi to study the effect of salicylic acid on Antioxidant enzymes in Rabi maize genotypes i.e., HUZM-185 and HUZM-80-1 under normal and delayed sowing conditions during low temperature stress. The experiment was laid out in split plot design comprising eight treatment combinations in three replications. Seeds were primed with salicylic acid (SA) @ 20 μg mL⁻¹ and 40 μg mL⁻¹ along with hydro priming (distilled water) for overnight and non-primed seeds as control before both sowings i.e., normal and delayed sowing. Observations were recorded at 20 and 60 days after sowing in leaves; Genotype HUZM-185 was found more antioxidant enzymatic activity with priming by 20 μg. mL⁻¹ of salicylic acid to enhance the activities of antioxidant enzymes viz., SOD, CAT, POX, PPO and APX than genotype HUZM-80-1. Increased activities of antioxidant enzymes indicated that seeds primed with salicylic acid play a significant role in mitigating low temperature stress during vegetative growth phase of Rabi maize.
Identification and characterization of miRNAs differentially expressed in rice spikelets based on their spatial location during grain filling

Tilak Chandra and Birendra Prasad Shaw
Plant & Microbial Biotechnology Laboratory, Institute of Life Sciences, Bhubaneswar, India

Rice grain quality and quantity is governed by its grain size and shape and this is determined by various molecular mechanisms. Based on the spatial location on panicle, the spikelets in rice may be apical where there is complete filling or proper metabolite assimilation, or basal where there is an aborted filling, particularly in the panicle bearing large number of spikelets. The reason of differential grain filling in apical and basal spikelets, and the regulation of grain filling process per se is poorly understood. PTGS is an emerging regulation under which the tiny rapidly growing class of small RNA molecules; miRNAs are believed to contribute to the regulation of grain filling in rice. We screened six rice cultivars for differential grain filling and chosen cv. Mahalaxmi showing maximum differential grain weight between apical and basal grains for next-generation sequencing of sRNAs in the apical and basal spikelets. In deep sequencing data analysis, we found differential expression of conserved as well novel miRNAs in spikelets on 5 DAA (days after anthesis). Here we finds less explored miRNAs like Osa miR 2118o and Osa miR 6248 which are most differentially expressed among apical vs. basal library in sequencing data and few Novel miRNAs were validated through Northern blotting, targeting Pullulanase and 14-3-3 transcript in which former is positively and later transcript is negatively regulate grain size by downstream pathway. Relevant target of Novel miRNAs are soluble starch synthase 1 and transmembrane protein validated through qRT-PCR and 5’RACE. Truncated transcript of these transcripts leads to poor activity in grain of basal position of spikelets via miRNAs cohorts limit productivity. Functional characterization of these targets might improve our knowledge in understanding the mechanism lying in grain filling of rice and further improvement of this crop towards productivity.
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2019

KEYNOTE FORUM

DAY- 2
HALL- 1
India is an agrarian country with nearly 52% of net cultivated area under semi arid climate in distributed over different states. The major problem in these areas include land degradation in the form of soil erosion along with fertilizers, climate variability in terms of high intense rainfall, reduced rainy days and floods. Due to the global warming happening in the country these effects have become more pronounced affecting the water availability and access to the farmers. Though IWMP projects were taken in these areas they have served the purpose of groundwater recharge and it has become very difficult to maintain the SWCE infrastructure created in IWMP. However, the density of borewell digging has phenomenally increased and the groundwater levels have gone down too deep due to excess pumping and interface of the wells. In this context surface rainwater harvesting has tremendous potential for making the farmers to access water for critical irrigation with diversified agriculture for doubling the income of farmers. A field research on climate resilient rainwater management technology was conducted in farmers field in a tribal watershed of 4700 ha for augmenting water resources and enhancing water productivity with profitability of the farmers. On farm reservoir (OFR) was designed for storing surface runoff based on the catchment area and runoff coefficient determined through modelling approach for both kharif and rabi seasons by using SWAT. A size of 20x10x3.5 m with 600 m³ capacity on farm reservoir was constructed with inclusion of SWC measures of contour bunds and field channels for effectively collecting water into the structure. A portable raingun irrigation system was designed for water application in the critical stages of the crops during dry spells. Experiments in tribal farmer field during 2016-19 with two integrated farming system models: Pulse and cotton based systems with OFR for 2 critical irrigations to main crop during dry spells and 5 irrigations with 10 - 30 mm depth of water application at 10 day interval in vegetable and fodder, were conducted. The time period of experimentation had different intensity of droughts in the study area with seasonal rainfall deviation from the normal (450mm) were -53% (2016-17),-24% (2017-18) and -75% (2018-19) respectively. In the first year of medium drought, a pulse based cropping system was taken which resulted into a net income of Rs.17225/-, in the normal rainfall year (2017-18), cotton based cropping system resulted into net income of Rs.51365/- and in the third year with severe drought the net income in the same cotton based system was Rs.10090/- in 3 acres of farm land with ratio of 2.5 acres of main crop, 0.5 acre of vegetables along with small ruminants. The system water productivity was 1.96 kg/m³ in the pulse based system (2016-17), 3.45 kg/m³ in cotton based system (2017-18) and 1.86 kg/m³ in cotton based system (2018-19). However, the net income from rainfed cultivation of cotton is negative in the region in most of the farmers with cotton yield varying from 3-10 q/ha from normal to drought.
P.D. Sreekanth  
*Principle Scientist, ICAR-National Academy of Agricultural Research Management, Hyderabad*

There is a major deficit between the measure of nourishment we produce today and the sum expected to encourage everybody in 2050. There will be about 9 billion individuals on Earth by 2050. The demand for food will be 70% greater than it is today. We require 120% more water and 42% more cropland to feed 9 billion population by 2050. However, at the same time declining natural resources and climate change will make it more difficult to meet the food security target. To meet such a prerequisite, it has become extremely important to continuously monitor various vegetation indices and post monsoons surface water over time at different spatial scales, it can be possible by using geospatial technologies. Satellite-based remote sensing has been widely used over the past several years for monitoring various vegetation indices and surface water levels at village to global-scale.

The primary target of the analysis was to discover the status of vegetation at micro level and it assumes a significant role to help policy makers as a decision support feature. Satellite derived data sets have been used to study the time series trend of NDVI (Normalized Difference Vegetation Index), NDWI (Normalized Difference Water Index) and NDDI (Normalized Difference Drought Index) for Tallasingaram village, Nalgonda district, Telangana state. The study uses Landsat 8 with 30 m resolution 8 days interval images from 2013-2018. The results show that, a temporal curve that summarizes the different stages that green vegetation undergoes during a complete developing season. This data assists the policy and decision makers to evaluate performance of vegetation growth at micro level, in turn assess the crop insurance claims by the farmers. Enhanced Vegetation Index (EVI) was additionally analyzed as an elective vegetation record to address a portion of the constraints of the NDVI. These remote sensing technologies also give a huge measure of information at various spatial, spectral, and temporal resolutions for detecting and extracting surface water using efficient water indexes such as Normalized Difference Water Index (NDWI) and the modified Normalized Difference Water Index (mNDWI). Characterization of surface water dynamics is necessary for studying ecological, hydrological processes and agricultural planning. In this study uses 30m resolution Landsat 5, 7 and 8 top-of-atmosphere (TOA) reflectance 16 days collection was used to study the time series trend of surface water from 2013 to 2018 for Telangana state. The surface water estimation results were compared with post monsoon rainfall and ground water levels. The results found that, where ever rainfall is more surface water is more accordingly ground water levels are increased.
Session 6: Climate change and Mitigation
Chair: S. S. Rao, ICAR-IIMR, Hyderabad, Telangana
Interactive effect of temperature and CO₂ on rice brown planthopper, *Nilaparvata lugens* (Stal.)

M. Srinivas, R. Sunitha Devi, N. Rama Gopala Varma¹ and R. Jagadeeshwar¹  
Professor Jayashankar Telangana State Agricultural University, Hyderabad  
Rice Research Centre, Agricultural Research Institute, Hyderabad

The studies on combined effect of temperature and CO₂ on rice brown planthopper, *Nilaparvata lugens* (Stal.) carried out during 2015-2016 at Rice Research Centre, ARI, Rajendranagar and Agro Climatic Research Centre, ARI, Rajendranagar, Hyderabad revealed that the number of eggs laid and per cent nymphal emergence was highest at elevated CO₂ (580±25ppm) and 30°C temperature treatment (148.67 eggs/female) than other interactive treatments. Among the different interactive treatments, significantly higher nymphal survival was observed at combination of elevated CO₂ and 30°C temperature treatment (75.93%) which was on par with combination treatment of 25°C temperature both at ambient CO₂ (64.44%) and elevated CO₂ (62.22%) concentrations. The total nymphal duration recorded was highest at interactive treatment of ambient CO₂ and 25°C temperature (12.07 days) which was on par with elevated CO₂ and 25°C temperature treatment (11.96 days) followed by 35°C temperature both with ambient CO₂ (10.80 days) and elevated CO₂ (10.27 days) which was on par with each other. The adult longevity was observed to be highest at ambient CO₂ with 25°C temperature (14.42 days) and it was found on par with elevated CO₂ at 25°C (13.72 days). The adult longevity at ambient CO₂ with 30°C recorded was 11.59 days while it was significantly reduced at elevated CO₂ with 30°C (9.64 days).
Plant species are characterized by a high content of tannins, alkaloids and phenols. These secondary metabolites are released during DNA extraction and might hinder molecular studies based on polymerase chain reaction (PCR). Thus, extraction of good quality genomic DNA is a crucial prerequisite in plant molecular biology. Existing conventional extraction methods are labour-intensive, lengthy, not suitable or have handling variations. The demand for automated systems has grown markedly with the increase in use of PCR testing. HiMedia Laboratories Pvt. Ltd. has developed an automated nucleic acid purification system that utilizes the innovative Super-S membrane column method that purify nucleic acids providing a high yield and purity from a wide range of samples. In this study, we describe a novel protocol for genomic DNA extraction from fresh plant leaves, roots and seeds that is amenable to PCR-based genetic analysis. Genomic DNA was extracted from leaves, roots and seeds of different plants such as mint, rice, garlic, onion, maize, mustard, soya bean, sugarcane, banana, pomegranate, etc. This method takes 50 to 350 mg of sample to give good yield with a purity of 1.6 to 1.9. Spectral measurement and conventional PCR were used to demonstrate genomic DNA purity. The automated extraction method was found to be very efficient, rapid and capable of providing high DNA yields which can be used for downstream PCR-based genetic analysis.
Climate resilient sweet sorghum cultivars and Agro-technologies for Biofuel production in India

SS Rao*, VA Tonapi, CV Rathnavathi and AV Umakanth
ICAR- Indian Institute of Millets Research, Hyderabad, India

Production and utilization of biofuels from renewable biomass sources are important to overcome the depletion of fossil fuels, reduce the dependence on imported oil, and mitigate climate change by GHG emissions. The Government of India’s policy mandated blending of ethanol (5-10%) with gasoline has necessitated searching alternative feedstocks other than sugarcane molasses. The prices of molasses are highly variable with its inadequate supply besides associated pollution hazards that necessitated looking for alternative feedstocks such as sweet sorghum. Sweet sorghum (Sorghum bicolor (L.) Moench) is an important field crop grown in India and around the world, and accumulates fermentable sugars (10-20%) in its stalks as similar to sugarcane. The crop has an advantage of producing both food (from grains) and bioethanol (from stalks) in rainfed condition, and thus does not compromise food security. Sweet sorghum crop is grown in India in the regions where annual rainfall ranges between 550 and 800 mm with the temperatures of 15 to 370 C.

Agricultural yields realizable in optimum conditions include fresh stalk yields (35 to 40 t ha⁻¹), juice brix (16-18%), sucrose content (8-11%), and juice yield (12-14 KL ha⁻¹). Biofuel yields that were obtained in various pilot-studies include ethanol recovery (6-9% of juice), unit ethanol yield (35-40 L per one tonne of stalks crushed), and total ethanol yields (1200-1500 L ha⁻¹ one crop cycle ⁻¹), bagasse yield (5-7 t ha⁻¹). Power from bagasse cogeneration process can be produced to the extent of 3.5 MW ha⁻¹ of crop. Agronomic research showed that the best planting window for sweet sorghum is from June first week to July first week and CSH22SS is the best performing hybrid for grain and bioenergy production across the years and locations. Sweet sorghum stalks can be retained up to 2-days after harvest in the ambient field condition without significant deterioration of stalk juice. Currently, best crop cultivars available are CSH22SS, SSV84, SSV74, and CSV19SS Sugargraze and Urja. Several biofuel industries have organized pilot studies on sweet sorghum as feedstock for bioethanol production in India. It is concluding that producing biofuel from sweet sorghum with appropriate policies will enhance the India’s food and energy security, and environmental sustainability, besides creating remunerative markets to the farmers. The large-scale crop cultivation is recommended under contract farming with buy-back arrangement between growers and agro-fuel industry or entrepreneurs' as similar to sugarcane industry model. The implication of these results is discussed in this paper to promote the sweet sorghum as bioenergy energy crop in India.
Climate change vulnerability and farmers suicide: An empirical analysis in Indian context

G Sridevi, G Jagadeesh and Amalendu Jyotishi

Impact of climate change on agriculture has received the attention of the policy makers and practitioners because of its high degree of susceptibility to climate change and its associated adverse impacts on the people, particularly the poor and marginalized sections of the society who are dependent on agriculture and its allied sectors for their livelihood. In this context, the climate change literature revealed that the dependence on erratic and unpredictable South-west monsoon, preponderance of the marginal and small farmers and more reliance on climate sensitivity activities including agriculture, forestry and fishery for livelihood trigger the vulnerability of Indian agriculture (Ranuzzi and Srivastava, 2012).

In this paper we analyse the climate change vulnerability among agrarian communities across the states of India and juxtapose it with farmer’s suicide that reflects the extreme form of vulnerability. We examines the climate change vulnerability characteristics among agrarian communities in different states of India with the help of five specific sub-indicators such as socio-demographic, agriculture, occupational, common property resource (CPR), and climate across the states in India. To have a comprehensive understanding composite vulnerability index tool is used. We then expand the farmer’s suicide across States and attempt to understand the association between climate change vulnerability and farmer’s suicide. Our analysis suggests that the states with high vulnerability also show high incidence of farmer’s suicide.
Microalgae could be an efficient system for bio-mitigation of CO₂ due to their faster growth rate, ability to fix CO₂ from atmosphere, flue gases and chemically fixed soluble carbonates and conversion to biomass containing value added products. The flue gases emitted by thermal power plants, oil refineries and other industries containing about 15% CO₂ are the major contributors to global warming. Therefore, there is a need to evaluate and select efficient micro algal isolates for bio-mitigation of CO₂ and production of biofuel.

**Methodology**

Micro algal isolates from natural habitats Oocystis sp was supplemented with 5, 10, 20 and 30% CO₂ in LDPE based photo bioreactors for 16 days (16:8 light: dark cycle; 25±1 oC). The biomass was harvested and freeze dried at the end of the incubation period. The microalgae were evaluated for ability to tolerate and sequester CO₂ in terms of specific growth rate, productivity, carbon content, CO₂ fixation rate and biomass yield. The obtained biomass was analyzed for lipid contents and fatty acid profile.
Improving farm level adoption of climate resilient rice production practices is essential to enable farm families to improve their household food security. The present study was undertaken to analyze the farmers’ awareness and adoption of selected climate resilient rice production technologies and to elicit the barriers to adoption of these technologies. Data was collected from 120 farmers from six villages based on random sampling in Nalgonda district of Telangana State, India. Visual questionnaire (photo elicitation) was used to assess farmers’ awareness and adoption of selected climate-resilient practices viz. System of Rice Intensification (SRI), Direct Seeded Rice, green manure crops, Integrated Nutrient Management (INM), Leaf color chart (LCC), drought tolerant rice varieties and Crop diversification. The findings of the study indicated that 50 percent of the farmers were aware of SRI practice but none of them were adopting it, similarly, 20 percent of the farmers were aware of integrated nutrient management but little less than 2 percent only had adopted the practice. A very low percentage of farmers were aware of the climate resilient use of leaf color chart (13.5%), drought resistant paddy varieties (8.2%) with equally low adoption of these technologies. Shortage of labor to adopt SRI, non availability of drum seeder, high cost of the machine, small farm size to implement interventions, non availability of seeds of different green manure crops, formation of soil cracks in SRI, non availability of different farm inputs, non availability of Leaf Color Chart and non availability of drought resistant paddy varieties were the hardware barriers reported by farmers. Large scale demonstrations and seed production efforts may be undertaken to provide drought tolerant varieties to farmers. Training programs are needed to enhance the adoption of knowledge and skill intensive technologies like SRI, DSR and use of leaf color chart. It is highly essential to popularize insurance as an effective adaptation strategy among farmers through awareness generation and sensitization. Strengthening social capital, collective action and farmer to farmer dissemination is to be promoted for faster and widespread adoption of climate resilient practices.
Studies on phenophagic thermal requirement of soybean (Glycine max) under varied climatic conditions

M G Jadhav, D Usha sri, A.S. Jadhav and D.N. Gokhale

Soybean is an important pulse crop substantial in food value. Maharashtra is accounting second place in production. The field experiment was conducted at Department of Agricultural Meteorology, College of Agriculture, and Vasantrao Naik Marathwada Agricultural University Parbhani. The experiment was laid in split plot design, replicated thrice in which four sowing dates were imposed as main treatments and three varieties were tested as sub plot treatment. The result revealed that the crop was sown on 26 MW (25th June to 01st July) took maximum growing degree days, photo thermal unit, to attend various phonological stages till maturity which reduced significantly with subsequent delay in sowing time. Among the different phenophases, the pod development stage of crop took highest growing degree days, photo thermal unit, and helio-thermal unit to reach the maturity.
Session 7: Agriculture Machinery & Technologies
Chair: D G Rao, formerly with CFTRI, Hyderabad
Co-Chair: Bharat Bhushan Singh, Director, Vishwa Vishwani Institute of Systems & Management, Hyderabad
The paper mainly focuses on post harvest processing of agricultural produce for better handling, transportation, packaging and storage to extend the shelf life of the produce. The machinery being contemplated here relates to food processing. The technologies are those related to food processing and preservation what are classically known as Post Harvest Technologies (PHT). In engineering terminology, they are known as unit operations and unit processes. Very few unit processes such as fermentation, hydrogenation, oxidation etc are used in food processing. Most of the operations are unit operations which deal with separations, mixing and emulsifications. Essentially all food materials are classified as solids, liquids, gasses and emulsions. The separation processes are classified as (i) physical processes that do not involve phase change viz., filtration, centrifugation, sedimentation, sieving, air aspiration etc. and (ii) other types are those in which separation takes place with phase change of matter viz., drying (or dehydration), distillation, extraction, leaching, crystallization etc. We have also got operations such as disintegration (milling and size reduction), and forming (extrusion). Transportation and material handling are also important crucial operations in food processing. Machinery and equipment are needed to carry out all the above operations.

Now the basic issues to be addressed, in terms of machinery and equipment, are what should be the size of equipment and what should be the level of operations. These issues are not purely technical, but they are more of managerial in nature. They depend on the local socio-economic conditions of the country and the region. If it is desired to generate more employment for the local people, which is mostly the case in most of the under-developed and developing countries, we prefer to go for establishing a large number of small units with smaller capacities. Contrary to this, if the human labour is costly as in the case of most of the developed countries, then we prefer to go for big processing units with larger capacities of handling. Both the concepts have their own advantages and disadvantages which will be discussed.
Studies on the impact of Annamalai ring bud technology as source of planting material in SSI method of sugarcane cultivation

Karthikeyan.A¹ and S.Babu²
1. Assistant Professor. 2. Associate Professor
Department of Agronomy, Faculty of Agriculture, Annamalai University, India

A field experiment was conducted at Experimental Farm, Annamalai University, Annamalai Nagar, Tamil Nadu, India to compare the impact of Annamalai ring bud technology with existing chip bud as a source of planting material in SSI method of sugarcane cultivation. In this study, it’s explained that Annamalai ring bud is nothing but single bud sett having 1 cm nodel length on either side of bud used as a source of planting material. The experimental results showed that among the two different source of planting materials Annamalai ring bud technology recorded significantly higher values of germination percentage (98.65), plant height (36.68cm), No of leaves plant⁻¹ (5.4) and root volume (1.38cc) and also reduced the nursery period from 35 days to 25 days as compared to chip bud as source of planting material in SSI method of sugarcane cultivation.
Development of cost-effective machinery is a major challenge in the vastly followed rice-wheat cropping system of India for timeliness of operation and to manage the enormous amount of stubble left after paddy harvesting. To reduce the number of passes of tillage with the proper incorporation of stubble in the soil, a tractor drawn right-hand combination offset disc harrow (CODH) was developed. It comprised six notched type concave discs at the front gang and six plain type concave discs at rear gang with a provision to transmit the tractor PTO power to the front gang axle. Each of the discs used had an edge circle diameter 560 mm, thickness 4 mm and concavity 70 mm. Each notched disc had 11 numbers of equally spaced notches of width 82 mm and depth 32 mm. The total cutting width obtained with the disc harrow was 1.45 m and it was tested in the field at different forward speeds (3.46 to 6.82 km h⁻¹); rotational speeds of front gang axle, NFGA (95 to 150 rpm); and operating depths (80 to 145 mm) in sandy clay loam soil at a moisture content of 11±0.75% (db) and cone index of 975±50 kPa using a 31 kW two-wheel drive tractor. Its comparison was also made with conventional free-rolling right-hand offset disc harrow (ODH). The developed CODH outperformed the conventional free-rolling ODH in terms of tillage performance index (TPI) comprising both energy required to carry out tillage and quality of soil tilth obtained. The best performance of CODH in terms of TPI was found at forward speed of 4.55 km h⁻¹ and NFGA of 133 rpm corresponding to the tip speed ratio of 3.09 with a reduction in draft, wheel slip, and clod size by 55.01%, 78.13%, and 37.41%, respectively at the cost of 0.06% increase in fuel consumption (l ha⁻¹) when operated at average depth of 120 mm as compared to free-rolling ODH. Use of this developed implement could prepare the stubble field with lesser number of passes, fuel consumption and time with the proper incorporation of crop residues as compared to that with conventional free-rolling ODH. Hence it would reduce the cost of operation in preparing the field.
Attaining food security for a growing population and alleviating poverty while sustaining agricultural systems under the current scenario of depleting natural resources, negative impacts of climatic variability, spiraling cost of inputs are the major challenges before Indian agriculture as well as world. In addition to these challenges, stagnation in productivity in the India has also led to quest for resource conserving technologies that can save water, reduce cost of cultivation and increase production and productivity. Therefore, Zero Tillage Technique provides an opportunities to reduce the cost of cultivation, save water and nutrients, increase production and productivity, reduction of CO2 emission, reduce fuel consumption, lower soil erosion, increase soil health & status, increase microbial activity, reduce health hazard by avoiding crop residue burning, enhancement of water use efficiency, reduction in the incidence of weeds, encourage efficient use of natural resources, and save our environment. However, there are still so many barriers in promotion of ZT technologies, such as lack of appropriate seeders especially for small and medium scale farmers, competition of crop residues between ZT use and livestock feeding, burning of crop residues, availability of skilled and scientific manpower. There is urgent need to develop the policy frame and strategies to promote ZT for
Session 8: Soil Health
Chair: A.K. Reddy, ICAR-CIFE, Maharashtra
Co-Chair: Rahul Kumar, University of Hyderabad, Hyderabad, Telangana
Field experiments were carried out in the Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamil Nadu to evaluate the conservation tillage along with the application of glyphosate vis-a-vis conventional tillage in rice – pulse cropping system in low land areas of Cauvery delta. Three field experiments were conducted during August 1999 to January 2002. The experiments were laid out in Randomised Block Design with seven treatments, viz., T1- Conservation tillage with one ploughing + application of glyphosate @ 1.02 kg ha-1 prior to rice planting + application of rice herbicide, butachlor @ 1.25 kg ha-1 at 3 DAT, T2 - Conservation tillage as in treatment T1 without butachlor application, T3 - Conservation tillage with two ploughings + application of glyphosphate @ 1.02 kg ha-1, prior to rice planting + butachlor application @ 1.25 kg ha-1 at 3 DAT, T4 - Conservation tillage as in treatment T3 without butachlor application, T5-Conventional tillage (farmers’ practice) with butachlor application @ 1.25 kg ha-1 at 3 DAT, T6 - Conventional tillage (farmers’ practice) without butachlor application and without hand weeding and T7 - Conventional tillage (farmers’ practice) with twice hand weeding at 20 and 40 DAT.

Results of the field experiments conducted in all the three years revealed that conservation tillage (two ploughings) + pre – planting application of glyphosate @ 1.02 kg ha-1 + butachlor @ 1.25 kg ha-1 at 3 DAT (T3) was significantly superior to other treatments by way of resulting maximum values of growth and yield components. This treatment was significantly superior to the conventional tillage with twice hand weeding at 20 and 40 DAT (T7) as now practised by farmers, by recording an additional grain yield of 450, 690 and 640 kg ha-1 in 1999 – 2000, 2000 – 2001 and 2001 – 2002, respectively. This treatment also resulted in higher net income and return per rupee invested and it also resulted in significant reduction in population and biomass of all types of weeds (grasses, sedges and broadleaved weeds) with a higher WCE. Treatment, T7 (Conventional tillage (farmers’ practice) with twice hand weeding at 20 and 40 DAT) was the next in order of magnitude.
Rahul Kumar
Dept. of Plant Sciences, School of Life Sciences, University of Hyderabad, India

Modern crop varieties have become highly dependent on the use of chemical fertilizers to maximize yield. Phosphorous (P), together with nitrogen (N) and potassium (K), is one of the main nutrients applied as fertilizer with agriculture being by large the main user of phosphorous globally. Over-use of chemical fertilizers has severe environmental implications such as it is detrimental to soil health and leads to water pollution. Phosphorous is an essential element that is often a limiting factor for plant growth and development. Phosphorus deposits are finite and unevenly distributed globally, which poses a significant threat to food security, especially in countries with limited natural phosphorus reserves. India lacks large natural P deposits and is largely dependent on imported P-fertilizers from other countries. Therefore, developing crops with improved phosphorus-use-efficiency (PUE) can help attain sustainability of agriculture. Plant adaptation to low phosphorus involve both structural and metabolic changes. While metabolic changes are targeted for internal remobilization and recycling of P and metabolic remodelling to ensure cellular functioning, structural alterations include root system architecture with more secondary roots and longer root hairs, enhanced secretion of organic acids, ribonucleases, and acid phosphatases to enable foraging of the poorly mobile phosphorous. In the present study, comparative genomics approach using RNA-seq from 7-day-old and 15-day-old tomato seedlings, grown in P-sufficient and P-deficient media, identified a combined 1275 genes upregulated (FC ≥ 2; p-value ≤ 0.05) and 772 genes downregulated (FC ≥ 2; p-value ≤ 0.05) under P-deficient conditions. While 316 genes were found to be commonly upregulated, only 84 genes were downregulated at the two time points under P starvation. Gene Ontology (GO) and KEGG enrichment analysis of differentially expressed genes revealed an overrepresentation of ‘metabolic pathways’ and biosynthesis of secondary metabolites’ pathways. Overall, this analysis identified several interesting candidates which could regulate PUE in tomato. Functional characterization of several candidate gene is under process and the outcome will indicate their possible involvement in the regulation of PUE. Once validated, the candidate genes can be later used in molecular breeding programs to improve PUE in tomato and other solanaceae species.
Consequence of integrated nutrient management on phenotype and nutrient uptake of irrigated groundnut (Arachis hypogaea L.) var. VRI-2 for sandy loam soils.

C. Ravikumar, M. Ganapathy, D. Ganesamoorthy and A. Karthikeyan
Annamalai University, Chennai, India

A field investigation was carried out during (December - April) the year of 2015-16 to study the effect of integrated nutrient management on the yield of irrigated groundnut grown in sandy loam soil. Around seven ameliorative amendments used as INM sources in the experiment and the details of the treatments are T₁ - Control, T₂ – RDF 17:34:54 kg ha⁻¹ + Gypsum @ 400 kg ha⁻¹, T₃ - Vermicompost @ 6.25 t ha⁻¹, T₄ – Rhizobium + Phosphobacteria @ 2Kg ha⁻¹ as soil application, T₅ – T₂ + T₃, T₆ - T₂ + T₄ as soil application, T₇ – T₃ + T₄ as soil application, T₈ - T₂ + T₃ + T₄ as soil application. The results of the experiments revealed that application of RDF 17:34:54 kg ha⁻¹ + Gypsum @ 400 kg ha⁻¹ + Vermicompost @ 6.25 t ha⁻¹ + Rhizobium + Phosphobacteria @ 2Kg ha⁻¹ as soil application (T₈) enhanced the growth-promoting substances, availability of nutrients and eventually increased the growth components viz., LAI, DMP and number of nodules per plant which paves a way for increased nutrient uptake of N, P and K.
Bacterially derived Biopolymer for enhancing abiotic stress tolerance and improving soil health

Kamlesh Kumar Meena, Ajay M. Sorty, G. C. Wakchaure and Utkarsh. M. Bitla
ICAR-National Institute of Abiotic Stress Management, Pune, Maharashtra, India

Microbes are important contributors to stress resilience in plants. The soil microbes get associated with plants as soon as the seed germinates and initiates its life cycle. It has been proved that microbes influence the plant growth by producing variety of metabolites. The predominant metabolic products include microbes originated plant growth hormones, siderophores, exopolysaccharides, etc. Many of such microbial metabolites have been demonstrated for their efficient plant growth promotion potential under different environments suffering from acute and / chronic exposure to various abiotic stressors. The microbial exopolysaccharides are carbohydrate-polymers made up of either single or combination of different monomeric sugars moieties. The microbial exopolysaccharides have been shown to perform multi-facet jobs including enhancement of soil aggregation, microbial colonization, water holding capacity, and biofilm formation. They also serve as attachment factors for biofilm formation; additionally, they can act as signaling factors for rhizosphere colonization. Pertaining to the gel ability and the water holding potential of the microbial exopolysaccharides, their utility in water deficit regions for likely improvement of crop productivity was proposed. It is thus needful to evaluate the influence of the exo-polysaccharide augmentation in the rhizosphere on overall plant growth and development. Extending the same, we evaluated the influence of a microbial exopolysaccharide produced by a soil bacterium (Rhizobium sp. AMAAS-IXX) on productivity and quality improvement in rabi-onion under simulated water deficit conditions generated using line-source sprinkler system in shallow basaltic soils of Deccan plateau of Maharashtra. The exogenous microbial exopolysaccharides successfully enhanced the growth, development and quality of onion under water deficit conditions. The improvements in terms of physicochemical aspects like potential of enzymatic antioxidant machinery, chlorophyll content, phenolics content were also recorded. Significant improvements in the quality parameters like pyruvate content, nutritional parameters were observed. The overall results strongly endorsed the potential functionality of the microbial exopolysaccharides in mitigating water deficit stress in rabi-onion. The results also necessitate the keen evaluation of the same with other crops.
Trace elements in agroecosystems - relevance to productivity and human health

M.N.V. Prasad  
*University of Hyderabad, Hyderabad, Telangana*

The concentration of trace elements in agroecosystems may be small, but their role in the environment is very large. Some elements are required for growth while others are toxics. Trace element toxicity and tolerance in plants has been established by classical methods such as a) Comparative plasmology (cells’ ability to plasmolyse and deplamolyse in 1M glucose), b) Tolerance index- that is root growth in trace element rich solution/ root growth in control solution and c) whole plant analysis (= trace elements budget in phytomass). Trace elements uptake, transport and accumulation depend upon transporters and plasma membrane reductases.

Plants can ameliorate potentially toxic elements (PTE) from contaminated substrates which had gained considerable popularity during the past 2 decades i.e. “phytoremediation’s”. Several plant species are known to hyper accumulating elements like nickel, gold etc. Phytomining is an emerging technology. On the other hand, crops with a reduced capacity to accumulate PTE in edible parts should be valuable to improve food security + nutritional security. As many PTE are hyper accumulated by plants and are considered as two sides of the same coin viz. Bio fortification and phytoremediation.

Cadmium (Cd) contamination of rice is found in areas irrigated by wastewater from mines. Cd contamination of rice fields can also result from the application of Cd-rich phosphate fertilizers. As a consequence, millions of tons of rice are discarded. In Asia, irrigated paddy-based cropping systems provide rice grains as food for about 2 billion people. A daily intake of 20 – 40 μg Cd from rice is reported in regions where rice is used as a food. Daily rice Cd intake leads to diseases such as bone mineralization. Hence, Cd minimization in rice is required which can be achieved by co-cultivation of Azolla. Different techniques involved in large scale cultivation and production of Azolla and its benefits are explained in this presentation.
Impact assessment of Soil Health Card (SHC) scheme on production and productivity and Soil Health in Bihar

B.D. Singh and Ranjan Kumar Sinha
Krishi Vigyan Kendra, Barh, Patna
TM Bhag.University, Bhagalpur, Bihar

In Bihar Soil Health Card (SHC) are being used by farmers since 10th plan but a new centrally sponsored SHC scheme was introduced in 2015, aimed at issuing SHCs providing soil test based fertilizer recommendations to all farmers once in a cycle of 3 years on continuous basis, which further squeezed to a cycle of 2 years to facilitate quick soil test based management practices. In the state, against the cumulative target of 1308778 for soil samples collection and testing during cycle-I (2015-16 to 2016-17) 6469650 (494.3%) and the same for cycle II in 2017-18 against the target of 654389 SHCs were distributed to 925446 farmers (141.4%). A study conducted by Agro. Economic research centre (Bhagalpur, Bihar) in two sample districts with 120 farm households comprising 60 soil tested farmers and 60 control farmers for Kharif, 2015 as reference period, aimed at documenting the status of implementation of SHC scheme and its impact on soil testing technology and recommended doses of fertilizers on crop production, productivity and soil health in Bihar. The study reveals about the positive changes in yield of three major crops. Yields of paddy, wheat and Lentil were found to have increased by 1.98, 0.84 and 2.23 percent respectively after application of recommended doses of fertilizers. The study found that soil testing is not a priority for farmers, besides a few others.
Conservation agriculture for improving the soil health, nutrient use efficiency, cane, water productivity and environmental quality in sugarcane cropping system

ICAR-National Institute of Abiotic Stress Management, Maharashtra India

A field experiment was conducted during the year 2017-2019 with six main plot treatments viz., M1: parallel planting of each plant in single rows spaced at 150 cm with surface drip irrigation (PSR-150 cm + SDI); M2: parallel planting of each plant of paired rows by maintaining spacing of 90 cm between the rows and 210 cm between the pairs with SDI (PPR-90-210 cm + SDI); M3: zigzag planting of each plant of paired rows by maintaining spacing of 75 cm between the rows and 225 cm between the pairs with SDI (ZPR-75-225 cm + SDI); M4: ZPR-60-240 cm + SDI; M5: ZPR-75-225 cm + SSDI; M6: ZPR-60-240 cm + SSDI. Two treatments of soil surface mulching management practices viz., S1: Mulching with live crop/ trash and S2: No- mulch was accommodated in sub-plots. The result revealed that the maximum cane yield and nutrient use efficiency (141.7tha-1) was recorded under the M5 treatment with mulching live crop/ trash which was significantly higher by 5-14 % as compared to remaining planting and micro irrigation techniques, except M1 and M3 treatments. While covering of soil surface with live mulch of mung bean followed by retention of mung bean residue and trash in the field improved the cane yield on an average by 11 % as compared to without residue retained treatment. This indicated that yield of paired row planted sugarcane could be improved significantly with adoption of zigzag planting, micro irrigation techniques and retaining the crop residues on soil surface. The soil health and water productivity also improved was recorded under the M5 treatment with mulching live crop/ trash which was significantly higher as compared to remaining planting and micro irrigation techniques. To reduce the emission GHGs in treatment M5 due the zigzag planting of each plant of paired rows by maintaining spacing of 75 cm between the rows and 225 cm between the pairs with SSDI with mulching of live crop/trash.
Soil protection is a need for tomorrow: Remarkable ways to conserve soil

Rakesh S, Ranjith Kumar G, Manasa R, Subha Lakshmi C and Annapurna M V V I
ICAR - National Academy of Agricultural Research Management, Rajendranagar, Hyderabad

Soil is a life to the living population on planet Earth. Unfortunately, it is mishandling by the human activities in many ways since decades through excessive farming practices with chemicals and pesticides. Continuous disturbance of soil upset the natural function of it and also affect many ecosystems which depends on soil for its survival. Changing weather phenomenon like floods, storms, droughts itself says the level of threat posed by anthropogenic causes. Soil losing its fertility and producing capacity day by day. Nature alarming us by showing its aggression by means of low productivity, pest and disease infestation and also affecting human health that ultimately leads to economic crisis and global insecurity. Protection of soil, today a greatest challenge and a need for the future generation. Various soil protection techniques involving minimum soil disturbance, proper crop management, protective measures prior to soil erosion as well as sustainable and integrated farming system approaches etc. play a significant and an important role in conservation of soil. Soil is a non-renewable resource because, once degraded its regeneration is an extremely slow process. If we don't protect the soil today, we are no more longer having such medium to grow our food for tomorrow.
Groundnut shelling is done either manually by hand or by hand, pedal and power operated decorticators. Hand shelling of groundnut gives the higher whole kernel count but it is a slow, time consuming and labour demanding and have no facility to separate kernels and husk. Whereas some power operated decorticators have these facilities but they are costlier. And also they are huge in size which is not affordable for small and marginal farmers. The Power operated Groundnut Decorticator cum grader was developed in Dr P.D.K.V, Akola to bridge these two extremities. The functional components of power operated Groundnut decorticator cum grader are frame, decorticating unit, gear box, blower, motor, concave sieve decorticating lever and grading unit. The gear box assembly was provided in the power operated groundnut decorticator to variate the rpm. The power operated Groundnut decorticator cum grader was evaluated for its performance where maximum clean kernel percentage 89.18% was observed at 645 rpm, 18 mm of concave clearance and 5.03 m/s air velocity and the average minimum broken kernel percentage was 5.51% for AK-303 variety, the maximum clean kernel percentage 95.05% was observed at 1251 rpm, 8 mm of concave clearance and 5.42 m/s air velocity, the average minimum broken kernel percentage was 10.15% for TAG-73 Variety, whereas maximum clean kernel percentage 93.25% was observed at 1251 rpm, 6 mm of concave clearance and 5.03 m/s air velocity and the average minimum broken kernel percentage was 4.98% for TAG-24 variety . The cleaning and decorticating efficiencies decrease with decrease in clearance. The average maximum decorticating and cleaning efficiencies was 95.90% and 78.13% respectively AK-303 variety, 91.20% and 80.94% respectively for TAG-73 variety and 95.39% and 85.43% for TAG-24 variety. The average germination percentage for all three varieties decorticated using machine was found in the range of 96 to 97%.
Session 9: Organic Farming- Production & Marketing
Chair: Sudha Reddy, Founder and Managing Director, KN BioSciences India Pvt. Ltd
Co-Chair: Ramasamy Subbiah, Madurai Kamaraj University, Madurai, India
Endocrine Disrupting Chemicals (EDCs) - (Agrochemicals & food colorant) what we learned & study recommends?

Ramasamy Subbiah  
**Cardiac Hypertrophy Laboratory, Department of Molecular Biology, School of Biological Sciences, Madurai Kamaraj University, India**

Organophosphates (OP) are the largely used insecticides in the world and every human is being exposed to OP via food, water and air. Due to their biodegradable nature OP are considered comparatively harmless but studies exposed their association with neuronal and other disorders. Here, we demonstrate that chronic exposure to OP is associated with hyperglycemia and glucose intolerance mediated by OP metabolizing potential of gut Microbiota. Intestinal metatranscriptomic and Metabolomics analyses revealed that gut microbial degradation of OP produces acetic acid, which induces intestinal and hepatic gluconeogenesis and thus accounts for glucose intolerance. We also identified a similar association of plasma OP residues and fecal acetate level with Diabetic status of humans. We demonstrate a high prevalence of diabetes among people directly exposed to organophosphates in rural India (n = 3080). Correlation and linear regression analysis reveal a strong association between plasma organophosphate residues and HbA1c but no association with acetylcholine esterase was noticed. Collectively, our results implicate gluconeogenesis as the key mechanism behind organophosphate-induced hyperglycemia, mediated by the organophosphate-degrading potential of gut Microbiota. This study reveals the gut microbiome-mediated diabetogenic nature of organophosphates and hence that the usage of these insecticides should be reconsidered.

A major by-product produced during Caramelization is 4-methylimidazole (4-MEI) that is detected in noteworthy concentrations in colas and other beverages. Previous studies revealed the neurotoxic and carcinogenic potential of 4-MEI in animals at higher doses but the effect of 4-MEI at theoretical maximum daily intake dose on glucose homeostasis is unexplored. 4-MEI induced pancreatic beta cell hyperplasia and leads to disruption of glucose and lipid homeostasis. 4-MEI suppressed the glucogenic potential of non-artificial sweeteners and promotes lipogenesis. This study suggests the need for further assessment and reconsideration of the wide usage of 4-MEI containing caramels as food additives.
The inter-relationship between food security and organic farming seems to be ambiguous. Due to the limited nutrient values in organic source, declining attention to cattle rearing, poultry farming, less attention to green biomass decomposition and farmers’ attraction towards easy-to-apply chemical fertilizers have led to the slow pace of organic farming in India. However, organic farming is gaining momentum in recent years as a sustainable crop and soil management practice especially for the small and marginal hill farmers contributing to food security to some extent. Soil health and carbon sequestration are promoted and provides multiple ecosystem services including mitigation of climate change through organic farming. Organic farming system will not only promote organic food production chain, but also reduce dependence on external resources through efficient recycling of on-farm biomass and other resources. Animal and crop components are the integral part of organic farming in the process of food production and food security. The benefits of inter-dependence of crop and animal component must be felt and realized wherein, the wastes of one is the wealth of the other. Prospects of marketing and value addition are important areas of concern for the farmers to get actual benefit out of organic farming. A well knitted public private partnership is warranted to achieve the desired momentum. The formal certification of organic products by the resource poor farmers is another major challenge to the region. Hassle free certification process of organic certification amongst farmers can be achieved by community certification in a cost effective manner for sustainable livelihood development. Large scale adoption of organic farming is anticipated to bring equitable development in agricultural productivity and bring food security to the country, India. Wider crop diversification within the ambit of organic farming should be stressed unlike the Sikkim model of organic farming where limited crop comes under the purview of organic farming process. India, particularly the mountainous North eastern states with abundant natural resources needs a diversified quantum of crops within organic farming. The natural resources of the region need to be tapped to the fullest so that the food security is not at stake.
Natural sanctity, Food and Bio-Organic Agriculture - A global imperative

T. Chakraborty and G. W. Bird  
*Visva Bharati University, India*

Nature is the supreme power and force, creator of the universe and lives and food is not an exception. Man cannot produce any food; it is articulated and processed to edible form by man. A complete, balanced food should contain carbohydrates, fats, proteins, minerals, vitamins and enzymes. The habitual practice of taking particular food by a community for generations called food habit, genetically in nature. Unavailability of proper food cause hunger resulting malnutrition and ultimately famine and death. Therefore, a zero-hunger stage of community is the primary policy and strategy of agricultural development since pre-historic times (10,000 BC). Thus, an all-out search has been going on internationally for appropriate technology for food security, good health and resource conservation; from- traditional - improved and natural-conventional-organic-Bio-organic method. For food security, all are not technological problems or limitations; but there are other barriers too, such as global change of climate, environmental warming, drought, flood, socio-economic conditions of farmers, their ethical values, skill and education, and even political interference. Many countries achieved food security by conventional method of farming. But, this again resulted deterioration of physico-chemical characters of soil, accelerate soil erosion, destroy beneficial insects, fishes and animals, increase pollution and global warming, decrease food quality and health, decreasing trend of production: 32.5-1.5 per cent global basis and no sustainability. Global Food Security Index is highest in America, more than 90%, and India 45%. India is almost self-sufficient in food (264 mt-2018), but lagging behind in pulse and oilseeds; still, additional growth rate of rice production needs 1.7mt/yr. The natural bio-organic agriculture is a holistic, noble, healthy eco-friendly, sustainable, natural resource based system, with optimisation of yield, lesser cost and more profit margin, fits well to small farmers. The total area globally covered by BOF is 57.5 mha; more in Australia (22 mha) and Europe: 27%, Latin America: 15%, North America: 7% and India and China about 3% each. Although it occupies very limited area, it is increasing @ 3-20 per cent. The demand is highest in Europe and North America. The BOF technology depends on 6 hexagonal package system and it is not an old traditional system of agriculture, such as: 1) Ecologically best adaptivity and diversity, 2) Strong vibrant soil organic base, 3) Appropriate situation of specific technology, cropping/farming system, 4) crop nutrition – organic, on-farm based manures, bio-fertilization, crop recycling and rotation, GM etc., 5)
Risk assessment of chemicals in food

Shashi Vemuri and G. Venugopal
Formerly at Professor Jayashankar Telangana State Agricultural University, India

Risk Assessment of Chemicals in Food is the scientific basis for assessment of the risk to human health and the environment from exposure to chemicals for the promotion of chemical safety, and to provide technical assistance in strengthening national capacities for the sound management of chemicals. Risk assessment of chemicals in food involves the following steps:

1. Risk assessment
2. Hazard assessment
3. Exposure assessment
4. Dose-response assessment
5. Chemicals
6. Food safety
7. Food additives
8. Contaminants
9. Pesticide residues
10. Veterinary drug Residues

Risk assessment and its role in risk analysis: Risk analysis consists of three components: risk assessment, risk management, and risk communication. Risk assessment is the central component of risk analysis and provides a scientific basis for risk management decisions on measures that may be needed to protect human health. It takes into account all available relevant scientific data and identifies any uncertainties in the knowledge base. Risk assessment comprises the four steps of hazard identification, hazard characterization (including dose–response assessment), exposure assessment, and risk characterization. It is a conceptual framework that, in the context of food chemical safety, provides a mechanism for the structured review of information relevant to assessing possible health outcomes in relation to exposures to chemicals present in food. Risk assessment of chemical substances present in or on food forms the core work of JECFA and JMPR. Based on the advice from these two committees, food safety measures are taken in the risk management executed by countries nationally and by the Codex Alimentarius Commission (CAC) internationally. CAC and its respective committees deal with chemicals in food are responsible, as risk managers, for the final decisions on establishing maximum limits for pesticide residues, veterinary drug residues, contaminants and additives in food and adopting other related measures. Although it is desirable to separate the functional activities of risk assessment from those of risk management in order to ensure scientific independence, it is imperative for the risk managers to communicate and interact with risk assessors during the process to establish the scope of the analysis. Foods from novel sources include traditional and non-traditional foods, novel foods and foods for special dietary uses. Specifications are necessary to ensure that levels of potentially hazardous contaminants, such as Mycotoxin and heavy metals, are kept to a minimum.
Biochar production and its use in rainfed Agriculture

G Venkatesh*, G Ravindra Chary, KA Gopinath and K Sammi Reddy
ICAR-Central Research Institute for Dryland Agriculture, India

Burning of unusable and surplus crop residues is becoming an issue of concern in India due to loss of valuable residues and environmental pollution. Slow pyrolysis of these crop residues to biochar, a carbon rich solid by-product, is an emerging novel strategy for crop residue management, carbon sequestration, soil improvement and crop productivity enhancement in rainfed ecosystem. Castor, cotton and pigeon pea stalks were chosen as raw materials for biochar production due to their wide availability in rainfed areas. The aim of the study was to develop a biochar kiln, standardize the biochar production process and to evaluate the effects of different biochars on soil properties and yields in pigeon pea. On-farm usable portable biochar kiln unit (1200 per kiln) was developed with single barrel cylindrical design of vertical structure with perforated base. Biochar kiln functions on bottom-lit direct natural up-draft principle. Slow pyrolysis experiments were performed under limited supply of air for three different kiln loads for each residue type for two-color phase development. Reaction time for each loading rate was correlated with internal kiln temperature. Grey gas color was correlated to 350-400°C and blue gas color to 450-500°C internal kiln temperature range. The biochar was characterized for various physico-chemical properties. The properties of biochar were influenced by the kiln temperature and feedstock type. In general, fixed carbon, ash, TC, total N, P, porosity, MWHC, FC and AWC in the biochar increased, while biochar yield, VM, bulk density, CEC and recovered total C and N decreased with increase in kiln temperature range from 350-400°C to 450-500°C. The estimated cost of pigeon pea stalk biochar production was lowest followed by cotton and castor stalk biochar. A two years field experiment was carried out in Randomized Block Design (RBD) with eight treatments in three replications in rainfed Alfisols at Hayatnagar Research farm, Hyderabad. The field experiment treatments included RDF (20:50:0 N: P₂O₅:K₂O kg ha⁻¹), biochar from stalks of castor, cotton and pigeon pea (each @ 3.0 and 6.0 t ha⁻¹) and a control (with no external nutrient input and biochar). A common dose of recommended fertilizer was applied to all the treatments receiving biochar, with pigeon pea (PRG 158) as test crop.
Practicing Agriculture through Zero Budget Natural farming

Chakilam Akash Bharadwaj  
National Institute of Rural Development & Panchayati Raj, Hyderabad

The objective of ZBNF is to reduce the usage of chemical fertilizers and pesticides and promote sound agronomic practices and mitigate climate change. Farmers use earthworms, cow dung, urine, plants, human excreta and such biological fertilizers for crop protection. The method reduces the farmers’ investment to a greater extent while increasing the levels of production. A major chunk of the farmers’ investment is spent on chemical fertilizers. Also, repeated usage of fertilizers on the land degrades its quality over a period of time and renders the land unfit for cultivation. ZBNF aims at cultivating crops by promoting self-reliance of farmers while protecting the environment and stimulating harmony between humans, animals and plants for a sustainable development. The fundamental principle underlying natural farming is that everything is connected to everything else on earth as every function is served by many elements and every element has many functions.
The paper reports the views and activities of a sample of system certification bodies with respect to the integration of quality management, environmental management and occupation health and safety management systems. It points some bodies have not been active in the promotion of integration but they are indications that they are now starting to show an interest. However their activities at the movement are limited to the promotion of integration by the identified linkages between ISO 9001/2, ISO 14001 and BS 8800.

It also reports the process of certification undergoing in the TQ Cert and lists the chances to make changes in the organisation to reduce the manpower and time to enhance the certification. The decrease in the certification of ISO 9001 standard is, during the past few years, noticeable in many countries. Therefore there is a need to analyse the phenomena.
Organic farming through sustainable agriculture meets not only the food requirements of the present generation in an environmentally friendly way but also the requirements of future generations and maintains our environment. No doubt, the advantages of organic farming outweigh its disadvantages but in practical it has several constraints. Thus, a complete shift to organic farming is neither desirable nor possible. Organic certification is a written assurance given by an independent third party. Organic certification systems have been a boon and bane for the organic agriculture movement. However, the inspection and certification process has become too cumbersome and very expensive for poor farmers. These additional costs are charged on the consumer which makes organic produce even more expensive and unaffordable.
Muruganandam, C, G. Thamizharasan and R. Rajeswari  
Annamalai University, Chennai, India

An investigation was undertaken to study the “Effect of organic inputs on yield of Aloe (Aloe vera. L). Trial was conducted as a pot culture study at Floriculture unit in the Department of horticulture, Faculty of agriculture, Annamalai university, Annamalai nagar during 2018-2019. The experiment was carried out in completely randomized block design with fifteen treatments and replicated thrice. Healthy suckers of uniform size were collected from Vilamuthur village near Perambalur were used for the study. Application of organic inputs viz., FYM @ 300, 400 and 500 g bag⁻¹, Pressmud @ 200, 300 and 400 g bag⁻¹ and Humic acid @ 10, 20 and 30 mg kg⁻¹ as soil application and @ 0.2%, 0.4%, 0.6% as foliar application bag⁻¹ were given respectively. The results of the present study revealed that the yield attributes viz., number of suckers plant⁻¹, single leaf weight, single plant weight, total plant yield bag⁻¹ were significantly increased with soil application of FYM @ 500 g + Humic acid 30 mg kg⁻¹ (T₆) followed by soil application of FYM @ 500 g + Humic acid @ 0.6 % foliar application T12. The least value was obtained in Control.
Session 10: Animal Nutrition
Chair: Atanu Jana, Anand Agricultural University
Co-Chair: Nagireddy Nalini Kumari, PVNRTVU, Hyderabad
Atanu Jana
Department of Dairy Processing & Operations, S.M.C. College of Dairy Science, Anand Agricultural University, India

Hunger and malnutrition continue to be the issues that require to be tackled worldwide. Nutrition is one of the most basic needs of people. The population segments at greatest risk for food security include the poor, especially young children, pregnant and lactating women, the sick and the elderly. Milk is a good source of protein, fat and lactose. Dairy protein like whey protein can enrich foods not commonly high in protein like beverages, bars, pastas and baked goods. Milk is relatively cheap source of essential nutrients, especially for the developing world. Milk and dairy products are the main sources of dietary protein in human diet. Dairy foods contribute only 9% of total calories available in the nation's food supply. One liter of milk contributes to 25% of the daily recommended intake of β-carotene and vitamin A, and 10% of RDI values for vitamins D and E. Yet, dairy foods naturally provides 19% of protein, 26% of riboflavin, 23% of vitamin A, 20% of vitamin B₁₂, 72% of Ca, 32% of P and 18% of K. The FAO portrays dairy as a way to help the people meet the body’s requirement for Ca, Mg, Se, riboflavin, vitamin B₁₂ and Pantothenic acid. In US, milk is the number one food source for Ca, K and vitamin D in the diets of adults and children; cheese takes second place as the source of calcium, after milk. According to National Health and Nutrition Examination Survey (NHNES) milk was the highest contributor of protein, vitamin B₁₂ and Mg for children and adolescents aged 2 to 18. The level of Conjugated Linoleic Acid (CLA) in milk fat ranges between 2 to 37 mg/g fat. The bioactive milk components such as Immunoglobulins, bioactive peptides (i.e. Casoxin, Casomorphin), etc. has a role to play in bone and dental health and exerts functions such as immunomodulation, mood, memory, stress relaxation, weight management and heart health. Dairy products are associated with maintaining a healthy weight and have been associated with reduced risk of several complications such as osteoporosis, hypertension, colon cancer, metabolic syndrome and type 2 diabetes. The mass fortification of milk with vitamin D contributed to the eradication of rickets in some developed countries. Milk fortified with iron and vitamin C was found to reduce the prevalence of anaemia in infants and young children. Milk fortified with ω-3 long chain PUFA (Eicosa Pentaenoic Acid and Docosa Hexaenoic Acid) has been commercially available in several countries. Consumption of such milk improved blood lipid profiles by reducing mainly cholesterol, LDL-cholesterol and triglycerides. Studies suggest that milk enriched with plant sterols shows promise in reducing Cardio Vascular Disease risk factors. Increasing trust in dairy is essential for food security.
Effect of dietary inclusion of Condensed Distillers Solubles (CDS) on nutrient utilization in growing calves

Nagireddy Nalini Kumari
PVNR Telangana Veterinary University, Hyderabad, India

The condensed distillers Solubles (CDS) has high energy, protein and phosphorus and it is relatively inexpensive by product from ethanol production. A growth trial for 120 days was conducted using eighteen growing calves, which were randomly allotted to the three experimental sorghum stover based complete rations at 50:50 roughage to concentrate ratio with varying levels of CDS (DM basis) viz. T0 (0% CDS), T5 (5% CDS) and T10 (10% CDS). A study on storage of CDS was also carried out for 60 days by evaluating the nutrient composition and Aflatoxin level. The proximate composition and fibre fractions viz., dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF), nitrogen free extract (NFE), total ash (TA), neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose, cellulose, calcium and phosphorus of CDS were 34.95, 87.8, 24.52, 13.27, 2.14, 47.87, 12.2, 5.57, 3.23, 1.43, 0.12 and 1.28 per cent, respectively. Copper, zinc, manganese, iron (ppm) and elemental Sulphur (%) of CDS was 4.21, 95.52, 21.06, 106.43 and 0.08, respectively. No significant difference was observed in dry matter intake (DMI) among the three experimental complete rations. No significant difference was found statistically (P>0.05) among the CDS supplemented complete ration (T5 and T10) in the digestibility coefficient of DM, OM, CP and NFE and it was comparable to control (T0). The EE intake was significantly (P<0.05) increased in T10 followed by T5 and T0. No significant difference was recorded in the Digestibilities of EE, CF and fibre fractions among the experimental rations. The calves fed T0, T5 and T10 rations were in positive nitrogen balance. The digestible crude protein (DCP), total digestible nutrient (TDN), digestible energy (DE) and metabolizable energy (ME) contents of the three experimental rations were comparable. DCP intake (g/d or g/kg w0.75) and TDN intake (g/d or g/kg w 0.75) was not significantly (P>0.05) different among T0, T5 and T10 rations. There was loss of OM and total carbohydrates on DM per cent and these were increased significantly (P<0.01) with advancement of storage period. There was no significant effect of storage period on CP and EE loss. The DM content was increased significantly (P<0.01) with advancement of storage period. There was increased Aflatoxin levels significantly (P<0.01) with advancement of storage period but, these levels were in safe permissible levels for calves.

The results of the study implied that, growing calves fed varying levels of CDS based sorghum stover rations met the nutrient requirements indicating that, CDS is considered as suitable which can replace the traditional feed ingredients. It is concluded that, the CDS could be included in the complete diets of the calves up to 10 per cent on DM basis without affecting the health of the calves. Further the CDS was stored longer, that affected the loss of OM and total carbohydrates. It could be used up to 20 days with minimal loss of nutrients and odour.
AUGUST 29
2019

Technical Sessions

DAY- 2
HALL- 2
Challenges and opportunities for smallholders livestock and poultry production: An analysis of Andaman & Nicobar Islands

Subhash Chand, Kamal Sarma*, S.N. Sethi and RC Srivastava****
Principal Scientist, ICAR-NIAP, India
*Principal Scientist, ICAR- Res Complex, Patna, Bihar
**Sr. Scientist, ICAR- CIBA, Chennai, T.N.
***Vice Chancellor, CAU, Samastipur, Pusa, Bihar

The livestock population in the islands consists of non-descript cattle, buffaloes, pigs, and goats. The total livestock population on the islands was 1.8 Lakhs including crossbred. The total milk production was more than 25 lakh liters in year 2013-14 and per capita availability at Island level was 185 ml/day. The average per day yield was about 1.5 liters for cows and 1.5-2.0 litres for buffaloes. The productivity of milch animal was less due to socio ecological constraints in A & N Islands. The per capita meat availability was around one kg/annum and that for eggs it was 168 annually. Majority of livestock and poultry farmers have stated that this sector in an integral part of their mixed farming system. Therefore, they are practicing the integrated farming system and by doing so limited land is being utilized optimally in these islands. The total poultry population was 0.80 million in year 1997 and it increased to 1.11 million 2012-13. Thus per capita wise it was three birds and now these islands have become self-sufficient in poultry production. The major challenges in maintaining livestock and poultry population were deficit in fodder production, concentrated feeds and basic infrastructures and geographic isolation from the mainland. Therefore, meeting the demand for feeds and fodder including healthcare were the bigger challenges in livestock sector. However, there is potential of introduction of improved forage, bovine, goat, pig and poultry species but climatic and socio economic constraints are hindrance in it. The scientific effort and extension agencies need to work together for technology development and transfer so that challenges can be reduced.
Therapeutic role of milk exosomes in Cancer and Viral Infection

Vengala Rao Yenuganti
Department of Animal Biology, School of Life Sciences, University of Hyderabad, Hyderabad, Telangana, India

Exosomes are Nano-structured extracellular vesicles containing different miRNA, mRNA and nucleic acids and play an important role in intercellular communications. Recently, various exosomes enriched sources have been established including milk, and also several previous studies have shown the usage of milk exosomes as a drug delivery vehicle. Presently we are trying to understand the therapeutic role of milk exosomes in Dengue virus infection, identification of better milk exosomes for drug encapsulation and delivery against cancer cell lines. For this we collected cow and goat milk and isolated exosomes by differential centrifugation process. Then physical properties of exosomes were characterized by various techniques like Dynamic Light Scattering (DLS), and transmission electron microscope (TEM) and molecular characterization was carried out using Real time PCR and western blotting. Encapsulation of drug was carried out by three methods saponin treatment, incubation and sonication. Therapeutic potential of drug-encapsulated exosomes against cancer was examined on HpG2 cell lines. Therapeutic potential of milk exosomes on dengue infection was examined in vitro. Results showed the presence of 30-150 nm size extracellular vesicles, milk exosomes miRNA markers (mir-26a, miR-148a, mir-30d, miR-30a-5p and miR-423-5p) and exosomal protein markers (CD-81 and CD-63), respectively. Drug encapsulated exosomes treatment efficiently induced cell death in HpG2 cells as compared with the drug alone and exosomes. Milk exosomes treatment to DENV infected cells showed significant reduction in viral infectivity. In summary, milk derived exosomes acts as a good drug delivery vehicle and has therapeutic potential to combat dengue infection.
Effect of different tank colour on skin colour of *Clarias magur* (Hamilton, 1822) Larvae

Sharad Raosaheb Surnar  
*Nanaji Deshmukh Veterinary Science University, Jabalpur, India*

The present experimental period and the values of water quality were within the recommended range for rearing of *Clarias magur* larvae. The CIE L* (Luminosity) of *magur* are varied in different treatments and it was maximum in T1 (89.32±0.09) where the fishes were reared in White colour tubs. The minimum Luminosity was found in T3 (69.99±0.06) for the fishes reared in Black colour tubs and followed by T2 (84.24±0.06) for in Blue colour tubs in the treatments. The mean values of CIE C* (Chroma) of *C. magur* larvae in descending order were in the following order: T2 (74.27±0.18) > T3 (72.97±) > T1 (36.50±0.08). It is clear from data that CIE a* colour co-ordinate of *C. magur* is varied in treatments. It was maximum in T1 (69.24±0.07) and minimum CIE a* being in T2 (-56.45±0.17) followed by T3 (-54.55±0.02) with White, Blue and Black colour tubs. CIE b* colour coordinate of *C. magur* varied in different treatments. It was maximum in T3 (48.46±0.28) Black colour tubs. Whereas, the minimum CIE b* value was found in T1 (32.08±0.02) and T2 (48.27±0.08). It is clear from the data presented that CIE h° (hue angle) of *C. magur* varied in treatments. The statistical analysis of variance on CIE h° of *C. magur* indicated significant different (p < 0.05) except T2 and T3 between treatments.
Session 11: Agricultural Extension and Economics
Chair: M.B. Dastagiri, NAARM, Hyderabad, Telangana
Co-Chair: Baskaran, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu
Innovation of novel technologies for entrepreneurship development in food industry 
creating generations of healthy India

D. Baskaran
Tamil Nadu Veterinary and Animal Sciences University, India

Food Processing Industry is identified as the ‘Ever green Industry’ which is indispensible in securing the existence of human beings in Earth. Food processing sector has emerged as an important segment of the Indian economy in terms of its contribution to GDP, employment and investment. Though there are many tertiary processed foods available in the market, the extent of its usage is limited to meagre population. Novel technologies developed namely Milk Protein Enriched (MPE) Noodles, Fibre enriched Noodles, Millet Ice cream, Natural Ice-cream, Fruit Yoghurt and Omega 3 enriched designer chocolate are being introduced to entrepreneurs for adoption at field level with marked appreciation of returns to the producers and processors as well. The physicochemical and functional properties were improved through standardisation at different levels of incorporation of highly nutritious ingredients. Total Protein content of MPE noodles was found to be 24.8g per 100 g of servings. Enrichment of noodles with milk protein is a novel concept which not only energises the consumers but also provides vegetarian protein of animal origin for it to be completely available for absorption into the human system. Total Dietary fibre content of fibre enriched noodles was increased to 7.5g per 100g of servings. Study was conducted to investigate the effect of amla, dragon, grape, jamun and kiwi to enrich the functional properties of ice cream, to determine the potential use of fruit extracts as a healthy ingredient in ice cream and to evaluate the effects of addition of fruit extracts on the functional and organoleptic properties of enriched ice cream. It was concluded that the antioxidant, antidiabetic and antilipase activities of ice cream were enhanced by addition of fruit extracts. The nutrients and health benefits of millet ice-cream is far superior to normal ice-creams available in the markets. The product shows a significant increase in Calcium content and other nutrients and proves to be suitable for all ages irrespective of Paediatric to Geriatric population. Novel fermented milk products like fruit yoghurt are developed with a view to enhance the health of individuals. This is further facilitated by using low fat milk, beneficial bacterial species and fibre rich grains in fermented milk products. The capacity building programme on value addition of food products helps in improvising the net income of the farming community through creation of skilled manpower.
Usefulness and extent of adoption of Agro Advisories Disseminated through interactive information dissemination system (Annapurna Krishi Prasar Seva) in the state of Telangana

B. Soumya1*, B.Savitha2* and I. Sreenivasa Rao3*
1. PG Student; 2. Assistant Director of Extension; 3. Professor, Extension Education Institute, University Head, PJTSAU, India.

The increasing penetration of ICT’S in agriculture scenario makes an opportunity to disseminate the useful information more widely among the farming community. These ICT’s are helping to meet the information needs of farmer. ‘Annapurna Krishi Prasaar Seva’ is an innovative ICT model to address the information needs of the Indian farmers. This ICT tool was designed and developed under a project awarded by Indian Council of Agricultural Research under National Agricultural Innovation Project (NAIP). It is a multi platform and multi mode application and the unique feature of the model is, it enable the scientists to provide personalized advisories based on the farm and farmer profile in the areas of agriculture, horticulture, animal husbandry and fisheries. Farmer can record their queries 24x7 through Toll Free Number. Farmers are provided with Text & Voice messages in local language (Telugu) and provides platform for direct interaction with Scientists. This model also facilitated the Scientists of the University to provide alert & emergency messages on their mobile. The present study was conducted with 120 farmers who got registered under Annapurna Krishi Prasar Seva (AKPS) in two districts i.e. Nalgonda and Khammam Districts of Telangana state, India. The farmers were selected by random sampling method. The study used ex-post facto research design. The results indicated that advisories disseminated were early, highly relevant, ease of the readability level, audio quality, content adequacy and content usefulness. Further, the results also indicated that 36.66 per cent of the respondents were grouped under medium category of adoption followed by high (34.17%) and low (29.17%) categories of extent of adoption of agro advisories disseminated through AKPS in rice crop. The relationship between profile and extent of adoption revealed that, higher the education, total annual income, farming experience, socio political participation, information acquisition behavior, use of ICT tool, innovativeness and access to KVK, the higher was the extent of adoption.
India is basically an Agrarian country since from its inception time immemorial. Occupation in Indian villages reflects the base of the socio-economic culture prevalent in rural areas of the country. The main occupation types in Indian villages comprise of agriculture, fishing, weaving, cottage industry, handicrafts etc. Since the ancient period, Indian villagers have been involved in various occupations out of which, agriculture is the principal one. Apart from agriculture, the villagers are also involved in other occupations like fishing, farming, cottage industry, pottery, business, various small, medium or large scale industries, carpentry, etc.

Many of India’s problems are self-made problems. Main reasons for these problems are misuse or disuse of available valuable natural resources. Most of the fertility of Indian soils was lost due to heavy dumping of synthetic fertilizers and pesticides by the illiterate farmers. Andhra Pradesh is once known as the ‘Food Bowl’ of India now becomes ‘Hunger Hotspot’ and Agricultural farmers became the scapegoats in our own land in the 21st century. Now, Agro-ecosystem sustainability of our soil resource is the vital process for the India to save the soils from further degradation, agricultural farmers from suicides and food scarcity or food deficiency of many masses from hunger in India. In this juncture, this research paper reveals certain ways to adopt for the sustainable agriculturism to safeguard and conserve our soils, life and agro-ecosystems by following the Israeli Kibbutz style of farming techniques.

Kibbutz (gathering) is a farm or factory in Israel where profits and duties are shared and all work is considered equally important. This farming techniques we can solve our existed many problems like sewage management, ecological, economical, pollution, poverty, employment, water, food security etc. food security is a critical concern as the global population expands and natural resources dwindle. Smart solutions for more efficient farming, hardier crops, alternative sources of nutrition, and safer food packaging and storage are essential. Since the 1950s, Israelis have not only been finding miraculous ways to green their own desert but have shared their discoveries far and wide, involve many unemployed youth and younger generations by establishing collaborative family farming system which enhance our relationships among and nourishment. One can regain our lost glory as food bowl of India.
Impact of Agricultural Programme of Radio and Television on Awareness of Farmers

Bharti
KrishiVigyan Kendra, Birsa Agricultural University, India

The present study was conducted in the two districts of Jharkhand. Out of twenty four districts Jharkhand State, two districts Dhanbad and Giridih were selected randomly by using simple random sampling method. From the selected two districts, a total of 6 Panchayat samities were selected randomly. A total 29 villages were selected randomly from the selected panchayat samities in proportion to size of the panchayat samities. From each selected village 10 % respondents were selected. In this way a total of 302 respondents were selected for study purpose. Majority (92.72%) of farmers were aware about the name of Farmers friend programme broadcasted by AIR. More than two-third of the respondents were using radio for the timings of broadcast of the Farmers friend programme of AIR. Majority (85.43%) of the respondents were aware about, the duration of broadcast of 'Krishi Ki Batein'. All the respondents were aware about the name of the TV programmes, like ‘Jharkhand news’, ‘Rangoli’ and entertainment programmes followed by more than 90 % of farmers were aware about the name of ‘Choupal’, ‘Krishi Darshan’, ‘Kalyani’, ‘Kheti Badi’, ‘Prashnottari’ programmes telecasted from Doordarshan. All the respondents were aware about the duration of telecast of Rangoli, film and entertainment programmes followed by more than 90 % farmers who were aware about the duration of telecast of ‘Choupal’ and ‘Kheti Badi’, programmes. Majority (61.92%, 57.62% and 48.34%) of respondents were aware about the name of farm magazines viz. ‘Khet Khalihan’, ‘Kheti Ki Batein’ respectively. Majority of respondents (85.76% and 83.11%) were aware about the name of newspapers like ‘Prabhat Khabar’, ‘Dainik Bhaskar’, ‘Dainik Jagran’ and ‘Hindustan’, respectively.
The rainfall forecasting was not as per expectations and was quite late in the kharif season of the year 2014-15. The precipitation was reported from 2nd week of July 2014. As a result, the sowing time of most of the agronomical crops was almost over and farmers were worried about their livelihood. The yield of the major crops like Soybean & Tur was expected to be reduced to 50%. On the other hand, in the Washim district most of the soils are light to medium type having good drainage capacity. Looking to soil strata and to overcome this climatic situation, KVK and Krushi Samruddhi project emphasised on promotion of late kharif onion in the district. In Washim district of Vidarbha region, farmers are growing onion in only Rabbi Season. The yield and quality of rabbi onion is good but fetches low market rate due to glut in market. Storage and holding capacity are the main constraints observed in Rabbi Season. Market rate starts increasing from October onwards till February because of shortage and increased demand of onion bulb for seed production programme. The yield & quality of Kharif onion (15 to 20 t/ha) is low as compared to rabbi (20-25 t/ha) and late kharif (22 to 25 t/ha) season. The yield of onion in late kharif season is highest due to suitable climatic conditions. Accordingly training programme on late kharif onion production technology was organised. The farmers facilitated for seed (input) with DOGR, Rajgurunagar and Private seed companies and provided all required handhold support. As a result around 76 farmers from district specifically from Risod block have cultivated late kharif onion on 72 acres of area. The yield ranges from 19.5 t/ha to 28.2 t/ha. Average yield and price of late kharif onion is 22.7 t/ha and Rs. 11700/- per ton. The total income and net profit of Rs. 265590/- and Rs.202090/-. As compared to late kharif onion, the average yield, income and net profit of Soybean per hectar was 11.25qt/ha, Rs. 34875/- and Rs. 13700/-, respectively. The benefit cost ratio of late kharif onion and soybean was found to be 1:3.18 and 1:0.65. Because of intervention of late kharif onion production in Washim district, the farmers get stability in drought situation in the year 2014-15.
Climate change has emerged as a critical component in global development component. Agriculture sector is inherently sensitive to climatic conditions and is one of the most vulnerable sectors to the risk and impact of global climate change. Himalayan regions are among the most vulnerable regions to climate change in the world. To improve the livelihood and food security of people in the Himalayan region, there is an urgent need to better understand the impact of climate change in this region. Understanding level of awareness and knowledge about adaptation practices is important to implement the adequate agricultural policies and food security. The present study was conducted in the Himalayan Region of Uttarakhand. Total eight villages were selected from four selected districts of Tehri Garhwal, Uttarkashi, Bageshwar and Nainital respectively. Total 200 farmers were interviewed by using the structured, pre-tested questionnaire. It was found that majority of the respondents (67%) were fully aware of the phenomenon of irregular and erratic rainfall, increase in temperature (68%), reduction in snowfall (61.5%) and changes in water level of waterbodies (57.5%). Farmers adopt to climate change based on their awareness and attitude so to know the different adaptation practices used by farmers is also important. Data regarding knowledge about adaptation practices showed that large majority of the respondents (92.5%) adopt drought tolerant variety, 91.5 percent diversify from farming to non-farming activities, 88 percent store fodder for animals in lean seasons of year, 87 percent change their size of land under cultivation, 86 percent change the use of chemicals and fertilizers, 80 percent bring diversification in livestock assets in their farm and 79.5 percent bring diversification of crops and varieties in their farm. The Result analysis may help the government to facilitate location specific research, policy formulation and implementation in Hilly region for sustainable future of farmers.
Despite the variety of agricultural extension approaches which include IT-based approaches, the majority of farmers in India are not acquiring the actionable agricultural information. Farmers are facing difficulty in acquiring actionable agricultural advice in a real-time manner from call centers and web portals due to communication and perceptual issues. The radio, video, SMS and voice-based services push generic information to farmers, the farm specific advisory systems like eSagu suffers from scalability issues. By exploiting the latest developments data science and smartphone technologies, there is an opportunity to build a system to enable the farmer in identifying the crop problem and getting the agro-advice. To enable the farmer to get the actionable agro-advisory, we are making an effort to build a smart-phone based Field Diagnosis Guide (FDG) (or Crop Darpan) by exploiting the progress in data science and mobile phone technology. It is assumed that the farmer possesses a smart phone with Internet connection and visits the field. The basic idea of Crop Darpan is as follows: A field problem is a combination of a set of visual perceptions. The farmer identifies the visual perceptions of the field problem through smartphone and identifies the field problem and acquire the agro-advice, the methodology to develop Crop Darpan is as follows. Being semi-literate, a farmer is able to identify the generalized visual perceptions (or symptoms) of the crop. The low-level visual perceptions of field problems of the given crop can be collected from subject matter specialists. The proposed Crop Darpan contains an hierarchy of visual perceptions of field problems that consists of generalized, middle-level, and lower-level perceptions. The Crop Darpan helps the farmer to identify the field problem by confirming the corresponding low-level perceptions and acquire the agro-advice. A prototype was built for a Cotton crop (www.cropdarpan.in) in English and Telugu languages. It was found out that the farmers are able to identify the field problem with the Crop Darpan system.
Enabling “green jobs” for the youth in India: Insights and Strategies

B.D. Singh* and Aditya Sinha**
* Krishi Vigyan Kendra, Barh, Patna
** B.A.U., Sabour, Bhagalpur

In the era of climate change, the green jobs can be an enabler to help protect ecosystems by reducing energy, materials, and water consumption through high efficiency strategies. Green jobs could be understood as jobs that contribute to preserve or restore the environment either in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as waste management, renewable energy and energy efficiency. It calls for specific skillset for realizing the potential of this sector in the current decade. Skills gaps is a major bottle neck in India where it affects the employability coefficient in the long run. The emerging sectors such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services, and green agricultural technologies needs specific trained manpower for meeting the challenges of this sector. The ambitious projects of the government like Smart city project can efficiently utilize the potential of the sector with the implementation of climate smart technologies for a better tomorrow. Also, in India, the markets related to solar and wind energy markets is still in infancy but have seen a substantial growth after the initiation of policy framework on renewable energy resources. It can gather substantial foreign investments since India is still an emerging market but has a high degree of prospective consumer base. It will altogether help in managing the carbon footprint in a sustainable manner. Effective training strategies are required to harness the potential of the sector with cutting edge researches on the training gap and training imparted to compete with countries like China, Brazil, the US, Japan and Germany. The current paper is an attempt to provide an insight of major sectors with a green job potential in the country which would be of benefit to the youth. Also, it aims to identify the potentials and prospects for ‘green industries’ and ‘green jobs’ in the country with broad policy measures to facilitate the sector.
Importance of dry chain to minimize the losses in Agriculture

Balmuri Pavan Kumar  
Food and Agriculture Business School, Hyderabad, India

About one-third of the total food produced for human consumption is wasted, with the majority of loss in developing countries occurring between harvest and the consumer. Controlling product dryness is the most critical factor for maintaining quality in stored non-perishable foods. The high relative humidity prevalent in humid climates elevates the moisture content of dried commodities stored in porous woven bags, enabling fungal and insect infestations. Mycotoxins (e.g., Aflatoxin) produced by fungi in insufficiently dried food commodities affect 4.5 billion people worldwide.

Dry Chain is an economically viable and environmentally friendly option to overcome these problems. It implies an initial drying of a commodity to low moisture and maintaining the low moisture throughout the supply chain. The concept of drying products and maintaining their dryness with hermetic storage is called the “dry chain.” Implementing the dry chain can prevent mold growth after harvest and during storage, reducing food losses and exposure to Mycotoxins such as Aflatoxin. This is analogous to the “cold chain” in which continuous refrigeration is used to preserve quality in the fresh produce industry. However, in the case of the dry chain, no further equipment or energy input is required to maintain product quality after initial drying as long as the integrity of the storage container is preserved. In some locations/seasons, only packaging is required to implement a “climate smart” dry chain, while in humid conditions, additional drying is required and desiccant-based drying methods have unique advantages. Any break in the dry chain that allows products to re-absorb moisture can result in losses, quality problems or safety problems.
Improvement in the performance of the agricultural sector will impact the wellbeing of the rural population as bulk of the rural population is dependent on agriculture as a source of income. At a time when farm productivities in major crops have attained a plateau, it is imperative that the state focuses on the vital aspect of farm profitability. The crop husbandry sector has been affected by various factors; social, technological, economic, political, legal and environmental. These challenges have made raising crops as an enterprise riskier than ever. This paper address the issue of sustainability, food security, markets and preservation of natural resources as they are integral to the sustenance of crop husbandry.

The role of Custom Hiring Centres is proving to be crucial in providing farm mechanization services while also creating a rural entrepreneurship model. The need for creating greater awareness about institutional finance and crop insurance as a risk mitigation measure had been emphasized. The potential of Horticulture and Sericulture as emerging areas has been highlighted, given the favorable geo-climatic conditions and changing consumer preferences. Organic farming and Residue free farming are increasingly being adopted by farmers and such produce is also being sought by the informed consumer. Residue testing and certification of produce are keys to wider adoption of organic farming.

Public and private investments are crucial for creating infrastructure and supporting the sector and have been emphasized. Collectives such as Farmers’ Cooperatives and Farmer Producer Organizations/Companies need to be encouraged for attaining scale and lending business character to small sized holdings or have been duly mentioned. Role of Agriculture Education and Research, particularly location specific and farm problem centric research are important for improving farmer’s income have been highlighted. Governance reforms pertaining to planning, human resources, decentralized decision making, maintaining statistical data and adoption of emerging technologies also form part of the recommendations.
Modern high yielding varieties have become highly dependent on the use of chemical fertilizers for maximization of their agricultural output. Given the fact that Phosphorus (P) reserves, one of the essential macronutrients for plant growth and development and an integral component of chemical fertilizers, are finite and unevenly distributed globally, its deficiency could derail crop yield. Therefore, developing crops with better P-use-efficiency (PUE) presents one of the solutions to achieve sustainable agriculture and food security. In the present study, comparative genomics approach using RNA-seq from 7-day-old and 15-day-old tomato seedlings, grown in low and high P media, identified a combined 1275 genes upregulated (FC ≥ 2; p-value ≤ 0.05) and 772 genes downregulated (FC ≥ 2; p-value ≤ 0.05) in P-deplete conditions. A total of 316 genes were found to be commonly upregulated under low P-deficiency. On the contrary, only 84 genes were found to be commonly downregulated in both 7-day-old and 15-day-old tomato seedlings. Gene Ontology (GO) and KEGG enrichment analysis showed an overrepresentation of ‘metabolic pathways’ and ‘biosynthesis of secondary metabolites’ pathways in the differentially expressed genes. Besides the known phosphate starvation response (PSR) genes, novel regulatory genes were also identified. Upregulation of several AP2/ERFs and MYB transcription factors and novel HAD-superfamily hydrolase genes under P deficiency is really interesting. Functional characterization of the candidate genes indicates their possible involvement in the regulation of PUE in tomato. The candidate genes, characterized in this study, can be used in molecular breeding programs to improve PUE in tomato, in the future.
Bioactive potential of marine organisms

A. Shanmugam¹ and S. Vairamani²

1. Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, India
2. D. G. Government Arts College for Women, Tamil Nadu

Study of marine organisms for their bioactive potential, being an important part of marine ecosystem, has picked up its momentum in recent past with the growing recognition of their importance in human life. This interdisciplinary study of the life in the oceans ensures an exciting new frontier of scientific discovery and economic opportunity.

New trends in drug discovery from natural sources emphasize on investigation of the marine ecosystem to explore numerous complex and novel chemical entities. These entities are the sources of new leads for treatment of many diseases such as cancer, AIDS, inflammatory conditions, and a large variety of viral, bacterial and fungal diseases. Because of the highly chemical and physical harsh conditions in marine environment, the organisms produce a variety of molecules with unique structural features and exhibit various types of biological activities. Majority of the marine natural products have been isolated from sponges, coelenterates (sea whips, sea fans and soft corals), tunicates, opisthobranch molluscs (nudibranchs, sea hares, bivalves etc.), echinoderms (starfish, sea cucumbers, etc.) and bryozoans (moss animals) and a wide variety of marine microorganisms in their tissues. The sea, covering 70% of the Earth’s surface, offers a considerably broader spectrum of biological diversity than terra firma. Containing approximately 75% of all living organisms, the marine environment offers a rich source of natural products with potential therapeutic application. Marine organisms have evolved the enzymatic capability to produce potent chemical entities that make them promising sources of innovative cytotoxic compounds.

Over 50% of the marketed drugs today are either extracted from natural sources or produced by synthesis using natural products as templates or starting materials. The oceans are a rich source of biological diversity. Natural products from the land have been studied for thousands of years. The oceans, however, were largely overlooked until the late 1960s. In December 2004, the Food and Drug Administration approved the first totally marine-derived drug, ziconotide (Prialt), to treat chronic and severe pain. The drug, manufactured by Elan Pharmaceuticals, is stronger than morphine and mimics the deadly venom of a cone snail found in the Indian and Pacific oceans. Although marine compounds are under-represented in current pharmacopoeia, it is anticipated
Developing maize hybrids in a changing climate for food and nutritional security in Eastern India

Aditi Ghosh*, Amitava Ghosh, and Sabyasachi Kundagrami
University of Calcutta, India

Eastern India is represented by West Bengal, Bihar and Odisha. They are highly subtropics in nature because of their high temperature and humidity which prevails almost major part of the year. Lately, there is a renewed interest for Maize as Fodder, feed and food. Maize in West Bengal covers an area of one hundred sixty thousand hectare but productivity is more than 4 tons/ha which is almost twice that of national average of 2.5 tons/ha. Much effort is devoted to increase its productivity. Simultaneously, quality becomes a core issue to provide nutritional security. The work has been initiated to develop maize hybrids with improved quality without compromising its yield potential. As many as 76 hybrids were raised involving 27 parents (25 QPM and 2 Non-QPM inbreds). Based on yield performance over 3 years 10 best hybrids having 145-169g yield/plant were selected with exceptionally good cob characters (large cob and grain size as well high grain number). These selected hybrids were analyzed for ash, crude protein, amylose, carbohydrate and total carotenoid content. Quality wise among 10 hybrids three namely CUH57 (QPM x QPM), CUH50 (QPM x Non QPM) and CUH26 (Non QPM x QPM) appeared to be hybrids of choice. Of these CUH50 stood out because of its yield potentiality and enhanced quality where it recorded protein as high as 19%, ash close to 1.5 and amylose 55% but with moderate level of carotenoid. The hybrids endowed with higher yield potential and better seed quality profile present promising opportunity for cultivation.
Avenues for enhancing profitability, nutritional status and energy efficiency in rice and wheat in different crop establishment methods

Shahane Amit Anil  
Krishi Vigyan Kendra, ICAR- Central Institute of Cotton Research, India

The rice and wheat have highest resource (natural as well as artificial) consumption and generation. At the same time, both crops have high contributions towards fulfilling calories and protein requirements of Indian population. In this context searching avenues for enhancing profitability and nutritional status both crops along with due consideration to energetic is worthy. Our study showed that, the zinc fertilization have positive effect on grain yield of rice and wheat with yield increase of 120 to 180 kg/ha for rice and 50 to 220 kg/ha for wheat. The increase in net returns due to Zn fertilization was 4070, 4266, 4062 and 2493/ha in rice when applied with RDN, 75% RDN + MC1, 75% RDN + MC2 and 75% RDN, respectively. Similarly, increase in net returns in wheat was 2424, 2870, 2455 and 577 `/ha, respectively. The Zn fertilization increases its concentration rice and wheat grain by 0.6-0.7 mg/kg and 0.2-3.2mg/kg, respectively. This leads to increase in grain Zn uptake in rice and wheat by 2.1-4.0 and 3.0-21.9 g/ha. Application of microbial inoculation (Anabaena sp. (CR1) + Providencia sp (PR3) consortia (MC1) and Anabaena- Pseudomonas (An-Ps) biofilmed formulations (MC2)) significantly increases the grain yield, net returns and net energy production. Among crop establishment methods (CEM), system of rice intensification (SRI) and aerobic rice system (ARS) found profitable; while zero tillage wheat (ZTW) found economically as well as nutritionally sound. In nutshell, the role of Zn fertilization, application of microbial inoculation and suitable CEM need to be emphasized to have productive and nutritive output with increased energy efficiency in rice and wheat.
Expression profiling of SWEET gene family in rice (*Oryza sativa* L.) roots during early interactions with endophytic *Gluconacetobacter diazotrophicus* and *Bradyrhizobium japonicum*


ICAR- Indian Institute of Rice Research, India

The Sugars Will Eventually Be Exported Transporters (SWEET) gene family in plants are a group of sugar transporters involved in cellular sugar efflux with key roles during growth, development and various stress responses. In rice (*Oryza sativa* L.), SWEET transporters are the pivotal target for pathogenic bacteria, especially the rice bacterial blight pathogen *Xanthomonas oryzae pv. oryzae*. The pathogen, during the interaction, induces expression of specific SWEET genes in rice that leads to transport of sucrose to the apoplast, thereby providing the pathogen with the carbon source necessary for growth inside the host plant. However, expression pattern of SWEET family genes in rice during interaction with nitrogen-fixing plant growth-promoting bacteria (PGPB) are unexplored. Here, in a study to decipher the role of SWEET genes in PGPB-rice interaction, we report the qRT-PCR based expression profile of twenty SWEET (OsSWEET) genes belonging to different clades (I-IV) in rice root tissue inoculated with endophytic nitrogen-fixing *Gluconacetobacter diazotrophicus* PAL5 (RG) and *Bradyrhizobium japonicum* (RB) in comparison to uninoculated control (RC) at 72 hpi (hours post-inoculation) and 240 hpi. Dehusked surface-sterilized germinated rice seedlings (2 days old) were grown aseptically in phyta jar containing Hoagland’s medium for five days followed by acclimatized in Hoagland’s N (nitrogen) free medium for five days before culture inoculation.

The SWEET genes, OsSWEET3a (clade I), OsSWEET4, OsSWEET6a, OsSWEET7c (clade II) and OsSWEET11, OsSWEET12 (clade III) exhibited higher expression via qRT-PCR assay at 240 hpi than the 72 hpi in rice root tissue in response to G. diazotrophicus and B. japonicum inoculation. Expression level of clades III SWEET genes (OsSWEET11 and OsSWEET12) were enhanced in bacterial interaction. Similar enhanced expression level of clade III SWEET genes has been reported in rice and *Medicago* in response to bacterial interaction. Thus, our results indicate that SWEET genes belonging to clades III may play an important role in transporting sugars into rice root sinks during associations with G. *diazotrophicus* and B. *japonicum* and hence might be involved in root colonization process leading to better root growth, root architecture and enhanced nitrogen fixation. Our study, hence, not only provides new insights on the role of OsSWEET genes in rice but also identifies for the first time of key SWEET genes/ gene clades associated with the interaction between rice and nitrogen-fixing bacteria.
Bio control on rhizome rot of turmeric

Anitha B\textsuperscript{1} and Tanuja P\textsuperscript{2}

\textit{Sri Konda Laxman Telangana State Horticultural University, India}

Turmeric (\textit{Curcuma longa L.}) is a rhizomatous herbaceous perennial plant belonging to the family, \textit{Zingiberaceae}. It is native to tropical South Asia but is now widely cultivated in the tropical and subtropical regions of the world. Turmeric is valued for its underground orange coloured rhizome which is used as natural colouring agent for food, cosmetics and dye. It has been used in traditional medicines as a household remedy for various diseases. Turmeric has attracted much attention due to its significant medicinal potential. It is susceptible to many diseases caused by fungal pathogens. Among the various diseases now a days farmers are facing most problematic condition due to rhizome rot caused by \textit{Pythium sp.} It is a major problem in all turmeric growing areas of India. Management of the disease using fungicides has led to the development of resistant strains of pathogens. Hence there is a need to focus on ecofriendly and food secure base management of rhizome rot of turmeric using antagonistic bio control agents. \textit{Trichoderma} species are well known antagonists which have strong bio-control potential against soil borne phytopathogenic fungi. Biological control of soil borne plant pathogens by species of \textit{Trichoderma} is a vital area of plant pathological research all over the world in these days. Most of the soil borne diseases is not amenable for management through chemicals. Uses of several antagonistic species of \textit{Trichoderma} (\textit{T. viride, T. harzianum}) against a range of economically important soil borne plant pathogens have been well documented. In recent years, the search of biological control agents for the management of dreaded soil borne diseases has been advocated widely. Since the bio control agents are applied either to seed or soil or both, there is every possibility of interaction and interference that would arise with the commonly used fungicides. The full expression of potential bio control is considered in terms of rhizosphere competence, suppression of pathogens, tolerance to pesticides, competitive saprophytic ability, adaptability to environment etc.
Isolation and characterization of deltamethrin degrading bacteria from chilli rhizosphere and assessment of their application in plant growth promotion

Ashutosh Kumar¹ ²*, Mohd. Imran², Jeevan Kumar¹, S.P., Madan Kumar¹ ³, Dinesh K. Agarwal¹, Govind Pal¹, Sripathy K.V.¹ and Ramesh K.V.¹
¹ICAR-Indian Institute of Seed Science, India
²Integral University, India
³ICAR-Indian Institute of Agricultural Biotechnology, India

Chilli is highly demanded crop which is consumed around the year and momentum of high production of chilli under continuous changing climatic condition is ensured by application of various pesticides. Among these pesticides, pyrethroid group insecticides has high consumption rate. As a result, soil quality of agricultural land deteriorated and uses of pesticides resistant microbes with plant growth promoting attributes are apt remedy to overcome the soil sustainability issue. Hence, deltamethrin degrading bacteria were isolated from chilli rhizosphere cultivated under the stress of 0.1mg deltamethrin and isolated bacteria were subjected to plant growth promoting activities like Siderophore production, Indole acetic production, phosphates solubilization and Gibberellic acid production. Later, the superior and selected strains viz. ImAsIU-204, ImAsIU-206 and ImAsIU-235 were bioprimed through the root dipping method on chilli seedling and simultaneously, the minimum inhibitory concentration of deltamethrin for selected strains was found to be in range of 75-81 mg/ml. The selected and superior strains were identified by 16S rDNA sequencing method as Pseudomonas aeruginosa (ImAsIU-204), Pseudomonas fluorescens (ImAsIU-206) and Bacillus cereus (ImAsIU-235) and selected and superior strains have significantly enhanced the vigor indexes I and II and chilli production under stress condition of 30 ppm of deltamethrin concentration.
Genetic diversity analysis in Bt cotton lines

Ashwini N R Samak², Amala Balu P¹, Rajeshwari S¹, Ravikesavan R¹ and A. V Kini²
1. Department of Cotton, Centre of Plant Breeding & Genetics, Tamil Nadu Agricultural University, India
2. Sponsor: Indo-American Hybrid Seeds (I) Pvt Ltd, Bangalore, India

In present study was undertaken to assess the genetic diversity present in the 72 American cotton (Gossypium hirsutum L.) germplasm lines of Indo –American Hybrid Seeds (I) Pvt Ltd in 2018 Kharif at research station, Dharwad, Karnataka. Mahalanobis D² analysis grouped all 72 genotypes into 9 clusters. Cluster VI (17 genotypes) and Cluster II and VIII (2 genotypes in each) were the largest and smallest clusters respectively amongst all. The mean seed cotton yield (1592.56 kg/ha) was highest in cluster I whereas Cluster III had the highest mean of boll weight (6.03g), plant height (98.19 cm) with Ginning out turn (37.76%). Cluster VII had the highest mean number of bolls (31.85) and number of sympodia (17.37). Cluster VIII had the highest mean seed index. The minimum intercluster distance (6.75) was noticed in between Cluster VI and V whereas maximum intercluster distance value (65.42) was recorded in between Cluster VI and VIII indicating that genotypes in these clusters were distant to each other. The present study can be used to exploit the heterosis for commercial purpose.
Trends of food security in India

Avinash Sharma  
Arunachal University of Studies, India

Food security is indications that show the level of growth and development of people as well as country. The present paper discusses about the status of food security of India. The year wise food grains production, agriculture GDP, global hunger index, poverty line, undernourishment and food deficit observed are received. The data collected from various agriculture information sources. The figures of observations were utilized for the study from 2000-2018 years. The food grains production of 285.20 million tonnes was reported with an area of 123.22 million hectare in 2018-19 year. The agriculture GDP of 17.39% was obtained in 2018-19 year. 23% percent of populations were observed in undernourishment in 2004-05 year. 14.8% percent of populations were observed in undernourishment in 2018-19 year. 37.2% populations were reported under poverty line in 2005-06 year and 21.9% populations were recorded under poverty line in 2017-18 year. The GHI value of 38.2% was observed in 2017 year and of 31.1% was recorded in 2018 year. The food deficit of 152 kilocalorie was obtained in 2006-07 year and food deficit of 105 kilocalorie was obtained in 2018-19 year. The government food scheme and the programme are outreached to poor people and remote villages, establishment of food rehabilitation centre in state, district and block to serve food at low price and encouraging farmers for more crop yield. These aspects will improve food security of India.
Genetic diversity of horticultural crops in Arunachal Pradesh and their role in nutritional security

B N Hazarika
College of Horticulture and Forestry, Central Agricultural University, India

The state of Arunachal Pradesh has been blessed by nature with one of the richest flora and fauna on the earth and regarded as one of the ‘Biodiversity Hot Spot’ areas in the world. Its unique phyto-geographical positions, topography and high degree of precipitation are some of the important factors which are mainly responsible for its enormous biological diversity. As a result, an array of horticultural crops is grown across the region ranging from tropical to alpine. A large number of diversity in fruits belonging to the genera Artocarpus, Annona, Averrhoa, Garcinia, Musa, Passiflora, Phyllanthus, etc. are reported from the region. Besides diverse genotypes of cucurbits, solanaceous vegetables, ginger, turmeric, bamboo, leafy vegetables etc. are having unique quality because of their locational advantage.

Though agriculture is the major source of livelihood for the major section of people still it has been remaining complex, diverse and risk-prone and resulting into the low level of productivity and income since decades. Under this situation, probably horticulture sector has desirable attributes to accelerate the agricultural growth process in the state. Horticultural sector plays very important role towards sustainable rural livelihoods in all farming system in general and in rain-fed and hilly farming system in particular like Arunachal Pradesh.

Further most of these crops are rich in vitamins, minerals and such other bioactive molecules. These crops have the potentiality to alleviate the poverty, food and can give nutritional security and also play a major role in meeting the need of nutritional and ethno medicinal uses of the rural tribal people of region since time immemorial. Nutrition security implies physical, economic and social access to balanced diet for every citizen. Malnutrition has a complex aetiology and its prevention requires awareness and access at affordable price to all the above-unreached and undernourished. In this direction minor or underutilized fruit and vegetables plays a vital role. Many of these fruits are eaten locally to meet their nutritional requirement; many of them are used for their ethno- medicinal properties besides colour, flavour and other health benefits. However, there is yet to explore the full potentialities of some minor fruits, leafy vegetables of the state used by tribal people and also many of such valuable resources remain unexploited due to lack of awareness of their potential.
Animal nutrition approaches for profitable livestock operations and sustainable rural livelihoods

Blummel M
International Livestock Research Institute, Ethiopia

Globally, livestock contribute 40% of agricultural GDP, and create livelihoods for more than 1 billion poor (Steinfeld et al., 2006). From a nutritional standpoint, livestock contribute about 40% of the protein in human diets globally, and more than 50% in developed countries (FAO, 2017). As outlined in the livestock revolution scenario (Delgado et al., 1999) consumption of animal products will increase particularly in low and middle income countries in response to urbanization and rising incomes. While the increasing demand for livestock products offers market opportunities and income for small holder producers and even the landless thereby providing pathways out of poverty (Kristjianson 2009), livestock production globally faces increasing pressure because of negative environmental implications particularly because of greenhouse gas emissions (Steinfeld et al., 2006). Besides greenhouse gases, the high water requirements in some livestock production systems are a major concern.

Feed resourcing and feeding is at the very interface where the positive and negative effects of livestock, income, livelihoods and the environment are negotiated. Lack of affordable, reliable, and adequate feed (quantity and quality) represents a major constraint to smallholder competitiveness and the overall profitability of livestock production systems. Feed production and feeding are the major users of on-farm labour and very often it is the women who shoulder these responsibilities. Choice of feeds and feeding strategies also has major implications for natural resource usage and greenhouse gas emissions. For example, feed production can significantly deplete water resources, particularly in irrigated forage based systems. On the other hand, feed production, marketing and processing offers multiple business, income and employment opportunities for rural disadvantaged populations outside of the direct engagement in animal sourced food production (ASF).

The present paper therefore argues that the discipline of animal nutrition has a crucial role to play, and deserves greater attention, in livestock based livelihoods, than the other key technical inputs provided by animal health and genetics. The objectives of animal nutrition are therefore multi-fold: a) increase the economic benefit from ASF production by decreasing feed costs and/or increasing ASF production and productivity, b) decrease the environmental footprint of ASF production, c) reduce labour requirements and drudgery involved in feed resourcing and feeding; and d) provide opportunities for micro, small and medium enterprises (MSME) in feed production, marketing and processing to generate income and employment opportunities and while increasing the availability of affordable off-farm produced feed.
The present investigation conducted in Floricultural Research Institute, A.R.I, Rajendranagar, Hyderabad during the year 2015-16 using hydroponics (Solution culture) under shade net to develop and describe the nutrient deficiency symptoms of Mn, B, Fe, Zn and Cu. The experiment was conducted in CRD with 12 treatments and three replications. Plants of Gerbera var. Savannah were grown with complete modified Hoagland solution and nutrient deficiency treatments were induced with a complete nutrient formula minus one of the nutrients. Withholding of different nutrients from the nutrient medium resulted in characteristic visual symptoms on foliage and growth of Gerbera plants. Plants grown in Mn deficient treatment did not express visual deficiency symptoms. Boron deficiency symptoms resulted in marginal necrosis of leaf apex on newly emerging leaves at 21 DAT. Iron deficiency symptoms appeared at 40 DAT as intervenial chlorosis on younger leaves. Zn deficient plants expressed symptoms at 35 DAT which showed intervenial chlorosis on older leaves. Copper deficiency symptoms appeared at 20 DAT which resulted in distorted young leaves. Leaf analysis revealed that in deficiency situation, content of individual mineral element was reduced. Some interactions between nutrients also showed up which includes, increase in P content in Zn deficient treatment, Mn content in Mg deficient treatment, Fe content in Cu deficient treatment, Zn content in Fe deficient treatment and Cu content in Fe deficient treatment were increased. In the present study, plants grown in minus Cu treatments showed early symptoms (20 DAT). Whereas, treatment without Mn did not resulted in any visual symptoms during the period of study (60 DAT).
Genetic studies on heat tolerant indices in early maturing chickpea (*Cicer arietinum* L.)

Avinalappa Hotti¹ and Raghunath Sadhukhan²

1. Senior Research Fellow, ICAR-National Academy of Agricultural Research Management, India
2. Professor, Department of Genetics and Plant Breeding, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, India

High temperature (>35°C) is a critical factor affecting growth, development and seed yield of legumes. During flowering or reproductive period, if temperature rises above the threshold level, it would adversely affect pod formation and seed setting that result in reduced seed yield of chickpea, an urgent need to improve its productivity by varietal improvement. Understanding the mechanism of plant response to high temperature is a key strategy in breeding for heat tolerance in chickpea. Hence, the study was undertaken to identify a suitable heat tolerance index for identifying heat tolerant genotypes on the basis of their early maturity and seed yield performance under different environmental conditions. Twenty early maturing genotypes of chickpea were evaluated in replicated trail under normal and late sown conditions, and different heat tolerant indices were used to estimate the genetic relationship and heritability between heat tolerant indices in order to identify best indices for selecting heat tolerant genotypes. Six heat tolerance indices including heat susceptibility index (HSI), heat tolerance index (HTI), yield index (YI), yield stability index (YSI), mean productivity (MP) and geometric mean productivity (GMP) were used. The indices were adjusted based on seed yield under late and normal sown conditions. The analysis of variance revealed the existence of genetic variation for these indices and genetic coefficient of variation, heritability and genetic advance as per cent of mean indicated that maximum genetic improvement for heat tolerance can be achieved by adopting suitable indices for making selections. The significant and positive correlation of seed yield under normal sown and MP, GMP and HTI showed that these indices were more effective in identifying high yielding genotypes under different sowing conditions. The principal component analysis (PCA) revealed the variation with HTI, MP and GMP. Thus, selection of genotypes that have high PCA and low PCA are suitable for both sowing conditions. GMP and HTI in combination with yield stability index were the best indices for identifying heat tolerant genotypes. Among the genotypes, Annigeri 1, ICCV 10, JG 14, Pusa 372, BG 256, and JAKI 9218 were identified as thermo-insensitive and exhibited least heat susceptibility index (HSI) value and per cent reduction in seed yield under late sown conditions.
Livestock sector plays a prominent role in the rural economy in supplementing the income of rural households, particularly for landless laborers, small and marginal farmers. The study was conducted to know the role of livestock in farmer’s economy and to assess the economic inter-linkages of livestock with other enterprises in North-eastern Karnataka (NEK) region. During investigation, 24 villages were randomly selected from three districts of NEK region. Among selected villages, ten farmers were further selected to construct pre-determined 240 sample respondents. The data was analyzed using tabular presentation and social accounting matrix (SAM). The study revealed that the majority of farmers possessed education up to middle school. Around 70 per cent of the sample farmers were small and marginal. The importance of dairy was emphasized by the fact that it was the major source of income to more than half of the sample farmers. While, the integration of livestock with crop production was clearly established through forward and backward linkages, and indicated that paddy straw was the main source of fodder produced on-farm the highest gross return from the milk was observed in large farmers since they maintained more than seven crossbred cows. It is therefore, the milk consumption per family was more in large farmers than other categories. Determinants of rearing of crossbred cows were worked out and the significant factors responsible were family size, total land, literacy of the head of the family, paddy straw yield and household like farming. As per the opinion of 75 per cent of the farmers, the high cost of animal, lack of availability of feed and fodder were the major production problems in livestock rearing. In contrast, the marketing constraints such as difficulties in transportation of animals and inadequate space for shelter and social and political constraint were labour scarcity and delay in government subsidy.
Food security and nutrition and sustainable Agriculture

Asna Urooj
University of Mysore, India

India has made rapid strides in improving rates of under- and malnutrition. Between 2006 and 2016, stunting in children below five years declined from 48% to 38%. Yet, India continues to have one of the world’s highest child under-nutrition rates, impacting the child’s health and development, performance in school and productivity in adult life. The government has large food security and anti-poverty programs but there are critical gaps in terms of inclusion and exclusion errors. Women and girls are particularly disadvantaged. Despite the achievement of national food self-sufficiency, new challenges have emerged: Slowing agriculture growth, climate change, land degradation and shrinking bio-diversity. Large tracts of farmlands in India have become barren due to imbalanced fertilizer use and excessive use of a single fertilizer, urea. The Zero Hunger vision reflects five elements from within the SDGs, which taken together, can end hunger, eliminate all forms of malnutrition, and build inclusive and sustainable food systems. The ZHC is extremely relevant for India; home to 18% of the world’s population, 25% of the country’s people go hungry. India has made impressive strides on the agricultural front during the last three decades. There are many elements of traditional farmer knowledge that, enriched by the latest scientific knowledge, can support productive food systems through sound and sustainable soil, land, water, nutrient and pest management, and the more extensive use of organic fertilizers. Replacing rice and wheat with crops such as maize, finger millet, pearl millet or sorghum could help India save water and provide its people with more nutritious food. Given expected changes in temperatures, precipitation and pests associated with climate change, the global community is called upon to increase investment in research, development and demonstration of technologies to improve the sustainability of food systems everywhere. Building resilience of local food systems will be critical to averting large-scale future shortages and to ensuring food security and good nutrition for all.
Rural communities and small-scale agricultural producers are deeply affected by global, economic, environmental and political forces. The gap between the information rich and information poor is getting wider. However, the existing extension personnel can take advantage of the modern communication technologies to improve the transfer of technology process. With this background, the study was undertaken in Andhra Pradesh state to study the perception of sheep farmers (120) and veterinary officials (30) on the developed information technology enabled Sheep Advisory System (SAS). Sheep Advisory System was developed using Macromedia Director on selected dimensions of sheep farming. Both the groups expressed that SAS had great message components and technical components. It also possessed good utility and usability. This computer based module will help to impart scientific knowledge of sheep farming in local language to the end users.
P. Anantharaman
Professor, CAS in Marine Biology, Faculty of Marine Sciences, Annamalai University, India

Algae are an extremely diverse group of organisms that make up the lower phylogenetic echelons of the plant kingdom. Seaweeds or marine macroalgae which are the primitive type of plants growing abundantly in the shallow waters of sea, estuaries and backwaters. They flourish wherever rocky, coral or suitable substrates are available for their attachment. They are categorized into 3 groups namely, Green, brown and red algae, based on the pigmentation, morphological and anatomical characters. Seaweeds are one among one among the commercially important marine living and renewable resources known for their richness in polysaccharides, minerals and certain vitamins, but they also contain bioactive substances like polysaccharides, proteins, lipids and polyphenols, with antibacterial, antiviral and antifungal properties as well as many others. This gives seaweeds great potentials as a supplement in functional food or for the extraction of compounds. Therefore, the efforts to maximize the absorption of nutrients by spraying extracts of natural products that contain stimulants, is a strategic move to suppress the use of excessive doses of inorganic fertilizer.

Seaweeds are macroscopic algae, growing in intertidal and subtidal regions of the sea, serve as an excellent source of food, fodder, fertilizer and industrial raw material for the production of phycocolloids like agar, algin and Carrageenan. The use of seaweeds as manure in farming practice is very ancient and common practice among the Romans and also practiced in Britain, France, Spain, Japan and China. The use of marine macroalgae as fertilizer in crop production has a long tradition in coastal areas all over the world. Seaweed cast continued to be so valuable to farmers, even in the early 1900s. In many countries seaweed and beach cast are still used in both agriculture and horticulture. In India, it is used for coconut plantations especially in coastal Tamil Nadu and Kerala. The high amounts of water soluble potash, other minerals and trace elements present in seaweeds are readily absorbed by plants and they control deficiency diseases. Seaweed contains plant growth hormones required by plant, regulators promoters available to enhance yield attributes. Most seaweed-based fertilizers are made from kelp, a variety of seaweed known to contain trace elements of magnesium, potassium, zinc, iron and nitrogen—all of which are beneficial to plant growth.
Production performance and economics of Pratapdhan chickens for backyard farming in southern Rajasthan

Panakj Lavania
College of Agriculture, Agriculture University, Jodhpur, India

The present study was conducted to evaluate the production performance and economics of Pratapdhan Chickens for Backyard farming under sub-humid ecosystem of Sirohi District of Southern Rajasthan. A total of 560 Pratapdhan poultry chicks were procured from Maharana Pratap University of Agriculture & Technology (MPUA&T), Udaipur and distributed to 28 tribal selected farmers for rearing in backyard system. The overall mean body weights of Pratapdhan chickens at 8, 10, 12, 14, 16, 18, 20 and 40 weeks of age were 515.06±9.97, 698.90±16.32, 951.78±18.24, 1139.32±26.96, 1372.73±43.51, 1542.87±49.61, and 1721.82±46.35 and 2244.13±51.22 g, respectively. Differences in body weights between male and female chickens were found to be significant. The mortality in Pratapdhan chicken during the period from 6 to 20 weeks and 21 to 40 weeks of age was recorded 12.20 and 5.09 per cent, respectively. The average age at first egg laying was recorded 157.46±1.19 days while age at sexual maturity was recorded 173.36±2.71 days. The average hen day egg production up to 40 and 72 weeks of age were recorded 54.94±0.41and 167.89±1.42, respectively. Mean egg weight at 28 weeks was 46.37±0.26 g whereas at 40 weeks of age it was 53.49±0.21 g. The value for different egg quality traits clearly indicated that the eggs produced from Pratapdhan are of superior quality. The benefit cost ratio was recorded 1:5.63 per family for rearing under backyard farming system. Extension agencies can use this data set for further promotion of these backyard poultry strains in rural areas as many of the development agencies have this as an option for livelihoods. The advantage of promoting Pratapdhan has been in groups and individual farms as source of supplementary income that can be added to the livelihood of farmers.
Effect of dietary inclusion of Azolla (*Azolla pinnata*) on growth performance and meat characteristics of Satpuda poultry

Sameer Dhage¹ and Nitin Rathod²

*College of Agriculture- Karad, India*

The present investigation was carried out to assess the effect of feeding azolla on proximate composition feed, body weights, feed consumption, feed conversion ratio (FCR), meat characteristics and proximate composition of meat. In all Sixty, day old, Satpuda chicks were purchased from Yashwant agritech hatchery, Pvt. Ltd. Jalgaon, Maharashtra. They were randomly distributed into four groups T₀, T₁, T₂ and T₃ with 12 chicks in each group. The experimental broiler chicks were reared on deep litter system in well ventilated shed from 0–8 weeks. The Azolla was added in experimental diet at the rate of 2, 4 and 6 per cent for T₀, T₁, T₂ and T₃ respectively. The control group (T₀) was without Azolla. The experimental ration was isoproteinous. The experiment was continued up to 8 weeks. There was no any mortality recorded in Satpuda poultry birds of various groups during the experimental period. The average body weights at the end of eighth weeks of age were 716.58, 737.58, 775.67 and 855.92 g in T₀, T₁, T₂ and T₃ groups, respectively. The body weight of T₃ group was significantly superior over other. Average weekly body weight gain at the end of 8th week were 160.08, 161.25, 170.50 and 185.08 in T₀, T₁, T₂ and T₃ group respectively. The significantly higher weight gain was observed in T₃ followed by T₂, T₁ and T₀. Average total weekly feed intake (g/bird) at end the end of 8th week of study was recorded as 600.08, 603.09, 615.07 and 635.13 g for T₀, T₁, T₂ and T₃ groups, respectively. The trend of significantly higher feed intake was observed in T₃ followed by T₂, T₁ and T₀. The average weekly feed efficiency at 8th week of age was 3.76, 3.75, 3.66 and 3.44 in T₀, T₁, T₂ and T₃ groups, respectively. The FCR was found to be statistically significant for different treatment groups from 5th week onwards. T₃ group was significantly superior over control group followed by T₂, T₁ and T₀ groups. Meat characteristics showed non-significant differences among all treatments regarding dressing percentage, meat bone ratio, weight of heart, liver and gizzard and also regarding cut up parts percentage. Proximate composition of breast and thigh meat showed no significant differences among all the treatments. Statistically no significant difference was noticed between the treatments for different parameters viz. Appearance and colour, flavour and overall acceptability. The trends showed that there was no effect for sensory score observed when fed with Azolla. It is therefore concluded that dietary inclusion of Azolla upto 6% was beneficial in Satpuda poultry to improve growth performance and it doesn't have any adverse effect on meat quality.
An exploratory survey on the health status of cage cultured striped catfish, *Pangasianodon Hypophthalmus*

Gayatri Tripathi and Bharathi Rathinam  
*ICAR-Central Institute of Fisheries Education, India*

Indian reservoirs with the water spread area of 3.51 million ha offer enormous scope for enhancing fish productivity through cage farming. The predominance of reservoirs in Tamil Nadu, Karnataka, Andhra Pradesh, Kerala, Orissa, West Bengal and Maharashtra state account for more than 56% of the total reservoir area in the country. The cage environment provides rich nutrient sources to cultured fishes but also increases the risk of epidemics if not adequately maintained. The present study was carried out to catalogue the seasonal prevalence of bacterial pathogens in striped catfish *Pangasianodon hypophthalmus*, and also to identify environmental stress factors posed by the enclosures and high stocking density in cages. The sampling was conducted in Kanher, Manoli, Varasgaon and Panshet reservoirs of Maharashtra State during summer, winter and rainy seasons. The physico-chemical parameters of water showed a significant difference between the seasons. The catfish exhibited petechial haemorrhages on the body surface, lesions on the fins and around the mouth during summer season. Total 50 bacterial isolate could be identified and characterized by biochemical tests as well as 16s rRNA sequencing. The fish pathogenic bacteria, *Edwardsiella tarda, Aeromonas veronii, Lactococcus lactis, Pseudomonas aeruginosa, Pseudomonas putida, Pleisomonas shigelloides, Citrobacter freundii* and *Acinetobacter baumannii* were characterized from the study. Detailed histopathological study was also conducted to understand the quantum of damages inflicted by the pathogens in the tissues. This would be the first report on the health status of striped catfish cage cultured in freshwater reservoirs of Maharashtra state. The information suggests that there should be an increased awareness on timely investigations & identification of specific biotic & abiotic risk factors. Such awareness can lead to adaptation of effective prevention and control strategies for avoiding pathogenic prevalence in Indian freshwater cage fish farming.
The nitrogen fixing aquatic pteridophyte *Azolla* has the potential to be used as feed supplement for cattle and poultry. Centre for Conservation and Utilization of BGA, ICAR-Indian Agricultural Research Institute is involved in the maintenance and mass multiplication of *Azolla* and provide it to a number of stakeholders for its use as Bio-fertilizer and cattle feed supplement. However, systematic attempts have not been made to assess the biomass production and the proximate composition of *Azolla* mass multiplied under outdoor conditions. Therefore, in the present study biomass production and proximate composition of *Azolla microphylla* was analyzed. *A. microphylla* could be mass multiplied throughout the year. On an average, the plants multiplied in cemented tanks (5 m²) produced 2.27 Kg m⁻² biomass in fifteen days. Analysis of the proximate composition showed crude protein content (28.4%), crude fat content (2.7%) and crude fibre (14.6%) in the biomass. The essential and the non-essential amino acids varied in the range of 41 and 59%, respectively. Analysis of the fatty acid profile showed 55% polyunsaturated fatty acids, 12% monounsaturated fatty acids and 33% saturated fatty acids. Mass production of Azolla has been taken up by several farmers for its use as cattle feed supplement. Farmers experienced enhancement in the production of milk due to integration of *Azolla* biomass in the regular diet of animals. However, systematic and scientific validation of these results is necessary. Therefore, *Azolla* could be used as feed supplement for cattle and poultry due to the high rate biomass production and ideal nutrient composition.

Biomass production and nutritional composition of *Azolla microphylla* in relation to its exploitation as cattle feed supplement

Gerard Abraham, Ravindra Kumar Yadav, Keshawanand Tripathi, Pranita Jaiswal, and Yudhvir Singh

Centre for Conservation and Utilization of BGA, ICAR-Indian Agricultural Research Institute, India
Soil health management - Issues & concerns for sustainable development

Girish Chander and S Dixit
ICRISAT, India

Food and nutritional security of projected population of 9.7 billion globally and 1.7 billion in India by 2050 is a major challenge of the 21st century. Alongside the challenge is to improve incomes of 55% population in India who depend on agriculture and also to transform rainfed agriculture into a business that youth find lucrative and sustainable. Widespread soil degradation along with water scarcity is a major hindrance in realizing productivity potential in the drylands. Emerging deficiencies of secondary and micro nutrients along with low levels of soil organic carbon pose challenges for enhancing food production. Soil health mapping in present context is a cost-effective technology with high success probability to benefit most farming community and so the best entry point activity in any agriculture development initiative. ‘Bhoochetana’ program in Karnataka, India has been one of the initial exemplar initiatives of scaling-out the need-based soil health management practices to around 5 million farmers in the state. Soil mapping-based fertilizer management in Karnataka state recorded significant productivity benefits with participating farmers in the state during 2009-2013 that varied from 25% to 47% in cereals, 28% to 37% in pulses and 22% to 48% in oilseed crops. For one rupee spent, the returns were rupees 3-15. Even in comparatively drier years, application of balanced nutrients through including micro and secondary nutrients significantly increased grain yield and above ground dry matter which provides resilience against drought and food. There is evidence of relation of soil quality and balanced fertilization with food quality and with balanced fertilization, the food nutritional quality tends to improve. Also crop residues are important feed components in the crop–livestock systems, and the positive effects of improved nutrient inputs on feed availability and feed quality are very important in the predominant crop-livestock systems in the drylands. Inefficient nitrogen fertilizer related pollution is an issue of concern worldwide and studies showed that need-based micro and secondary nutrient amendments not only bring in productivity benefit, but also improve nutrient and most importantly nitrogen use efficiency. As soil organic matter is the single most important indicator of soil productivity, a proof of concept of soil C-building and cutting costs of fertilizers was also demonstrated at learning sites in Andhra Pradesh through recycling crop stubbles after chopping with 'shredder machine' on sharing basis in the village and using ‘microbial consortium culture’ for decomposing it into ‘aerobic-compost’.

Lack of sufficient infrastructure in the laboratories across the country in general is one major impediment for precise and thorough analysis of soil samples, which in view of emerging micro and secondary nutrient deficiencies is very important for working out a sound soil management program. Establishing fully equipped state-of-the-art laboratories to cater soil analysis requirement of large area (like district wise) works to be a better option not only technically but also financially.
Response of soil and foliar application of micronutrients on flowering and fruit characters of Sapota cv. Kalipatti under high density planting system

Guvvali Thirupathaiah¹* and A. M. Shirol²
1. Department of Fruit Science, KRCCH, India
2. AICRP on Fruits, KRCCH, Bagalkot, India

A field study was conducted out to know the response of soil and foliar application of zinc, iron and boron on flowering and fruit characteristics of Sapota cv. Kalipatti under HDP system (3x3 m) at KRCCH, Arabhavi UHS Bagalkot, during 2015-2016. For soil and foliar application Zinc and iron Sulphates were used for soil and foliar application, where as boron for soil application Sodium tetraborate (Jai bore) and for the foliar application Solubor were used. The present research results indicated that, the foliar application of (T10) 0.5% ZnSO₄ + 0.5% FeSO₄ + 0.3% B tree⁻¹ (i.e. in two times as foliar i.e. 1st at 50 per cent flowering and another at fruits at pea size) along with recommended dose fertilizers (recommended dose of macro-nutrients i.e. 100: 40: 150 g NPK and FYM 50 kg tree⁻¹ for four to six years plants) was shown less number of days (29 days) taken for flower initiation, flower opening to fruit set (29.50 days), days taken to reach harvestable stage (195.88 days) and the maximum number of flowers (17.15) and fruits (2.95) shoot⁻¹ and also the highest per cent fruit set (23.56 %) and fruit retained (85.91 %) at harvesting stage were noticed. Also it gave superior fruit characters like fruit weight (113.33 g), fruit length (6.10cm), fruit girth (5.84 cm) and fruit volume (101.50 ml) were noticed where as the lowest values were noticed in control (T1) and water spray (T2).
Comparative effect of bio fertilizers under drip fertigation system on nutrient uptake and yield performance in green gram (Vigna radiata. L)

K. Shravani, S. Triveni, G. Vinay, G. Prasanna, K. Manasa
Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, Telangana, India

A field experiment was carried out on “Comparative effect of Bio fertilizers under drip Fertigation system on nutrient uptake and yield performance in Green gram (Vigna radiata. L). It was conducted at water technology centre fields, college farm, College of Agriculture, PJTSAU, Rajendranagar, Hyderabad, Telangana during Kharif 2016 – 2017 with one of the objective of nutrient uptake and yield performance of Green gram, variety (MGG – 295) under Drip Fertigation system. The experiment was laid out in randomized block design with three replications along with 10 treatments. The liquid bio inoculants viz., Rhizobium and PSB were used under drip Fertigation system. The results of the field experiment indicated that the treatment T6 with combination of 100 % RDF along with LBBF drip Fertigation recorded significantly highest N, P and K uptake were 62.23, 26.60 and 51.33 kg ha-1 respectively and significantly highest seed yield (1019.50) kg ha-1 recorded with treatment (T6) when compared to all the treatments. Further, the percent of seed yield increased over control by 23.93 %.
Palak (Beta vulgaris var. bengalensis L.) is one of the most popular leafy vegetables of tropical and subtropical region and grown widely. In India, Palak is commonly cultivated as a cool season vegetable and its tender soft succulent leaves are used as vegetable. It is a rich source of vitamins like A, C and minerals. Soil solarization is a non-chemical approach which can be performed by heating the soil during the summer months through various methods. It is an effective method of controlling soil borne pathogens, pests and weeds become inactivated by high temperature and excessive moisture during the hot season. Therefore an investigation was conducted to study the Effect of off season eco-friendly soil management practices on growth and yield parameters of Palak (Beta vulgaris var. bengalensis) was carried at Annamalai University, Annamalai Nagar, Chidambaran in Cuddalore District, Tamil Nadu. The experiment was laid out in a Randomized Block Design with seven treatments in three replications consisting of soil management treatments viz., fallow summer ploughing one time in 30 and 45 days, summer ploughing 2 times in 30 and 45 days, application of transparent polyethylene film of 0.05 mm thick for 45 days and biodegradable polyethylene film for 45 days and compared with a control. The growth and yield components viz., plant height, number of leaves per plant, leaf weight per plant, leaf area per plant, yield of greens per plant, yield of greens per plot and yield of greens per hectare were recorded at the time of harvest and were analysed. The results revealed that application of transparent sheet polyethylene significantly recorded the highest weed control index and improved yield parameters in Palak.
Studies on the effect of different Fertigation levels on flower yield, soil and leaf nutrient status of Marigold (*Tagetes erecta* L.) Cv. Pusa Narangi Gainda

Kurakula Divya*, D. Vijaya, A. Girwani and P. Prasanth

*Department of Floriculture and Landscape Architecture, Sri Konda Laxman Telangana State Horticultural University, India*

Marigold flowers with attractive flower colors and long blooming period are extensively used as loose flowers in making garlands and they remain fresh for quite a long time after harvesting, these factors have made marigold as one of the most popular flowers in India for commercial cultivation. In recent advances, application of nutrients through drip is gaining popularity, which is cost effective in respect of nutrient use efficiency in high yielding cultivars of marigold. Inadequate and improper plant nutrition causes serious disorders in marigold cultivation. Therefore, to standardize the fertigation schedules during the crop growth the investigation was carried to study the effect of fertigation on the performance of African marigold cultivar, Pusa Narangi Gainda, at Floricultural Research Station, Rajendranagar, Hyderabad during 2016-2017. The experiment was laid out in Randomized Block Design with seven treatments and replicated thrice, which included different doses and sources of fertilizers. The biochemical status of soil before and after harvesting of crop was found non-significant due to fertigation treatments in marigold. At first flower bud appearance stage leaf NPK status differed significantly with levels of fertigation. Maximum available nitrogen content (3.82%), phosphorus content (0.26%) and potassium content (1.37%) in leaf were recorded in 75 per cent of RDF using WSF. Further, the flower yield per hectare was also maximum (14.42t) with the same treatment in marigold cultivated under open conditions.
In chilli breeding, yield and quality are of prime interest. Yield being a complex quantitative character is governed by a large number of yield contributing traits. A field experiment was conducted in Kharif 2018 at P.G. research farm, College of Horticulture, Rajendranagar, Hyderabad in randomized block design with three replications using forty genotypes of chilli for 24 characters. Significant difference was observed for all the characters under study. However, the mean data revealed that Warangal chapata was superior for average fruit diameter (3.28cm), fruit weight (17.11g), recovery percentage (40.33%), fruit yield/plant (0.690kg) and yield per plot (11kg), ascorbic acid content (150.13mg/100g) followed by PSR 7075 and EC 399574. Hirkani was found to be early for days to 50 per cent flowering (39.67 days), days to fruit set (43 days), days to first fruiting (71 days), days to first harvest (81 days). High Capsanthin content (276.59ASTA units) in PSR 7075 followed by NIC 19967 (274.92 ASTA units), highest oleoresin content (14.73%) in AAT 2 followed by Warangal Chapata (14.30%), were recorded. Genotypes ST 13837 and ST 13874 were found superior for capsaicin content (0.82%). Therefore, among the forty genotypes evaluated in Southern Telangana region, Warangal Chapata, PSR 7075 and EC 399574 for yield, Hirkani for earliness, PSR 7075, NIC 19967, Warangal Chapata, AAT 2, ST 13837 and ST 13874 for quality parameters were found to be promising. Hence, these genotypes can be used in further breeding and crop improvement programmes as parental lines.
IOT and sensor based protected cultivation and drip fertigation technology for food security in India

M. Hasan  
Principle Scientist, ICAR-IARI, India

Machine learning, Internet of Things (IOT) and Artificial intelligence (AI) based automation have been the recent most successful approaches for controlling protected cultivation greenhouses and its irrigation & Fertigation for maximizing the quality crop production of high value vegetables, flowers and seedlings. These recent techniques incorporate and integrate the human expertise, sensors, online and in-situ data, software's and hardware's from different sources for the efficient management of all the related inputs and maximize the output in terms of both quality and quantity. The future of smart, efficient and precision agriculture is mainly based on automation linked with IOT and AI.

Protected cultivation technology envisages immense promise especially for the high value horticultural crops against various types of biotic and abiotic stress conditions. The climatic parameters stress conditions like unusually low and high temperature, humidity, solar radiation; wind velocity comes under abiotic stress condition. The present climate change scenario dealing with various biotic and abiotic stress conditions poses serious threat to the agricultural production throughout the world. In the above scenario, protected cultivation provides the alternative to grow high value nutritive horticultural crops throughout the year on sustainable basis and provide food security in India. The main purpose of protected cultivation is to create a favourable environment for the sustained growth of crop so as to realize its maximum potential even in adverse climatic conditions. Protected cultivation technology offers several advantages to produce vegetables, flowers, hybrid seeds of high quality with minimum risks due to uncertainty of weather and also ensuring efficient and other resources. This becomes relevant to farmers having small land holding who would be benefitted by a technology, which helps them to produce more crops each year from their land, particularly during off season when prices are higher. This kind of crop production system could be adopted as a profitable agro-enterprise, especially in peri-urban areas. Thus, protected horticulture has great potential to enhance the income especially of small farmers if appropriate technological interventions are made. IOT and sensor based protected cultivation offers several advantages to produce horticultural crops and their planting material of high quality and yields, through efficient land and resource utilization.
The growth of world human population is already reached to 7.7 billion and expected to reach 9.7 billion by the year 2050. The India is most populous country (136 crores) in the world is next to China (142 crores). Due to the limited resources, natural calamities and global warming issues food production to the tune of growing population is one of the prime challenges to the researchers, policy makers and government. The food security and nutritional security is one of the yard sticks for nations growth and development. USA, China, India and Brazil are the top most countries contribute to global food production (Barley, Cassava, Maize, Oil palm, Rapeseed, Rice, Sorghum, Soybean, Sugarcane and Wheat). Even though that world Global Hunger Index (GHI) is 20.9 (in 0-100 scale; 0 is no hunger and 100 is deepest hunger) and GHI of India score is 34 with 104th rank in the world and countries like Belarus, Chile stood first rank in the hunger. Under this atmosphere, to achieve nutritional security of human population (including women, children and aged people) vegetables plays pivotal role due to their richness in nutrients in human diet including minerals, vitamins, fibres, carbohydrates, proteins and antioxidants. However, damage due to pests, diseases and post-harvest losses poses as one of the major constraints in vegetable productions. Among the diseases viral diseases are prime important due to its rapid spread, recombination in virus -vector population and lack of chemical management practices leads to severe yield losses. In India, the most common viral diseases observed on vegetable crops were belongs to the genus Begomovirus (85-100% incidence), Potyvirus (30-100%), Cucumovirus (30-80%), Tospovirus (30-100%), Polerovirus (30-100%), Tobamovirus (30-84%), Ilarvirus (40-85%) and Crinivirus (30-65%) are most predominantly occurring in endemic to epidemic manner with an incidence of 30-100% causing yield losses (10-60%) and quality (40-80%) loss of the produce including agricultural and horticultural crops. Detection of vegetable viruses through right diagnostic tools at right time is most essential to implement integrated virus disease management (IDM) strategies. The mixed infections, contagiousness, seedborne nature of viruses and insecticide resistance issue, cross infections due to wide host range leads to severe and rampant spread of viral diseases. However, development of virus diagnostics and IDM strategies for most predominant viruses helps the vegetable growers for increasing the production levels to assure uniform nutritional security to mankind across the nations through international trade relationships.
Quality seed a need of the hour - National perspective

Manimurugan C
ICAR-IIVR-Regional Research Station, India

Quality seeds of improved varieties are the basic input for increased production and productivity of agricultural and horticultural crops which can ultimately increase the farmer's income and ensure the food and nutritional security. Seeds are carriers of new technology and benefits of all the inputs in agriculture can be realized, only when quality seeds are used for sowing. India is the fifth largest seed market in terms of monetary value and it contributes 4.7% in global seed production which is preceded by the US (28.1 %), China (21.2 %), France (8.4 %), and Brazil (6.2%). In India, 343.52 lakh quintals of certified seeds are produced and distributed during 2015-16 by both public and private sector. Still the productivity is comparatively less than many developed countries which may be due to less Seed Replacement Rate (SRR) and seed distribution through unorganized sector. Higher seed cost and unavailability of quality seeds at right time are some of the reasons for low SRR. Seed Act (1966), Seed Control Order (1983), PPV&FR Act (2001), National Seeds Policy (2002) and Seed Bill (2004) are some of the policy initiatives which are governing the Indian seed sector. But changes in seed sector like introduction of GM crops demand changes in Seed Act and Seed Policy. Generation system of seed multiplication, seed certification and quality inspection at retailer points by seed inspector are in force to ensure quality seeds availability to Indian farmers. Apart from crop production farmers can also consider seed production as profitable venture to double their income. However, exploring possibilities of export of seeds to SAARC countries and African countries only will create a way to take up seed production as a remunerative entrepreneurship. Association of Official Seed Analyst (AOSA), International Seed Testing Association (ISTA), Organization for Economic Cooperation and Development (OECD) and European and Mediterranean Plant Protection Organization (EPPO) are some of the international organizations which are responsible for seed quality maintenance in international movement of seeds by developing seed quality standard and issuing seed quality certificate.
Mungbean, an important protein rich food legume, is suffering from different stresses causing alarming yield depression. Salinity stress remains a chronic threat to its yield in India, where ground water extensively used in agriculture causing unprecedented salt accumulation. Arbuscular mycorrhizal fungi (AMF) play a major role which influence plant growth, nutrient uptake and contributes to ecosystem processes. The present study aims, to demonstrate the impact of AMF (*Glomus mosseae*) on physio-biochemical attributes of mungbean exposed to salinity. Two highly tolerant, two moderately susceptible and two highly susceptible germplasms were screened from fifty high yielding early maturing germplasms and were subjected to salinity stress (300mM NaCl) alone and in presence of AMF (approx. 100 spores/g soil) under greenhouse. Results revealed that AMF alleviates the salinity related growth reduction by improving the nutrient uptake and by balancing the ratio between K:Na and Ca:Na which impact directly the osmoregulation of the plants. Growth parameters, photosynthetic efficiency and chlorophyll content were also enhanced in presence of AMF. Mycorrhiza inoculation also increased the proline content (23%), water-use efficiency (38%) and activity of different antioxidant enzymes in significant manner providing efficient protection against salinity. All these positive impacts of AMF were duly reflected in significant increase of grain yield (more than 2 fold increase) in mungbean. Interestingly, salinity stress induced retarded growth and decline in other biochemical parameters in susceptibles recorded remarkable recovery following AMF inoculation. The colonization of AMF appears to be a practical eco-friendly approach to attenuate the adverse effects of salinity on the growth and productivity of mungbean.
Managing soil health for sustainable agricultural production

Munish Kumar
Department of Soil Conservation and Water Management, Chandra Shekhar Azad University of Agriculture and Technology, India

India is endowed with a vast and rich diversity of natural resources particularly soil, water, climate and agro-biodiversity. To realize optimum potential of the agricultural production system on a sustained basis, efficient management of soil and water is of paramount importance. Misuse and abuse of the technologies led to over-exploitation of these resources beyond their intrinsic capacity in most part of the country. Consequently, a constant decline in factor productivity has been noticed in recent past, which is as an indicator of non-sustainability of agricultural production system. The concept of soil health includes ecological attributes of the soil which are chiefly those associated with soil biota, diversity, its food web structure, activity and the range of functions it performs. Soil health deals with both inherent and dynamic soil quality. A healthy soil will be balanced for all the components. Continuous cultivation and intensive cropping have resulted in loss due to soil erosion, decrease in soil organic matter and a concomitant release of carbon as CO$_2$ in the atmosphere.

India’s share in soil resources of the world is only 2% on which about 17% of global human population and 16% of world’s livestock survive. However, with its diverse agro-climate, topography and soil types, India is capable of producing a wide range of crops and vegetation. Soil related constraints are especially severe in arid, semi-arid and hilly regions. Important constraints are viz. low fertility and nutrients depletion, multi-nutrient deficiencies, physical degradation, and accelerated soil erosion. Apart from inherent constraints, there are several human induced constraints, particularly in intensively cropped areas. Fast shrinking soil resource to perform the critical functions of entire life support is undergoing unabated degradation of different kinds of deterioration due to pollution and nutritional disorders. Vast fertile lands in the canal irrigated areas are afflicted by soil salinity, Sodicity and water logging thereby rendering unsustainability in agriculture. There is practically no possibility of horizontal expansion of fertile arable land. Under above paradoxical situation, Indian agriculture has to face a very formidable task of achieving the target of doubling food grain production by 2022 without any detrimental effect on soil health. Nutrient monitoring in different production systems under different agro-ecological situations and timely employment of corrective measures to maintain good soil health for sustainable productivity.
Studies on genetic divergence in vegetable Amaranth 
(Amaranthus tricolor L.) genotypes

N. Tejaswini, K. Ravinder Reddy, P. Saidaiah and T. Ramesh
SKLTSHU, India

Presence of wide genetic diversity among the genotypes was revealed by Mahalanobis $D^2$ analysis. The genetic divergence was studied among a set of twenty seven genotypes of vegetable amaranth (Amaranthus tricolor L.) for nineteen characters. The lines/varieties differed significantly for all the characters. By using $D^2$ analysis, the twenty seven strains were grouped into four clusters. The intra cluster $D^2$ values ranged from 118.23 to 150.62. Cluster IV had the maximum $D^2$ value (150.62). Highest inter cluster generalized distance (268.51) was observed between cluster III and cluster IV. Hence, the crossing between the types of these two clusters may result in the development of useful progenies. The characters, which are contributing maximum towards divergence, were total foliage yield per plant contributed maximum (30.20%) towards divergence by 106 times followed by folic acid (15.10%) by 53 times, whereas carotenoids (0.28%) by one time, protein content (1.99%) by 7 times, moisture content (1.99%) by 7 times and moisture content (1.99%) by 7 times had minimum contribution towards divergence.
Quality and storability of guava cv. (Khaja) as influenced by packaging materials

Nagaraju. S* and A.K.Banik
Department of Post-Harvest Technology of Horticulture Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, India

Guava (Psidium guajava L.), having 2n=22, belongs to the family Description Myrtaceae and is native of Mexico. Guava has limited storage potential at ambient conditions, which leads to glut in market and poor return to the growers. Moreover, overripe fruit at ambient conditions lead to lot of wastage and economic losses. Postharvest losses can be minimized by adopting proper postharvest handling practices and better understanding of biochemical control of fruit ripening. Postharvest life of fruits and vegetables can be extended by using LDPE. LDPE films are commonly used to minimize weight loss, reduce abrasion, damage and delay fruit ripening. The experiment on “Quality and storability of guava cv. (Khaja) as influenced by packaging materials” was conducted during the period of December 2015 - January 2016 in the department of Post-Harvest Technology of Horticultural Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Nadia, to study the effect of treatments on quality of guava fruits. The cultivar of guava (Khaja) was harvested at mature but unripe stage. The guava fruit was packed in different microns of LDPE packages (25µ LDPE, 50µ LDPE, 75µ LDPE and 100µ LDPE) placed in ambient condition whereas control was without packaging. All treatments were kept in ambient condition. The fruits were examined for physiological loss in weight (PLW), shelf-life, and organoleptic quality. While biochemical parameters viz., TSS, Titrable acidity, TSS: Acid ratio, reducing sugars, total sugars and ascorbic acid were examined, the results revealed that fruits cv. Khaja packed in 75µ LDPE followed by 100µ LDPE under ambient condition proved to be the best treatments among all the treatments which not only extended the shelf life and increased marketable fruits but also reduced the post –harvest losses without adversely affecting the fruit quality of guava. These treatments are found obviously easy for practical application for extending the shelf life of guava.
Engineering salinity tolerance in *Brassica juncea*: Tailoring genes to unlock the future

Neelam P Negi* and Neera Bhalla Sarin
University Institute of Biotechnology, India

The development of environment-sturdy crops that are able to withstand abiotic stress is the need of the hour, to ensure food security to the growing population. Amongst the various environmental stresses, salinity is the major factor limiting plant growth and productivity world-wide. Due to exposure to excess salt stress, plants tend to accumulate reactive oxygen species (ROS) in their cells affecting plant growth and production. To achieve that, there must be a very intricate signalling network that needs to be explored, to develop crop varieties capable of growing in changing environmental conditions. The antioxidant metabolism protects cells from oxidative damage caused by ROS, such as peroxidation of membrane compounds, polysaccharide degradation, enzyme denaturation and DNA lesions. In the present study, we have utilised forward genetics approach to identify various components of signalling pathway in response to drought stress in highly important oilseed crop Indian mustard (*Brassica juncea*). The salt tolerant (ST) cell lines of Arachis hypogaea, stably thriving at 200mM NaCl were developed using multistep selection procedure. The ST cells showed higher transcript level of the antioxidant enzymes, ascorbate peroxidase and superoxide dismutase under multiple abiotic stresses, including drought, salinity, cold, and oxidative stress treatment. A cDNA library of *Arachis hypogaea* was used for isolating the gene for these antioxidant enzymes. A functional role of antioxidant enzymes in alleviation of abiotic stress was further exploited through its overexpression. Compared with wild type plants, transgenic plants survived under longer period of water deficiency and displayed improved recovery after rehydration. The enhanced levels of antioxidant enzymes in the transgenic plants correlated with higher relative water content, improved photosynthetic efficiency, less electrolyte damage, elevated accumulation of compatible osmolytes, less malondialdehyde as well as H$_2$O$_2$ accumulation and O$_2$- accumulation under stress conditions compared to untransformed wild-type controls. Our results substantiate that by overexpression of antioxidant enzymes play an important role in ameliorating oxidative injury induced by salinity stress.
Exploitation of medicinal properties of papaya leaf in preparation of ready to serve beverages

PC Sharma*, Anil Kumar Verma and Manoj Kumar
Department of Food Science and Technology, College of Horticulture and Forestry
Dr. Y. S. Parmar University of Horticulture and Forestry, India

Papaya leaf juice extract is known to improve the platelet counts in dengue fever patients due to presence of various bioactive components. In order to utilize this property of papaya leaves, efforts were made to optimize method for papaya juice extraction and preparation of papaya juice based beverages. Papaya leaf juice extracted by using different techniques viz. T1 Cold juice extract, T2 Hot juice extract, T3 hot juice extract with 10% water, T4 hot juice extract with 20% water and T5 hot juice extract with 30% water was analyzed for different chemical characteristics. It was observed that TSS of extracted juice varied between 2.2 – 5.54, Titratable acidity 0.02-0.06%, pH 6.8- 7.2, phenol 2.24- 2.47 mg GAE/ml extract, chlorophyll 0.057-0.214 mg/ml extract, Reducing sugar 2.98- 4.91 mg/ml extract, total sugar 3.75-4.97 mg/ml extract and ascorbic acid 0.47-0.86 mg/100ml. Further, the extracted papaya leaf juice was evaluated for different sensory parameter like color, flavour, taste, consistency and overall acceptability. Among these treatment, the T3 papaya leaf juice extracted by using hot extraction method after diluting with 10% water was adjudged the best with respect to sensory characteristics and this juice was used for preparation of papaya leaf juice based nectars. Out of different combination juice viz, 100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100% of mango pulp and papaya leaf juice, the combination of 70-30% (mango pulp and papaya leaf juice) was found to be best for preparation of nectar. Chemically, the nectar contained 15°B TSS, 0.3% acidity, 149.55 antioxidant activity, 68.2 mg/ml reducing sugar, 130.6 mg/ml total sugar and 1.07mgGAE/ml total phenol. Thus, papaya leaf juice can be utilized for preparation of papaya juice based mango nectar for its regular consumption as a health promoting beverage. Among these 50% papaya leaf juice and 50% mango pulp was found best with respect to sensory attributes (colour, appearance, taste and overall acceptability). The product can be developed successfully using these optimized condition. Since the both papaya leaf extract and mango pulp have beneficial nutritional and medicinal properties, the development of nectar using these with high sensory acceptance can be prove a boon market promoting health foods.
Effect of pre-treatments on quality attributes of solar dehydrated grape Pomace

P. Mamatha¹*, K. Vanajalatha¹, Veena Joshi¹ and S. Narender Reddy²
1. Department of Fruit Science, College of Horticulture, SKLTSHU, India
2. Department of Crop Physiology, College of Agriculture, PJTSAU, India

The focus of this research was to analyze the physico-chemical and nutritional quality of a solar dried grape Pomace as affected by eight chemical pre-treatments. Based on preliminary tests, grape Pomace was dipped in 1% (w/v) Calcium chloride (T1), 1% (w/v) Citric acid (T2), 1% (w/v) Potassium metabisulfite (T3), 2% (w/v) Sodium chloride (T4) independently and 1% (w/v) Citric acid along with 0.5% (w/v) potassium metabisulfite (T5), 1% (w/v) Calcium chloride along with 0.5% (w/v) citric acid (T6) and 1% (w/v) Potassium metabisulphite along with 1% (w/v) calcium chloride (T7), and in water solution (T8) for 5 minutes. Quality characteristics of dehydrated grape Pomace viz. moisture content, TSS, sugars, Titratable acidity, total polyphenol and anthocyanin content, recovery %, dehydration ratio, rehydration and reconstitute ability ratio as affected by pretreatment process were studied. The results expressed that the dehydrated grape Pomace pre-treated with 1% (w/v) Potassium metabisulphite along with 1% (w/v) calcium chloride (T7) had recorded highest recovery per cent (26.32), rehydration ratio (1.57), reconstitute ability ratio (0.41), TSS (8.69°B), reducing sugars (12.84%), total sugars (16.63%), minimum acidity (0.66%) and lowest dehydration ratio (3.79), with preferred moisture content (5.60%) followed by 1% (w/v) Citric acid along with 0.5% (w/v) potassium metabisulphite (T5). Higher content of total polyphenols (17.21mg/100g) and anthocyanin (62.08mg/100g) were recorded in 1% (w/v) Citric acid along with 0.5% (w/v) potassium metabisulphite (T5).
The production and marketing strategy of the organic farmers

P. Sumathi
Department of Commerce, Government Arts College, India

Agriculture is the backbone of all the developed and developing economy. Particularly in the country like India, which is basically an agricultural country and having a large number of agricultural labourers? In the past all the products are grown organically in India but later on after the introduction of green revolution excess usage of chemical pesticides and fertilizers are used to increase the productivity which in turn lead to the infertility of the soil and also results in the more number of health issues to the people. The investigation is based on the work with formers applying for support or implementing business plans under a measure of the national rural development programme for setting up holdings young formers. In addition a set of criteria for assessment of organic sector market development in the country, the study poses and discuss some important issues on the organic form profitability and the influence of the Indian and the state support. In the process of the study some conclusion were made concerning the important as motivation issue and marketing planning in the production.
Geospatial technologies in sustainable agriculture and food security

P.D. Sreekanth  
ICAR-National Academy of Agricultural Research Management, India

There is a major deficit between the measure of nourishment we produce today and the sum expected to encourage everybody in 2050. There will be about 9 billion individuals on Earth by 2050. The demand for food will be 70% greater than it is today. Which requires 120% more water and 42% more cropland to feed 9 billion population by 2050. However, at the same time declining natural resources and climate change will make it more difficult to meet the food security target. To meet such a prerequisite, it has become extremely important to continuously monitor various vegetation indices and post monsoons surface water over time at different spatial scales, it can be possible by using geospatial technologies. Satellite-based remote sensing has been widely used over the past several years for monitoring various vegetation indices and surface water levels at village to global-scale.

The primary target of the analysis was to discover the status of vegetation at micro level and it assumes a significant role to help policy makers as a decision support feature. Satellite derived data sets have been used to study the time series trend of NDVI (Normalized Difference Vegetation Index), NDWI (Normalized Difference Water Index) and NDDI (Normalized Difference Drought Index) for Tallasingaram village, Nalgonda district, Telangana state. The study uses Landsat 8 with 30m resolution 8 days interval images from 2013-2018. The results show that, a temporal curve that summarizes the different stages that green vegetation undergoes during a complete developing season. This data assists the policy and decision makers to evaluate performance of vegetation growth at micro level, in turn assess the crop insurance claims by the farmers. Enhanced Vegetation Index (EVI) was additionally analyzed as an elective vegetation record to address a portion of the constraints of the NDVI. These remote sensing technologies also give a huge measure of information at various spatial, spectral, and temporal resolutions for detecting and extracting surface water using efficient water indexes such as Normalized Difference Water Index (NDWI) and the modified Normalized Difference Water Index (mNDWI). Characterization of surface water dynamics is necessary for studying ecological, hydrological processes and agricultural planning. In this study uses 30m resolution Landsat 5, 7 and 8 top-of-atmosphere (TOA) reflectance 16 days collection was used to study the time series trend of surface water from 2013 to 2018 for Telangana state. The surface water estimation results were compared with post monsoon rainfall and ground water levels.
Effect rainfall on productivity of cotton

Pandya P. A., Patel R. J. and Mashru H. H.
College of Agricultural Engineering and Technology, Junagadh Agricultural University, India

Rain-fed agriculture has a prominent role to play in India’s agriculture and economy. Therefore, study of rainfall and its effect on crop yield is very useful for crop planning for rain-fed cash crop like cotton not only for farmers but also for policy makers. A study was conducted to evaluate rainfall variability and its effect on Cotton yield for Junagadh district considering 20 years data (1997 to 2016) by correlation & regression analysis and rainfall departure on regional scale as per IMD for seasonal monthly, fortnightly and weekly rainfall.

Arithmetic mean, standard deviation and coefficient of variation for seasonal rainfall was found as 982 mm, 349 mm and 36 % respectively. July month contributes about 40% of the total seasonal rainfall. The contribution of 1st fortnight (1F) (28 May-10 June) and 10F (1 October- 14 October) is least (2-3%) in total seasonal rainfall with highest CV% 152-153. The highest average rainfall was 200 mm in 5F which contributes about 20% of the seasonal rainfall with lowest CV 67%. If cotton crop critical stage falls under 5F, then it may result in high production as compare to other fortnights. Correlation coefficient between seasonal rainfall and yield was 0.66, while it was highest as 0.46 for September and lowest as 0.15 for August. For fortnightly rainfall, the highest correlation coefficient was founded as 0.64 for 5F and negative -0.27 for 1F. 31st Standard Meteorological Week (SMW) has highest positive correlation 0.65. SMW 34 had highest negative correlation coefficient as -0.35%. Seven years have recorded excess rainfall with yield 875 kg/ha, which was 31% higher than average 666 kg/ha. Excess rainfall in 1F and 7F resulted less than average yield. When no rainfall occurred in week no. 22 to 25 and 39 to 41, higher average yield were observed. The regression analysis revealed that predictability for seasonal, monthly and fortnightly rainfall was 43%, 55% and 84% respectively, while it was 0.96 for weekly rainfall which is 53%, 41 and 13% higher as compare to seasonal monthly and fortnightly rainfall.
Biorational management of major insect pest of safflower

Pragati Tangle, Lalsingh Rathod and P. N. Mane
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, India

An experiment was conducted during the Rabi 2016-17 at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to work out the effective Biorational management of Gujhia weevil, Tanymecus indicus, Aphids, Uroleucon Compositae Throb and capsule borer, Helicoverpa armigera of safflower, Carthamus tinctorius L. Based on the behaviour of Gujhia weevil, Aphids and capsule borer and their infestation different phenological stage of the crop, total nine treatments were tested in Randomised Block Design, replicated thrice.

Mean data revealed that, lowest plant population reduction 1.34 per cent, plant damage per hill 35.11% at 5 days after emergence and lowest plant damage 14.15 per cent at seedling stage due to Gujhia weevil was recorded from normal seed rate + Phorate 10 % G @ 10 kg/ha (at the time of sowing). Next best treatments was higher seed rate (15 % ) followed by thinning of damaged plants recording 3.49 per cent reduction in plant population, 43.89 per cent plant damage per hill and 23.93 per cent plant damage. Treatment comprised foliar spraying of Quinalphos 25 EC @ 2 ml/l at 40 DAS recorded minimum 9.19, 9.67 and 9.59 aphids per 5 cm apical twig/plant at stem elongation to branching stage of crop followed by Acephate 75 SP @ 1.6 g/l at 40 DAS recorded 10.39, 11.92 and 12.86 aphids per 5 cm apical twig/plant and Dimethoate 30 EC @ 1 ml/l at 40 DAS recorded 13.04 aphids per 5 cm apical twig/plant. All these were found at par. Minimum capsule borer population 0.16 larvae/plant was recorded from foliar spray of Dimethoate 30 EC @ 1 ml/l at 40 DAS + 2nd spraying of Chloropyrifos 20 EC @ 2.5 ml/lit of water at 70 DAS at capsule development stage. The next effective treatment was normal foliar spray of Verticillium lecanii 2×108 CFU/ml @ 5g/l at 40 DAS and foliar spray of Quinalphos 25 EC @ 2 ml/l at 40 DAS + 2nd spray with Beauveria bassiana 2×10⁸ CFU/ml @ 5g/l at 70 DAS 0.47 larvae/plant. Higher seed yield 1542 kg/ha was recorded from foliar spray of Quinalphos 25 EC @ 2 ml/l at 40 DAS + Beauveria bassiana 2×10⁸ CFU/ml @ 5g/l at 70 DAS.
Study of heat tolerance in Tomato (Solanum lycopersicum L.)

Priyanka T* and Saidaiah P  
Department of Vegetable Science, Sri Konda Laxman Telangana State Horticultural University, India

Heat tolerance is one of the major aspects to be considered in improvement program of any crop because of increasing temperatures day by day. A field experiment was conducted in the year summer, 2018 and Kharif, 2018 at P.G. research farm, College of Horticulture, Rajendranagar, Hyderabad in randomized block design with three replications using twenty three genotypes of tomato. The varieties varied in their production potential, growth characters under heat stress conditions. The result of mean performance of twenty three genotypes for twenty four characters revealed that the AVTO 1002 was the superior for fruit yield per plant (1.96 kg). The genotype AVTO 9803 was found to be early as observed from the character days to first flowering (27.63) and days to 50 per cent flowering (35.70) and it has low percentage of stigma exertion (14.00%) and pollen sterility (19.45%). The genotype EC 520078 was superior for plant height (181.23 cm), days to last harvest (126.03), number of fruits per plant (280.83). Therefore, the three genotypes AVTO 9803, AVTO 1002 and EC 520078 performed better under heat stress conditions.
Genetic Variability and Character Association study of Yield and 
Yield Related Components in Lentil (*Lens culinaris Medik*)

Riya Mondal and S.Kundagrami  
University of Calcutta, India

Lentil is one of the most important grain legumes and important source of dietary protein can be a good choice for people of developing countries where population is increasing at an alarming rate. Keeping this point in view, the main objective of present research work was to assess the genetic divergence for yield and yield contributing characters among fifty lentil genotypes. The analysis of variance revealed high significant difference for all traits that indicating variation among these characters would be best for phenotypic selection. High GCV for seed yield per plant and high PCV for harvest index (37.72, 43.28 respectively) were estimated. Considering all the parameters it was observed that the characters namely Seed yield per plant, Pods per plant, Harvest Index, 100 Seed weight have consistently shown high magnitude of Heritability (93.42%) and Genetic Advance as percent (72.59) of mean. Correlation study revealed that Plant height, pods per plant, seeds per pod and 100 seed weight were positively correlated with seed yield per plant. Among these traits pods per plant and seeds per pods were significantly correlated. The result showed that genotypic correlation was higher than phenotypic correlation indicating strong association between traits. Path coefficient analysis revealed that branches per plant, pods per plant, seeds per pod, 100 seed weight, and harvest index had positive direct effect on seed yield per plant, indicating that they are the main contributors to yield. The residual effect (0.5016) indicating that contribution of inherent character was almost half. Hence the findings of present research suggest that more emphasis should be given on traits while executing selection for genetic improvement of seed yield in Lentil.
Mungbean [Vigna radiata (L.) Wilczek] is the important and inexpensive protein rich pulse crop of Indian origin referred as poor man's meat. Bruchids (Callosobruchus maculatus) (Coleoptera: Bruchidae) are the major polyphagous storage pest. It causes deterioration of the quality and quantity of mungbean seeds which directly affect from farmers agriculture to commercial economy as well as the human health. As the storage problem due to bruchid infestation is one of the major constraints for mungbean production. Therefore, this problem must be sorted out. Secondary metabolites particularly the antinutritional factors create some obstacle to nutritional utilization in human life. In view of this fact, we aim to screen the bruchid susceptible and resistant mungbean genotypes and establish their relationship with secondary metabolites. Fifty-two mungbean genotypes were infested with two pairs of male and female bruchids into B.O.D condition for maintain the humidity and temperature. Four resistant and ten bruchid susceptible mungbean genotypes were recorded as per the bruchid susceptibility index (BSI) by Dobie, 1974. Then, assessed the secondary metabolites of resistant and susceptible mungbean genotypes. A negative relationship recorded between the anti-nutritional factors and the BSI and revealed that higher content of secondary metabolites observed in the resistant genotype. So, it will be hypothesized as presence of higher amount secondary metabolites defenses the intensity of bruchid.
The present study was undertaken on cows with reproductive disorders like repeat breeding and anoestrous to identify the Uridine-5 Monophosphate Synthase (UMPS) genetic disorder by Polymerase Chain Reaction (PCR) - Restriction Fragment Length Polymorphism (RFLP) in Cytogenetic Investigation Laboratory of Department of Animal Genetics and Breeding at Bombay Veterinary College. Total 102 animals’ blood samples were collected which were subjected to PCR amplification. The UMPS gene amplified PCR products were digested by using Ava I restriction enzyme at 37°C for 4 hours. The final PCR product was electrophoresed on 2 % agarose after digestion. The amplified PCR product size was 108 base pair digested by Ava I yielded three bands of 53, 36 and 19 base pair (bp) respectively for wild animals, but due to less size of 19 bp, it was not visible in RFLP. It was found that all the selected animals for the research had shown normal results. As per the previous studies, it is suggested that there is a possibility of mutant gene which is directly related to the reproductive performance of Indian cattle. Therefore, it is important to screen the animals to avoid the increase in the disease prevalence.
Effect of feeding bypass fat and bypass protein on rumen parameters of local goats

Nagpur Veterinary College, India

Goats are the lifeline of millions of small / marginal farmers / landless labours in India. This prominence has been linked with a multiple features special to this species, vast distribution across all complex agro-ecological environment, functional contribution (meat, milk, wool, skins, and manure) and socio-economic relevance (social security, income generation and human nutrition). Even if management, breeding, feeding, disease prevention and control are the requisite tools to secure optimum production from goats, feeding devote the most. Nutritional imbalances generate poor production, reproduction or reproductive failures. Keeping in view that proper feeding is mandatory for maximum exploitation of the genetic potential, twenty four local goats were used to study rumen fermentation characteristics as affected by feeding concentrate mixture supplemented with bypass fat and bypass protein. Local goats were divided into four equal groups. Group T0 was fed with concentrate mixture + green and dry roughage, Group T1 was fed with concentrate mixture + green + dry roughage supplemented with bypass protein @ 2.5 per cent of dry matter intake, Group T2 was fed with concentrate mixture + green + dry roughage supplemented with bypass fat @ 2.5 per cent of dry matter intake, Group T3 was fed with concentrate mixture + green + dry roughage supplemented with bypass protein and bypass fat in combination each @ 2.5 per cent of dry matter intake. It was found that NH3-N concentration differ significantly amongst the treatment groups whereas other ruminal parameters like pH, TVFA, Total Nitrogen, TCA-precipitated-N and NPN were not affected significantly. It was concluded that feeding concentrate mixture supplemented with bypass fat and bypass protein @ 2.5 per cent of dry matter intake separately and in combination had no adverse effect on the rumen fermentation pattern of local goats.
Siddhartha Mehrotra*, Alok Kumar Krishna and Alka Srivastava
CSIR –Central Institute of Medicinal and Aromatic Plants, India

The Cymbopogon flexuosus also known as Malabar grass or Cochin grass is well known for its reputation in traditional medicinal system as analgesic, ant-diabetic, aphrodisiac & to some extent ant carcinogenic phytogenic medicine and for the production of secondary metabolites used in various industries such as pharmaceuticals, food, perfumery & others. The morphological, cytogenetical and physicochemical study was conducted on lemongrass grown by farmers in the semi-arid region of Bundelkhand. The morphological characters such as plant appearance, plant height, leaf size, leaf colour, stem colour were recorded. The cytogenetical studies demonstrated the variability in ploidy level ranging from diploid (2n=20) to tetraploid level (2n=40). The physicochemical studies had established the fact as Citral and Geranial as predominant phytochemicals. Furthermore, root plantlets cultivated through tissue culture and their acclimatization, transplantation and maintenance under field conditions are matter of further investigations.

Lab and land assessment of Cymbopogon (lemongrass) for the emerging concept of Sustainable Development
Soumya Ranjan Purohit  
*Department of Food Technology, Vignan’s Foundation for Science Technology and Research, India*

Among biofuels alternative, bioethanol is considered to be the most viable option, and the government is targeting to enhance proportion of ethanol blending in regular fuel up to 20% by 2030, which is currently falling in the range of 2-3%. Since more than a decade, India is targeting for 20% blending program, however, limited water resource to grow sugar cane is the most challenging issue. Although India is in the list of top ethanol producers in recent years (8, 76, 000 MT in 2017), it lags far behind, the US (4, 47, 55, 000 MT) and Brazil (2, 10, 86, 000 MT) (U.S. Energy Information Administration). Currently, India’s ethanol production depends on sugarcane crop. Seeing the surplus of sugar, recently government has also encouraged distilleries to divert sugarcane directly for bioethanol fermentation. However, water foot print for sugarcane is significantly high. Production of 1 Kg of sugarcane requires 2000 L water. U.S and Brazil have 2,818 billion Cubic metres (BCM) and 5,661 BCM/year of water respectively, India has only 1,446 BCM per year, as per FAO (Food and Agriculture Organization of the United Nations) for 2013-17. For Brazil, which uses both an ethanol-petrol blend and just ethanol as fuel, the overall blend rate is 45-50%. India’s surface and ground water requirement will hugely exceed that of Brazil if India were to achieve its targeted 20% blend rate. In other words, while Brazil used 0.025% of its internal surface and ground water for ethanol production to achieve a 45% overall blend rate in 2017, India would use 0.701% even for 20%.

Apart from water resource, area of cultivation for sugarcane is accounts for 3% of total crop cultivation area. To achieve petrol-ethanol blending rate to even 10%, India need to divert another 4% of total crop cultivation area for sugarcane cultivation. This will create threat for both water resources and food security. Further, to attain 20% blending of ethanol and petrol, approximately one-tenth of the existing net cultivation area need to be diverted for sugarcane production. In one hand, water resources will deplete significantly, which can affect other crop cultivation as well. On the other hand, diversion of regular cultivation practice will lead to increased food grain price.

**Sorghum: Sustainable feedstock for bioethanol with lower water foot print**
During the course of two-staged evolution, present day tomato has gotten rid of many of the disease resistant genes. The tomatoes are sensitive to a group of viruses, called Tomato Leaf curl viruses (ToLCV) in generic terms, the New Delhi (ND) form, i.e., ToLCNDV being the most devastating amongst them. Many commercial tomato lines which are ingressed with Ty elements, derived from wild tomatoes, show partial resistance to a few ToLCVs but not all. Hence there is a scope to engineer durable and broad-spectrum virus resistance in tomato. The genomes of ToLCVs encode few proteins only (say about 6) and also code for at least three pathogenic factors (namely, C4, C2, V1 etc.) with RNAi-suppression activities. We designed tomato plants that are endowed with production of small RNAs to silence these viral encoded RNAi factors. A few of these designer tomato plants show immunity-level resistance to ToLCVs.

They aligned most of the Indian ToLCV accessions to reveal the conserved regions of each of three suppressors, namely, C4/AC4, C2/AC2 and V1/AV1. Each of the common regions is a part of at least two overlapping viral ORFs. For example, the conserved C4/AC4 region is also a part of a very important protein of the virus Rep (or C1/AC1), responsible for viral rolling circle DNA replication. From each of the conserved regions, we chose a segment of 21 nucleotides having minimal off-target effects. The small RNAs were expressed as artificial microRNAs in tomato using the pre-miR backbones of anyone of ath-mir-319a, sly-mir-159a and sly-mir-168a vectors. Three different types of transgenics were thus made and those expressing the artificial microRNAs were selected for advancing the generations and for their abilities to withstand the pressure of the challenge viruses (ToLCV). Data presented will reveal that a few of the transgenics were extremely tolerant of the challenge ToLCVs while the challenged non-transgenics were highly susceptible.

Besides the artificial miRNAs, we also designed another novel pathway for virus resistance. The constructions of vectors like harpin or artificial miRs often involve difficult recombinant steps for expression of small RNAs like si- or miRNA in plants. So we have developed a novel vector enabling production of siRNAs (technically called artificial tasi-RNAs), when the sequence of interest is directly cloned in the vector. The author confirmed the production of phased small RNAs by sequencing the small RNAs derived from the plant transiently agro-infiltrated with the recombinant vector.
Economic advances in Agriculture, Food security and nutrition:
India 2020

Suresh S. Patil¹* and Yasmeen²
¹Dean (Agri.), College of Agriculture, Kalaburgi, University of Agricultural Sciences (UAS), India
²Research Consultant, Institute of Social and Economic Change (ISEC), India

The concept of food security has experienced significant variations in recent years. Food availability and stability were considered as good indices of food security till the seventies while the achievement of self-sufficiency was accorded high priority in the food policies of developing countries. However, India achieved success in combating transient food insecurity caused by droughts or floods; it miserably failed to make much dent in chronic food insecurity as reflected in the low energy intake and high incidences of malnutrition. While, the overall improvement in nutritional status has also been very slow. There is a chronic under-nourishment in about half of the population, particularly among the vulnerable groups of children, women and elderly from the lower half of the expenditure class. Curiously, the proportion of consumption expenditure spent on food is slowly going down even in the households with chronic under-nourishment. The mounting of food stocks miserably failed to banish mass under-nourishment. Further, the current growth rate would significantly reduce income poverty by 2020; the chronic food insecurity is likely to persist. Moreover, with the recent shift to a more market-oriented and outward-looking macro-policies, the poor are likely to be exposed to the resultant risk of market uncertainties. As a result several types of programmes need to be targeted exclusively to the poor aimed to (i) eliminating transient food insecurity on account of inadequate access to food in periods of crises (ii) reducing chronic food insecurity by enhancing their capabilities to participate in the growth process (iii) reducing malnutrition among pre-school children and women and (iv) improving basic services (safe drinking water, health care etc.) to the poor. The portfolio of poverty alleviation programmes (PAP) should be contextual and suit the specific needs of the poor communities. Socially excluded groups are highly heterogeneous and, therefore, poverty reducing effects of any intervention based on a uniform package of programmes would be weak. Improvement in food consumption is a necessary but not a sufficient condition for overcoming the problem of malnutrition in India. Apart from inadequate food consumption, the other important causes of malnutrition are high incidence of gastrointestinal and respiratory infections and behavioral factors such as faulty child feeding and weaning practices, all of which contribute to the low absorption of nutrients from the food consumed.
Banana fruits harvested at 85% maturity stage were collected from farmer’s field were exposed to different ethylene concentrations (50 ppm, 75 ppm, 100 ppm and 125 ppm) along with different number of pulsings (6 pulsings in 24 hours @ 4 hrs. interval, 4 pulsings in 24 hours @ 6 hrs. interval, 2 pulsings in 24 hours @ 12 hrs. interval, 1 pulsing in 24 hours @ 24 hrs. interval.) in low cost ripening chamber. The increasing trend was observed in physiological loss in weight (PLW%), pulp to peel ratio, fruit color score. Whereas decreasing trend was observed in fruit firmness, peel thickness and DA meter reading. Among all the different treatments ethylene @ 100 ppm with 2 pulsings in 24 hours @ 12 hrs. Interval resulted best.
Two experiments were conducted to examine the effects of feeding cotton seed meal (CSM) and distillery dried grains with solubles of rice (DDGS) as a replacement for soybean meal on performance of broilers. In both experiments total of 936 day-old male broiler chicks were randomly distributed into four dietary treatments with 13 floor pens (replicates) with 18 birds in each. In experiment 1, corn soybean meal diet was prepared for starter and finisher phases (control) and other three iso caloric and iso nitrogenous diets were prepared by incorporating two variants (36 and 40% CP) of CSM or DDGS at 15%. In experiment 2, 4 is nitrogenous and isocaloric diets were prepared in which DDGS was incorporated at 0, 5, 10 and 15%. All the diets were in pellet form and fed ad libitum from 1d to 42 and 35 d of age, respectively in experiment 1 and 2. Results of experiment showed that the performance (weight gain, feed intake and feed efficiency) of broilers was not affected by incorporation of both variants of CSM. Inclusion of DDGS (15%) significantly reduced the performance. Therefore, the second experiment was conducted to know the optimum inclusion level of DDGS in broiler diet. The results suggested Inclusion of DDGS up to 10% did not affect body weight and feed efficiency, while these performance variables were significantly depressed at 15% DDGS in diet. The data from these experiments suggested that CSM can be included up to 15%, while DDGS from rice up to 10% in broiler diet without affecting their performance.
Internet of things (IoT) in the field of Agriculture and Animal Husbandry

Yuvaraju Chinnam, Vamsi Vemula and Goutam C.Nischay
Amrita Sai Institute of Science and Technology, India

Internet of Things, (IoT) has taken the globe by storm. It has gained a lot of popularity among home automation, fitness and health, logistics and automotive, industrial IoT and even in smart cities. It is absolutely important to see the IoT application in the field of agriculture, where uncertainty is the driving factor. The objective of the study is to expose the importance of the application of IoT in Agriculture and Animal husbandry, in short could be named as (AgoT) “Agriculture of Things”.

Smart and efficient agricultural practices are required to meet the global food needs, where by 2050 approximately the world population requires about five times the present production to suffice minimum food needs. This is also similar in case of livestock, as demand for animal food products are also escalating. This can be moderated if and only if we make use of available voluminous, dynamic and real time data for taking most efficient decisions for the management of natural resources and agricultural development (AgoT).

Smart agriculture and livestock management is driving towards a modern aspect with the solution of IoT. The implementation of IoT would make the life of farmers easier. This AgoT uses sensors to collect the information of all the processes involved like “Climatic impacts on crops” and rejuvenating through proper water supply, fertilizer requirements and all the other required information could be collected, analysed and managed for agricultural practices through Big data analytics. Proper “Crop management” can also be achieved by precision farming. “AgoT” collect the specific information that is related to the farming of crop such as precipitation, crop health, water lead potential, etc. This collected data helps the farmers to improve their process. Hence, it is easier to monitor the growth of crop and anomalies in order to take preventive measures for infestation on time. “End-to-End Farm Management” where certain field operations are under control of the processors of AgoT, so that the specific field operations can be monitored and performed simultaneously like sprinkling of water for irrigation. Storage management and logistic services are also included in AgoT. “Cattle Management and Monitoring”, this system is similar to crop monitoring which works on the sensors. hardware, maintenance and infrastructure.
Bimal Prasanna Mohanty  
*ICAR - Central Inland Fisheries Research Institute, Kolkata-700120, INDIA*

**NUTRIFISHINDIA and NutriFishIN Database – Important steps towards global food and nutritional security**

NUTRIFISHINDIA is a concept that started from the ICAR- Fisheries Science Division as an Outreach in a consortium-mode as a multi-institutional, multi-disciplinary program with the objective of studying complete nutritional composition of important food fishes from India, from varying habitats across the country. Nutritional composition of > 100 food fishes was studied and the food data generated were used to develop the open-access database NutriFishIN (NutriFishINDIA, http://www.cifri.res.in/nutrifishin). NutriFishIN has been a hugely popular and successful program and has drawn global attention. The NutriFish1000 program that is a joint initiative of the World Bank Group and FAO - United Nations Standing Committee on Nutrition (UNSCN), launched on the World Food Day 2018, could be taken as a success indicator for the NutriFishIN program; besides its inclusion and highlight in the World Food Day (16 October 2018) Special article collection by Elsevier.

Fish is a 'Health-Food' and rich in quality animal proteins and essential amino acids, heart-healthy and brain-healthy omega-3 polyunsaturated fatty acids EPA and DHA (especially the marine and cold water fish) and micronutrients (especially the small indigenous fishes, SIFs). NutriFishIN database documents important food data and is accessible not only through the database and in-built knowledgebase, but also through the powerful and common Android mobile technology as the NutriFishApp. This approach has definitely influenced the consumers, nutritionists, physicians, Aquapreneurs and planners in India and the Indian subcontinent and further reached the world community through World Fish and World Bank. Such approaches could play an important role in fighting the global challenge of hunger and malnutrition and achieving the food and nutritional security. However, there is also need for quality improvement of the farmed fishes through introduction of functional feed ingredients (FFI), which are rich in bioactive compounds, such as dietary Fiber, omega-3 PUFAs, phenolic compounds including carotenoids, Phytosterol, Saponins, phytic acid, vitamins and minerals to enrich the quality of fish meat as only enhancing the quantum of production perhaps could not be enough to meet the exponentially growing demand.
A field investigation was carried out during (December - April) the year of 2015-16 to study the effect of integrated nutrient management on the yield of irrigated groundnut grown in sandy loam soil. Around seven ameliorative amendments used as INM sources in the experiment and the details of the treatments are T_1 - Control, T_2 – RDF 17:34:54 kg ha\(^{-1}\) + Gypsum@ 400 kg ha\(^{-1}\), T_3 - Vermicompost @ 6.25 t ha\(^{-1}\), T_4 – Rhizobium + Phosphobacteria @ 2Kg ha\(^{-1}\) as soil application, T_5 – T_2 + T_3, T_6 – T_2 + T_4 as soil application, T_7 – T_3 + T_4 as soil application, T_8 – T_2 + T_3 + T_4 as soil application. The results of the experiments revealed that application of RDF 17:34:54 kg ha\(^{-1}\) + Gypsum @ 400 kg ha\(^{-1}\) + Vermicompost @ 6.25 t ha\(^{-1}\) + Rhizobium + Phosphobacteria @ 2Kg ha\(^{-1}\) as soil application (T_8) enhanced the growth-promoting substances, availability of nutrients and eventually increased the growth components viz., LAI, DMP and number of nodules per plant which paves a way for increased nutrient uptake of N, P and K.
Livestock developmental programs have been implemented in Andhra Pradesh by Government NGOs and other private agencies with the ultimate aim of improving the livestock production and thereby the socio-economic condition of livestock farmers. Besides these efforts by various agencies, sustainability of the farm depends upon efficient management of dairy animals by the farmers which ultimately depends on the farmers’ socio-economic situation along with knowledge and attitude towards the recommended practices. Many studies revealed that disease out-breaks cause major losses to the dairy farmers and hence, preventive animal health care practices play major role in safeguarding the farmer against such losses. This has obvious implications for dairy farmers to raise the need for improved diagnosis and early detection of diseases along with greatly increased awareness and management competencies to deal with disease patterns and vaccination programmes that are manifestly changing. With this background, the study was undertaken in Andhra Pradesh state to know the level of specific health management competencies of dairy farmers. A sample of 240 dairy farmers were interviewed through pre-structured interview schedule. The results revealed that two third of respondents had medium level of specific health management competencies. Among the components of specific health management competencies, maintenance of animal health and well-being stands first followed by checking of animals for presence of external parasites. Thus concluded as increase the availability of milk to human population through scientific disease management of livestock.
Sorghum (*Sorghum bicolor* L. Moench) is one of the main staple foods for the world's poorest and most food insecure people across the semi-arid tropics. A study was conducted during *rabi*, 2016-17 and 2017-18 to develop crop weather relationships in sorghum at Department of Agricultural Meteorology, College of Agriculture, Pune. The experiment was laid out in split-plot design with four varieties. Results showed that, correlation analysis for sorghum variety Maldandi, from panicle initiation to flowering, maximum temperature (-0.962*) was significantly negatively correlated and morning relative humidity (0.965*) significantly positively correlated with grain yield. From flowering to physiological maturity, during 2017-18, maximum temperature (-957*) was significantly negatively correlated and morning relative humidity (0.937*) was significantly positively correlated with yield. For sorghum variety Phule Vasudha, from sowing to panicle initiation maximum temperature and minimum temperatures were negatively correlated with grain yield in both 2016-17 and 2017-18. From panicle initiation to flowering, maximum temperature and minimum temperatures were negatively correlated. From flowering to physiological maturity, during 2016-17 maximum temperature (-937*) was significantly negatively correlated with yield. For sorghum variety Phule Maulee, from sowing to panicle initiation no weather variable was significantly correlated with grain yield though, maximum temperature was negatively correlated with grain yield and remaining weather parameters were positively correlated with yields in 2016-17. During 2017-18, maximum temperature (-974*) was significantly negatively correlated and morning relative humidity (0.962*) was significantly positively correlated with yield. For sorghum variety Phule Chitra, from sowing to panicle initiation, maximum temperature and minimum temperature were negatively correlated with grain yield correlated with grain yield in 2016-17. During 2017-18, maximum temperature (-958*) was significantly negatively correlated with yield. Maximum temperature affected the yield of sorghum significantly. It might be due to acceleration of physiological responses of the crop due to high temperature. Regression equations were developed based on maximum temperature for estimation of grain yield.
Profile analysis of Marathwadi buffalo rearers

J. M. Deshmukh¹ and K. D. Bande²
1Department of Extension Education
2College of Agriculture, Latur (MS)

The present study was conducted in Latur district, in Marathwada region, of Maharashtra State with specific objective to study profile of Marathwadi buffalo rearers and also to know their constraints in rearing Marathwadi buffalo. From Latur district Ausa, Nilanga and Udgir tahsils were selected for study. From each tahsil, four villages were selected which were having the considerable population of Marathwadi buffalo and from each village ten respondents were selected. The results of the study portray that majority of the buffalo rearers under study were from medium level of farm experience. Most of them were educated in primary, having medium size of family, buffalo rearing+farming occupation, having medium herd size, medium annual income, having medium land holding, medium social participation, medium economic motivation and medium use of source of information The important constraints reported by buffalo rearer is constraint of availability of fodder throughout the year and also in the rainy season, shortage of grazing land.
Duck Farming: A Potential Source of Livelihood in haor People in Bangladesh

S. Parvez¹, M. Y. Miah¹ and M. M. H. Khan²

¹ Sylhet Agricultural University, Sylhet
² Sylhet Agricultural University, Sylhet

Small-scale duck production represents an important component of sustainable livelihood strategies for poor haor (water basin) communities in Bangladesh. Study conducted to investigate livelihood improvement of underprivileged people through duck rearing in haor area of Sylhet. Feeding systems and availability of feed for raising ducks, performance of scavenging ducks, profitability and livelihood improvement of underprivileged women through raising ducks were evaluated. Information was collected from the farmers through a questionnaire. Nine hundred day old ducklings were distributed among 18 poor haor farmers and each farmer received 50 ducklings. Feed supplement and vaccines were provided to ducklings and trained farmers on duck rearing. Body weight and body weight gain were improved significantly with the increasing levels of feed supplementation at 12 weeks. Net return per batch was 1924 BDT in 25g feed supplementation group at 12 weeks and yearly net profit was 6735 BDT by rearing of 50 ducklings. The result revealed that duck intervention improved haor farmer's source of income and significantly contributes to rural livelihoods.
Bacterial cell lysate for enhancing drought stress tolerance in coriander (Coriandrum sativum L) crop.

Akash L. Shinde, Utkarsh M. Bitla, Ajay. Sorty and Kamlesh K. Meena
ICAR-National Institute of Abiotic Stress Management, India

Coriander is an important crop among the spices with high marketability in the form of foliage as well as seeds. This crop is generally cultivated during winter season across the India. The coriander is considering one of the highly vulnerable to water deficit situations. Drought stress exposure leads to a drastic reduction in both foliage as well as seed yield due to overall growth and development of the plant is severely affected. Considering the commercial importance, and vulnerability of the coriander crop to drought stress, a strategy to mitigate the drought stress was designed and assessed under field conditions. The study included foliar application of the cell-lysate of plant growth promoting bacterial strains isolated from the phyllosphere of halophytic weed – Psoralea corylifolia L; and endolithetic methylotrophic bacteria. The bacterial cell were raised individually and an equal quantities (0.5 gm of fresh pellet) of pelleted cells of the individual stains were then mixed, and lysed to prepare the cell-lysate. Freshly prepared cell-lysate was then used for application in coriander crop (25ml/liter of water). The drought conditions were simulated by restricted-irrigation technique at vegetative, flowering, and seed-setting stages respectively. Influence of the cell-lysate under drought conditions was recorded in terms of various physico-chemical characters of the crop, where marked enhancement effect was noted in the treated plants, particularly with respect to content of chlorophyll, phenolic compounds, protein, and activity Antioxidant enzymes catalase, superoxide dismutase, and peroxidase. Significant increase in fresh and dry biomass, umbel and umblets number was also recorded. Overall foliar application of the cell-lysate of plant growth promoting bacteria in coriander crop appeared successfully alleviating the adverse effects of drought stress. Keen analysis is therefore needed to reveal the operative mechanisms of cell-lysate mediated drought stress alleviation, thus achieve sustainable farming of coriander in drought-prone areas.
Development of symbiotic relationship among Rhizobia and legume plants is well known. Rhizobia colonize leguminous plants; develop highly specialized structures – the root nodules. Genus Rhizobium are comprised by characteristic plant growth promoting traits including production of plant growth regulators, Siderophore, organic acids, ACC deaminase, etc., and typically symbiotic fixation of atmospheric nitrogen. These unique groups of organisms have been also shown to contribute significant role in mitigation of abiotic stressor(s). Significant literature is available to prove plant-benefit instigated by crop-associated Rhizobium spp. in abiotic-stressed soil. However our knowledge regarding similar activity by the Rhizobium strains originating from wild habitat is still in infancy. Here we isolate a fenugreek-nodulating Rhizobium sp. from root nodules of a halotolerant, wild leguminous weed, and studied its beneficial effects through drought-simulated field trial. The strain found to tolerate high salt concentrations (10% of NaCl), produce Siderophore exopolysaccharide, etc. Additionally as evident from Biolog Gen-III assay the strain exhibited vigorous growth in presence of variety of carbon sources, thus proving high metabolic plasticity. Log-cells of the said Rhizobium strain was inoculated (109 cfu) by seed coating technique. The seeds were sown manually (30 X 10 cm). Water deficit situation was simulated by restricting the irrigation at flowering and seed setting stage respectively. Results revealed marked rise in leaf-phenol and protein content in inoculated plants. Similarly, the inoculated plants also exhibited higher activities of antioxidant enzymes including catalase, superoxide dismutase, peroxidase, and ascorbate peroxidase signifying the presence of efficient management system for detoxification of oxidative radicles. Significant influence on phenotypic traits following the inoculation with Rhizobium strain were also recorded. Inoculation with the strain significantly improved the seed size over the control. Inoculation with the Rhizobium strain also successfully increased the seed yield (~0.37 t ha-1) over uninoculated control. Moreover the total oil content of the seeds were also analyzed. Inoculation with the strain also found to increase the seed-oil content (0.98% over the control). In conclusion, the results strongly endorse dynamic utilization of the Rhizobium strain for fenugreek cultivation in drought-prone areas.
The rainfall forecasting was not as per expectations and was quite late in the kharif season of the year 2014-15. The precipitation was reported from 2nd week of July 2014. As a result, the sowing time of most of the agronomical crops was almost over and farmers were worried about their livelihood. The yield of the major crops like Soybean & Tur was expected to be reduced to 50%. On the other hand, in the Washim district most of the soils are light to medium type having good drainage capacity. Looking to soil strata and to overcome this climatic situation, KVK and Krushi Samruddhi project emphasised on promotion of late kharif onion in the district. In Washim district of Vidarbha region, farmers are growing onion in only Rabbi Season. The yield and quality of rabbi onion is good but fetches low market rate due to glut in market. Storage and holding capacity are the main constraints observed in Rabbi Season. Market rate starts increasing from October onwards till February because of shortage and increased demand of onion bulb for seed production programme. The yield & quality of Kharif onion (15 to 20 t/ha) is low as compared to rabbi (20-25 t/ha) and late kharif (22 to 25 t/ha) season. The yield of onion in late kharif season is highest due to suitable climatic conditions. Accordingly training programme on late kharif onion production technology was organised. The farmers facilitated for seed (input) with DOGR, Rajgurunagar and Private seed companies and provided all required handhold support. As a result around 76 farmers from district specifically from Risod block have cultivated late kharif onion on 72 acres of area. The yield ranges from 19.5 t/ha to 28.2 t/ha. Average yield and price of late kharif onion is 22.7 t/ha and Rs. 11700/- per ton. The total income and net profit of Rs. 265590/- and Rs.202090/-. As compared to late kharif onion, the average yield, income and net profit of Soybean per hectore was 11.25qt/ha., Rs. 34875/- and Rs. 13700/-, respectively. The benefit cost ratio of late kharif onion and soybean was found to be 1:3.18 and 1:0.65. Because of intervention of late kharif onion production in Washim district, the farmers get stability in drought situation in the year 2014-15.
A field experiment was conducted at Research Area, Department of Forestry, CCS HAU, Hisar. Eucalyptus seedlings of clone 2045 were transplanted at a spacing 6×6 m following randomized block design during the last week of November, 2010. Kinnow plants were transplanted alone (6×6m) and in combination with eucalyptus during mid September, 2011. Among different treatments, an average increase in height of 1.3 m was recorded. In the current growing session; maximum CAI (2.7) was observed for basal diameter in eucalyptus followed by dbh which indicated that trees achieved sufficient biomass during 7th year of growth. The fruiting in kinnow plants started from the last two years and it was moderate during this year. The fruit yield varied from 2.7 t/ha in agri-silvi-horti system (kinnow+eucalyptus+wheat) to 4.2 t/ha in agri-horti system (kinnow+wheat).

The sowing of wheat was done during second fortnight of November, 2017 in agri-horti, agri-silvi-horti and control. The significant variation in plant population was recorded among agri-horti, agri-silvi-horti and control. Significantly higher plant height was observed in case of agri-horti system as compared to agri-silvi-horti system at 30, 60, 90 and 120 DAS of wheat. The yield attributing parameters of wheat varied significantly under different agroforestry systems. Significantly higher yield attributing parameters of wheat were observed in case of agri-horti system as compared to agri-silvi-horti system. Significantly higher grain and straw yield of wheat was observed in case of agri-horti system as compared to agri-silvi-horti system. An increase of 21.0 and 29.1% in straw and grain yield, respectively of wheat was recorded under kinnow+wheat system as compared to kinnow+eucalyptus based agroforestry system.
The current study was carried out for the genotyping of Factor XI deficiency gene for the Gaolao cattle. The 42 number of blood samples of Gaolao bull were taken from Wardha and Amaravati District of Maharashtra State. DNA extraction of all the samples was done by Phenol Chloroform Isoamyl Alcohol Method. The isolated DNA were checked for the quality and quantity with the help of Gel electrophoresis and Nano drop respectively. Then best quality DNA was selected for the Polymerase Chain Reaction of FXID. The wild type of allele for FXID will show 244 base pair (bp) band and carrier animal will show 320 bp and 244 bp bands and heterozygous animals sample will show 320. In the studied animals all animals were showed only 244 bp band which is indicated that all the screened animals were having the wild type of allele.
Exploitation of plant growth promoting endophytic Burkholderia isolates to boost Agriculture production

A. Sandanakirouchenane\textsuperscript{1*}, Joseph Selvin\textsuperscript{1}, T. Geetha\textsuperscript{2} and Douglas JH Shyu\textsuperscript{3}

\textsuperscript{1}Pondicherry University, Puducherry, India  
\textsuperscript{2}Adhiparasakthi Agricultural College, Kalavai, India  
\textsuperscript{3}National Pingtung University of Science and Technology, Pingtung, Taiwan

Although many bacterial species have been isolated from the rhizosphere of various crop plants, the recent discovery is 	extit{Burkholderia} sp., an endophytic bacterium. In this study, the 	extit{Burkholderia} isolates viz., RB\textsubscript{1} (Rice Burkholderia 1), MB\textsubscript{2} (Maize Burkholderia 2), SB\textsubscript{3} (Sugarcane Burkholderia 3) and BB\textsubscript{4} (Black gram Burkholderia 4) were enumerated from the root, stem and leaf samples of four different crops viz., rice, maize, sugarcane and black gram using N-free BAz (Burkholderia Azelaic acid) medium, in which black gram roots were observed higher population. Further, growth promoting activities of the 	extit{Burkholderia isolates} were examined, the maximum production of IAA and GA was noticed on the BB\textsubscript{4} as compared to other isolates and the cytokinin production was recorded more in isolates SB\textsubscript{3} followed by BB\textsubscript{4}. Among the four isolates, maximum amount of salicylate type was noticed in RB1 and catechol type was recorded higher in BB\textsubscript{4} which showed that these isolates were capable to produce Siderophore. The ACC deaminase activity of the isolates were exhibited, the BB\textsubscript{4} was recorded more followed by SB\textsubscript{3}. Therefore, the endophytic 	extit{Burkholderia} isolates also the important contributor to the crop growth through secretion of growth promoting substances, production of siderophore and ACC deaminase activities may improve the Agriculture crop yield.
The present study was undertaken on cows with reproductive disorders like repeat breeding and Anoestrus to identify the Uridine -5 Monophosphate Synthase (UMPS) genetic disorder by Polymerase Chain Reaction (PCR) - Restriction Fragment Length Polymorphism (RFLP) in Cytogenetic Investigation Laboratory of Department of Animal Genetics and Breeding at Bombay Veterinary College. Total 102 animals’ blood samples were collected which were subjected to PCR amplification. The UMPS gene amplified PCR product were digested by using Ava I restriction enzyme at 37°C for 4 hours. The final PCR product was electrophoresed on 2% agarose after digestion. The amplified PCR product size was 108 base pair digested by Ava I yielded three bands of 53, 36 and 19 base pair (bp) respectively for wild animals, but due to less size of 19 bp, it was not visible in RFLP. It was found that all the selected animals for the research had shown normal results. As per the previous studies, it is suggested that there is a possibility of mutant gene which is directly related to the reproductive performance of Indian cattle. Therefore, it is important to screen the animals to avoid the increase in the disease prevalence.
Advancement of Horticulture through “Robotics”

Subhrajyoti Mishra¹ and K. M. Karetha²
¹Ph.D. Research Scholar,
²College of Horticulture, JAU, Junagadh, Gujarat.

India has witnessed voluminous increase in horticultural production over the last few years providing more than 30% to national income from agricultural sector. Significant progress has been made in area expansion resulting in higher production. In recent years food security for the increasing population is of utmost important in a developing country like India. There is a need for autonomous and time saving technology in agriculture to have efficient farm management. Indian agriculture system is still facing problems in rising of input costs, availability of skilled labours, lack of water resources and crop vigilance and monitoring. To overcome these problems, the automation technologies like robotics must be introduced. The automation in the horticulture could help farmers to reduce their field efforts. The robots are being developed for the processes such as fruit picking or harvesting, monitoring, irrigation, chemical spraying etc. Robots are perfect substitute for manpower to a great extent as they deploy sensing and machinery systems. The prime benefits robots are to improve repeatable precision, efficacy, reliability and minimization of soil compaction and farm drudgery. The robots have potential for multitasking, sensory acuity, operational consistency as well managed operating conditions. Few prototypes were designed by European Union named CROPS, USA-ISAAC2 and Michigan-Hortibot, Australia-AgBot, Finland- Demeter, India-Agribot, fire bird v robot and many others.
Growing green manure crops to reduce soil temperatures and maintain soil health to create favourable pod zone environment for Kharif groundnut is an inexpensive, sustainable and economizing technology for rainfed production system. A field experiment based on summer rainfall probability conducted by sowing and incorporating six green manure crops (cowpea, sunhemp, green gram, field bean, pillipesara and horsegram), FYM application and control treatments. FYM application and control treatments resulted in higher groundnut pod yield (1405 and 2193 kg/ha) with cowpea incorporation for two years (2016 and 2017) and green gram (1581 kg/ha) incorporation with one year (2018) followed by sunhemp and other green manure crops. After three years of experimentation, in addition to increase in pod yield and yield attributing characters, the soil microbial population due to different green manure crops was also increased several folds compared to control and mitigated the ill effects of dry spells during the crop growing period. The fungi increased from $7.0 \times 10^4$ cfu/g of soil to $28.3 \times 10^4$ cfu/g of soil in sunhemp followed by cowpea ($7.0 \times 10^4$ cfu/g of soil to $27 \times 10^4$ cfu/g of soil). Bacterial population increased from 5.7 to $33 \times 10^6$ cfu/g in green gram followed by horsegram and cowpea. Actinomycetes increased from $4.7 \times 10^4$ cfu/g of soil to $24 \times 10^4$ cfu/g of soil in cowpea followed by sunhemp and green gram. Organic Carbon (%) increased from 0.45 to 0.51 in sunhemp followed by cowpea (0.49) and horse gram (0.47) incorporated treatments.
Role of mineral component in contamination of soil and plant by some heavy metals for Al-Musayyib electricity thermal power station residues

Abbas S.S. AL-Wotaify  
Dept. Soil Sci.and WR. Coll. Agric. Univ. Al-Qasim Green, Iraq

This research included study of Barium, Copper, Rubidium, Bromine, Lanthanum and Thorium by XRF in soils and plant of Musayyib and Alexandria-Babylon Governorate between Longitude °32 99` 861``N and Latitude °44 29` 00``E. As well as estimation them in plant. They were (228.10-241.01, 54.40-56.20, 51.10-54.30, 23.90-240.0, 13.30-14.10 and 4.40-4.50mg kg-1) respectively in impacted soil(Ss1, Ss2) by Al-Musayyib electricity thermal power station residues. Also, they ranged in sand Ss11 and Ss21 of mentioned soil samples (18.20-20.18,11.04-12.30, 10.45-10.76, 2.66-3.80,1.21-2.10 and 0.85-1.01mgkg-1), while they were(138.16-109.80, 25.80-27.10, 25.20-28.50,16.80-21.90, 6.70-10.79 and 2.20-2.50mgkg-1) in clay fraction(Ss12, Ss22). Consequently, in dry matter of Vicia faba L. plant leaves were (38.90-65.10, 25.80-45.90, 30.30-30.80, 4.90-6.03, 2.01-3.10 and 2.01mg kg-1), and they were (35.40-55.30, 27.10-39.90, 23.70-28.80, 4.80-5.20, 2.01-5.20 and 1.50-1.80mg kg-1) respectively in dry matter of roots growing at polluted soil samples(Ss1,Ss2).

Pollution load index (PLI) for heavy metals group in each of contaminated Musayyib soil samples(Ss1,Ss2) compared with soil Alexandria samples (S01,S02) was (1.21-1.47). It was (1.12-1.45) in sand samples, while in clay samples was(1.29-1.70). Geo-accumulation index(Igeo) recorded the highest values for Br and La compared to other heavy metals in the study samples affected by the power station residues, and La was higher than Br in contaminated soil sample Ss1 comparison with S02 was(0.63), and contaminated sand sample Ss11 with comparison S021(Ss11-Ss021) was(0.43). While Igeo for Br was the highest(0.75) in clay sample Ss12-Ss22. For Th and Ba, Igeo was the highest in the sand sample Ss11- S011: 0.37 and 0.23 respectively. Igeo for La was the highest: 1.03 followed Br: 0.57 in clay sample Ss22-S022. Ba and Th maintained the increase in the sand sample Ss21-S011: 0.73, 0.44consecutively.

Mineral concentration factor (MCF) of clay fraction contributed to soil pollution more than MCF for sand which was(0.08-0.23, 0.46-0.68)respectively. While bioaccumulation factor (BCF) of sand fraction contributed to plant pollution more than BCF of clay(0.45-14.55 and 0.18-2.53)consecutively with regard to heavy metals in the study soils. minerals 23.29, 24.90, 12.85, 18.87 and 20.09% respectively.
Evaluation of different cultivars of Mango for preparation of instant mango powder

Anil Kumar Verma*, PC Sharma, Namita Rani and Shivani
Dr. Y S Parmar University of Horticulture and Forestry Neri, Hamirpur (HP)

The method for preparation of instant mango powder from different varieties of mangoes viz; Dasheri, Amrapali, Mallika and Seedling/In-situ mangoes by using foam mat drying technique was standardized. Fruit pulp was turned into stable foam by using carboxy methyl cellulose (CMC) as foaming agent (0-2%) followed by drying in tray drier for preparation of instant mango powder. Initially, the extracted mango fruit pulp was analyzed for various physico-chemical parameters viz. pulp yield, TSS, moisture, titratable acidity, sugar content and carotene. The pulp after foaming was dried in dehydrator at temperature of 60±5 0C to a moisture content of about 5%. Out of different combinations, use of 2% carboxy methyl cellulose in each variety was found the most appropriate for foaming of mango pulp on the basis of foaming properties. The pulp with 2% CMC of cultivars Dashehari, Mallika, Amrapali and Insitu mango contained foam density (0.686 g/cm³, 0.865 g/cm³, 0.686 g/cm³ and 0.698 g/cm³) foam expansion (15%, 14.99%, 15% and 13.99%) respectively with 100% foam stability in all cultivars. Foaming of pulp reduced the drying time appreciably in comparison to drying of unfoamed mango pulp. Chemically, fruit powder from cv Mallika contained 80o Brix, TSS, 4.9 pH and 14mg/100gm ascorbic acid, cv Dashehari powder contained 76oBrix TSS, 4.7 pH and 13mg/100gm ascorbic acid, Amrapali variety powder contain 80oBrix TSS, 4.8 pH and 17 mg/100gm ascorbic acid while, Insitu/seedling mango powder exhibited 74o Brix TSS, 4.1 pH, 25mg/100gm ascorbic acid. Thus, mango pulp can be utilized for the preparation of instant mango powder using foam mat drying technique.
The effect of natural processing method dehulling on nutraceutical, antinutritional and in-vitro antioxidant properties of total 17 genotypes of five small millets (foxtail, little, kodo, proso and barnyard millet) cultivated in Rayalaseema region of south India were investigated. The nutritional properties were determined by evaluating the proximate composition (starch, protein, fat), minerals (calcium and magnesium), trace elements (Iron and zinc) and total phenolic content (TPC), total flavonoid content (TFC), while the in-vitro antioxidant property was also investigated by the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity. Antinutritional factors such as phytic acid and tannin were also estimated. Whole and dehulled grain phenolic acids were identified and quantified by using Ultrafast liquid chromatography (UFLC), the analytes identified were Gallic acid, 4-hydroxy benzoic acid, Cinnamic acid, Salicin, catechin, chlorogenic acid, vanillic acid, caffeic cid, syringic acid, p-coumaric acid, salicylic acid and caffeic acid Experimental analysis concluding that dehulling of the grain affected the nutraceuticals, antinutritional and antioxidant properties of millets when compared with the whole grain millets.
Community based processes for participatory irrigation management

R. Ratnakar  
Former Director, Extension Education Institute, Hyderabad

The decentralized management of common pool resources like tanks, involves regular operations and maintenance covering water distribution, minor repairs, and consultative planning for water use based on water availability. In cases of tank degradation, major rehabilitation works to restore feeder channels, strengthen storage systems and repairs/improvement in distribution channels need to be taken up. All these activities need to be taken up by the community with need based external support. Sustaining users’ interest requires the confidence among themselves to manage their own productive activities to fulfill their needs and optimize economic returns. This implies that users need to be involved right from needs identification, works prioritization, planning, implementation and monitoring. Minor irrigation tanks are one of the water resources where users have control over both water source and the entire distribution system. This definitely helps users to be involved in tank management and build a sense of ownership and get involved in maintaining and managing this important resource.

These understandings need to be integrated in the planning and institution building process. It necessitates a well-designed institutional framework that can provide autonomy and flexibility of functioning to users and integrated approach not restricting to physical infrastructure development/up-gradation. The need of the hour is to understand the physical infrastructure as a means for achieving the goal of sustaining primary livelihoods and taking these to the next level of optimization of returns.

Field assessment of grassroots level situation also indicates the need of an integrated approach for tank management focusing on multiple tank based livelihood options and improving these to optimize the returns. This motivation will help to sustain users’ interest in resource management.
A field experiment was conducted during Rabi season 2018 at the Students farm, Dept. of Agri. Sci & RD, Loyola Academy to know the effect of bio-stimulants on growth and yield of Tomato hybrid US-440. The experiment was laid out in RBD and the treatments comprised of: T1 – Folicist @ 3 ml/L, T2 – Fylloton @ 3 ml/L, T3 – Globalga @ 3 ml/L, T4 – Tata Bahar @ 2.5 ml/L, T5 – Neo-Alpha @ 2.5 ml/L, T6 – Daiwik @ 2.5 ml/L, T7 – Recommended dose of NPK, T8 – Control. Biostimulants were applied as foliar spray at pre-flowering, flowering and fruit setting stages. From the results of the experiment, it was observed that all the growth parameters i.e., plant height (71.5, 69.5 cm), no. of branches (6.8 and 6.5) and no. of leaves/plant (285 and 280) were significantly increased by the application of Folicist @ 3.0 ml/L and Tata Bahar @ 2.5 ml/L compared to other treatments and control. Same treatment application resulted in significant increase in terms of no. of flowers/plant (71 and 68), no. of fruits/plant (42 and 39) and % fruit set (77% and 75%). The highest no. of fruits/plant, fruit weight (105 and 101 g), yield/plant (5.8 kg) were recorded in foliar application of Folicist @ 3 ml/L closely followed by Tata Bahar (5.6 kg) and Daiwik (5.4 kg) and the lowest values were observed in control (3.8 kg).
Response of soil and foliar application of micronutrients on flowering and fruit characters of sapota cv. Kalipatti under high density planting system

Guvvali Thirupathaiah¹* and A. M. Shirol²
Department of Fruit Science, KRCCH, Arabhavi, 591 218, India.
AICRP on Fruits, KRCCH, Arabhavi, 591 218 UHS, Bagalkot, India

A field study was conducted out to know the response of soil and foliar application of zinc, iron and boron on flowering and fruit characteristics of sapota cv. Kalipatti under HDP system (3x3 m) at KRCCH, Arabhavi UHS Bagalkot, during 2015-2016. For soil and foliar application Zinc and iron sulphates were used for soil and foliar application, whereas boron for soil application sodium tetraborate (Jai bore) and for the foliar application solubor were used. The present research results indicated that, the foliar application of (T10) 0.5% ZnSO₄ + 0.5% FeSO₄ + 0.3% B tree⁻¹ (i.e. in two times as foliar i.e. 1st at 50 per cent flowering and another at fruits at pea size) along with recommended dose fertilizers (recommended dose of macro-nutrients i.e. 100: 40: 150 g NPK and FYM 50 kg tree⁻¹ for four to six years plants) was shown less number of days (29 days) taken for flower initiation, flower opening to fruit set (29.50 days), days taken to reach harvestable stage (195.88 days) and the maximum number of flowers ((17.15) and fruits (2.95) shoot⁻¹ and also the highest per cent fruit set (23.56 %) and fruit retained (85.91 %) at harvesting stage were noticed. Also it gave superior fruit characters like fruit weight (113.33 g), fruit length (6.10cm), fruit girth (5.84 cm) and fruit volume (101.50 ml) were noticed where as the lowest values were noticed in control (T1) and water spray (T2).
Heat stress induced as a result of high ambient temperature and humidity affects productivity, reproductive efficiency and health of dairy animals which ultimately leads to severe economic losses. This devastating situation for livestock production is even becoming worse under the present climate change scenario. Strategies focused to breed animals with better thermo-tolerance and climatic resilience are keenly sought these days to mitigate impacts of heat stress especially in high input livestock production systems. Selection of thermo resistant animals is an effective way to improve the productivity of cattle during high environmental temperatures. There exist genetic differences in thermo tolerance at the physiological and cellular levels among the different breeds and this variability can be exploited to overcome the effect of heat stress on dairy cattle. Indigenous (Bos indicus) cattle survive and perform better under heat stress as compared to temperate breeds (Bos taurus) or their crossbreds due to high prevalence of heat shock protein genes. The heat shock proteins (HSPs) are a protein family known for their potential role in thermo-tolerance and widely considered as cellular thermometers. They function as molecular chaperons and have major roles in cellular thermo tolerance, apoptosis, immune-modulation and heat stress. Polymorphisms in the HSP genes have shown association with heat tolerance, milk production, fertility and disease susceptibility in Livestock. HSP genes may be ideal candidate gene markers for selection of animals with better climate resilience, immune response and superior performance. Suitable breeding programs can help to achieve animal population that could cope with effects of heat stress.
Despite the variety of agricultural extension approaches which include IT-based approaches, the majority of farmers in India are not acquiring the actionable agricultural information. Farmers are facing difficulty in acquiring actionable agricultural advice in a real-time manner from call centers and web portals due to communication and perceptual issues. The radio, video, SMS and voice-based services push generic information to farmers. The farm specific advisory systems like eSagu suffers from scalability issues. By exploiting the latest developments data science and smartphone technologies, there is an opportunity to build a system to enable the farmer in identifying the crop problem and getting the agro-advice. To enable the farmer to get the actionable agro-advisory, we are making an effort to build a smart-phone based Field Diagnosis Guide (FDG) (or Crop Darpan) by exploiting the progress in data science and mobile phone technology. It is assumed that the farmer possesses a smart phone with Internet connection and visits the field. The basic idea of Crop Darpan is as follows: A field problem is a combination of a set of visual perceptions. The farmer identifies the visual perceptions of the field problem through smartphone, and identifies the field problem and acquire the agro-advice. The methodology to develop Crop Darpan is as follows. Being semi-literate, a farmer is able to identify the generalized visual perceptions (or symptoms) of the crop. The low-level visual perceptions of field problems of the given crop can be collected from subject matter specialists. The proposed Crop Darpan contains an hierarchy of visual perceptions of field problems that consists of generalized, middle-level, and lower-level perceptions. The Crop Darpan helps the farmer to identify the field problem by confirming the corresponding low-level perceptions and acquire the agro-advice. A prototype was built for a Cotton crop (www.cropdarpan.in) in English and Telugu languages. It was found out that the farmers are able to identify the field problem with the Crop Darpan system.
Development of fortified millet cookies as a functional food for commercial bakery production

Rizwana shaik, Ratnavathi V. Chamarthi*, Venkateswarlu Ronda and Shobha Ediga
Indian institute of millets research, Hyderabad

Studies were conducted to develop a recipe for cookies with multi millets. Different proportions of millet flour was prepared [Sorghum, Pearl millet, Foxtail millet and Oats] and were mixed in four treatments i.e. T1 control [100% Refined wheat flour (RWF)] and experimental samples T2 [50%RWF+50% Millet Flour (MF)], T3 [30%RWF+70%MF] and T4 [100%MF]. The physico-chemical, nutritional, sensory properties and scanning electronic microscopic (SEM) study of cookies with control and experimental samples were studied. The results of physical parameters revealed that the cookie height was observed highest in T3 (1.104±0.01) whereas the cookie dough density was highest in T4 (1.124±0.02) and the spread factor of cookies were shown highest in T1 (0.357±0.00). The sensory results showed that the best acceptable cookie among the four treatments is T3 (8.00±0.59) and the same was selected for consumer evaluation along with control (T1). Results revealed that there was no significant difference in overall acceptability of T1 and T3. The protein (9.15± 0.19) and fat content (29.13±0.95) was highest in T4. Starch content of cookies ranged from (71.79±0.38 to 77.56±1.18) and total phenolic content was highest in T3 (57.66±3.20), the antioxidant activity was highest in T4 (45.09±1.05). T3 (0.543±0.06) and T4 (0.563±0.00) were reported to contain highest β-glucan content. The highest content of Dietary fibre (%) was observed in T4 (8.235 ± 1.47%) and least in T1 (5.673 ± 1.45%) cookies. The internal structure and pore structure of T3 cookie was finer smoother and better in texture than the control cookie T1 as per SEM imaging. The micro structure of T3 presents distinct distinguishable open pore structures as a continuous matrix, which is built up by starch and protein. Millets are rich in dietary fibre and low in glycaemic index and are proved to be a better diet for diabetic and cardio vascular patients. Consumption of millets will enhance nutritional status and health of the consumers, the process for multi millet cookies was developed. The results indicated that multi millet flour can be used as a potential ingredient for preparation of cookies as it was composed of rich nutrients. Hence, multi millet flour cookies can be promoted as healthy cookies for commercial production of baked products.
The er2 gene resistance against powdery mildew infection is associated with enhanced Antioxidative protection and defense gene expression

Sheetal Madhukarrao Bhosle, Nitinkumar Marathe and Ragiba Makandar

University of Hyderabad, Hyderabad

Powdery mildew causing pathogen, Erysiphe pisi is one of the important fungal pathogens infecting garden pea causing severe yield losses to the crop worldwide. Assessing variation among pea genotypes through germplasm screening previously suggested a host-specific interaction controlling the disease reaction to E. pisi. Therefore, to combat the disease in pea, it necessitates understanding host responses to E. pisi. The present study is aimed at analyzing host responses against E. pisi in JI-2480, a resistant pea genotype carrying a recessive gene er2 and a susceptible pea genotype, Arkel utilizing both incompatible and compatible interaction respectively. The cellular responses were analyzed through various biochemical, histo-chemical, and defense gene expression in a time-course study at 24, 48 and 72 hours post inoculation (hpi) which showed changes in the redox status and defense gene expression of pea genotypes. The er2 mediated resistance is likely to be conferred via maintaining a redox balance between the reactive oxygen species (ROS) generated and scavenged in host cells along with rapid activation of defense gene, pathogenesis-related protein 1 (PR1). Quantitative gene expression of defense pathway related genes revealed the higher transcript accumulation of PR1 suggesting role of salicylic acid (SA) accumulation in triggering defense response in resistant pea genotype against powdery mildew infection.
Development and evaluation of instant papaya fruit powder

Shivani, Anil Kumar Verma and PC Sharma

Department of Horticulture and Forestry, Neri, Hamirpur (HP)

The suitability of two foaming agents viz: glycerol-mono-stearate and carboxymethyl-cellulose were investigated using three concentrations of each (1%, 2%, and 3%) along with control. Out of two foaming agents on the basis of foaming properties glycerol mono stearate was adjudged best. Among these 2% concentration of glycerol-mono-stearate was found best on the basis of sensory score (color, free flowing, taste/aroma and overall acceptability). Initially, the extracted papaya fruit pulp was analyzed for various parameter viz. pulp yield, TSS, moisture, Titratable acidity, sugar content and carotene. Papaya pulp was foamed by different concentration of methyl cellulose and glycerol mono stearate (1%, 2% and 3%) as foaming agents. The maximum stable formation was obtained in 2% Glycerol mono stearate. The pulp was dried in dehydrator at temperature of 60±5°C. The drying time required for foamed papaya pulp was recorded lower than non foamed pulp. Chemically, this powder contained 60-80°B TSS, 0.02-0.17% titratable acidity, 500-825µg/100g carotene, 36-51 percent total sugar and 25-42 percent reducing sugars. Physico-chemical analysis showed a significant reduction in sugar content and carotene whereas in pH and acidity were found non-significant change during pulp to powder preparation and storage of the papaya fruit powder. The physico-chemical, foaming properties and sensory evaluation of the quality attributes of papaya powder obtained from the pulp of 20°Brix added with 2% glycerol-mono-stearate was found to be optimum to produce the foam-mat dried papaya powder.
Identification, isolation and cloning of flower and pod specific promoter from chickpea for tissue specific expression of transgene

Jagadale Mahesh Vasantrao a, b*, Sumita Acharjee a, b and Bidyut Kumar Sarmah a, b

a Assam Agricultural University, Jorhat, India.
b Agricultural University, Jorhat, India.

Tissue-specific promoter are useful to regulate transgene expression in a particular organ or developmental stage. For isolation of flower and pod wall specific promoter, RNA-Seq data and a forward subtractive cDNA library were generated from chickpea using flowers, pod wall and leaf tissues. Paired end RNA-seq data was generated using NextSeq500 to align with the chickpea reference genome. In addition, 226 EST clones were sequenced and analyzed. High quality ESTs sequences (179; Accession numbers JZ923200-JZ923378) were subjected to CAP3 assembly which annotated 126 genes comprised of 97 singletons and 29 contigs. Gene Ontology (GO) distributed them to 751 GO terms into three categories: cellular location, molecular function and biological process. To identify the genes exclusively expressed in the flower and pod wall, the RNA seq and EST data were searched using BLASTN of the Chickpea Transcriptome Database (CTDB) to obtain CTBD ID. The CTDB IDs for pod wall ESTs were used to obtain the gene expression profile in the flower. A total of eight (8) flower and pod wall specific genes were identified and subjected to quantitative PCR (qPCR) analysis. Of these, 3 genes (FHG: Floral homeotic AGAMOUS-like isoform X2, MADS1: MADS box transcription factor and CEP: chickpea expressed protein) showed significantly high levels of up-regulation in the flower and pod wall when compared with leaves. Therefore, 1000 bp region upstream of the start codon of FHG and MADS1 gene was obtained by genome walking and subjected to in-silico analysis using PlantCARE promoter prediction database. Sequence analysis revealed the presence of many tissue specific cis-acting elements that regulate transcript accumulation in the flower and pod wall. Finally, the isolated promoters were cloned in a binary vector, pBI121, harboring the GUS as a reporter gene in order to study the efficiency of the promoters.
Quality evaluation and storage study of papaya guava fruit bar

A. Laxman Kumar¹*, C. Madhumathi², Syed Sadarunnisa³ and P. Latha⁴
Dr. Y.S.R. Horticultural University, India

Among the different blending ratios of papaya cv. Red Lady and guava cv. Lalit (100:0, 80:20, 60:40, 50:50, 40:60) in preparation of fruit bar, 50% papaya pulp and 50 guava pulp (L) treatment (T4) recorded as best blending ratio as the treatment recorded maximum sensory score and overall acceptability (8.67) and also with better ascorbic acid (127.32 mg/100 g), total carotenoids (1218 μg/100 g) and protein (1.00%) contents.
Nitrogen is the major nutrient element required for the plant growth and development. In rice, development of varieties with improved nitrogen use efficiency will reduce the nitrogen fertilizer application. This study was investigating the genotypic differences in photosynthetic nitrogen use efficiency, nitrogen use efficiency, yield and yield related traits of 12 different rice genotypes under two different nitrogen levels viz., T1 and T2. Different physiological and agronomical characters were measured in selected 12 genotypes, growing in field. The photosynthetic rate was recorded higher (23.3 μmol CO2 m-2 s -1) with rice genotype Sampada. Efficiency parameters including Photosynthetic Nitrogen Use Efficiency and Harvest Index were studied in order to determine NUE. Chlorophyll content was recorded maximum in vegetative stage under 100% RDN and in reproductive stage under T1 and T2 in NUE genotype of Vardhan and minimum in low NUE genotype Sampada x Jaya/3 under T1 and T2 treatments. Total Dry Matter, grain yield and leaf nitrogen content were higher in high NUE genotype Vardhan. High chlorophyll content in case of Vardhan under low nitrogen content support their higher grain yield and total dry matter content. The Nitrogen Use Efficiency (7.11), photosynthetic nitrogen use efficiency (12.50) were lower when treated with 100% of recommended Nitrogen. The maximum average grain yield of 824 g m-2 was registered in Vardhan genotype.
De novo whole-genome assembly in Safflower (Carthamus tinctorious L.) and its application to genetic and gene discovery analysis

Usha Kiran Betha and V. Dinesh Kumar
ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad

Cultivated Safflower (Carthamus tinctorious L.) is one of the most economically important Oilseed crop grown in India, Mexico, United States, and the Middle East for oil, medicinal and industrial uses. It has a diploid genome (2n = 24) and large genome size of (~1.4 GB). Breeding priorities include increased seed oil yield in safflower. To contribute towards this goal and expand our knowledge of the cultivated safflower, we here performed de novo whole-genome assembly in C. tinctorious using the Illumina Hiseq2500 sequencing platform. A1, a popular variety cultivated in India was used for genome sequencing. Illumina 2 paired-end and 2 mate pair sequencing chemistry generated high quality 1.3 GB and 0.3 GB raw reads respectively. Raw reads were assembled using MaSuRCA assembler. About The 1.02 Gb of assembled sequences consisting of 1,74,116 scaffolds, covered 73.0% of the 1.4 Gb C. tinctorious genome. The N50 length of scaffolds was 15,515 bp and 2,34,437 contigs were obtained with an N50 length of 11,532 bp. The assembly was found to be 66% repeat rich (interspersed repeats). These repeats were used for masking the assembly using repeat masker. The repeat masked genome was then used for gene prediction using Augustus using arabidopsis species as model organism. The number of predicted CDS were 40,800. In gene discovery analysis, candidate genes related to glycerolipid biosynthesis enzymes (55) and enzymes/proteins involved in lipid metabolism (53) were identified. Genomic SSRs were also predicted on the assembly of >-500bp size using MISA tool. A total of 3, 77, 825 SSRs were identified and primer pairs were designed for 3, 15, 289 regions. The class I SSRs (>20bp) and class II SSRs (10 to <20 bp) were 1, 39, 418 and1, 75, 871 respectively. The safflower genome was found to be rich in dinucleotide repeats followed by mono-, tri-, tetra, hexa- and penta- nucleotides. A subset of 500 microsatellite (>30 bp) loci was synthesized for testing amplification and identification of polymorphic markers in parental panel of 24 safflower germplasm lines. Further, the genome sequences assembled in the present investigation are expected to contribute to future safflower studies.
Optimization of microwave puffing process for preparing ready-to-eat snack using potato and green leafy vegetables

Deshmukh, S.D, Pardeshi, I.L.
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, India

Microwave puffing process, used for production of potato and green leafy vegetable based ready-to-eat snack foods, comprising of convective drying followed by microwave puffing. The cold extrudate in flat strip form with constant initial moisture content of 0.55 kg/kg of dry matter was used for experimentation with sample size of 200 g for each set of experiment. The experiment was conducted using central composite rotatable design (CCRD) with variables like convective drying temperature (100-140 °C) using convective drying time (60 to 300 s) followed by microwave power (180 to 900 W) heating for (0 to 120 s), so as conduct 30 experiments in Toto. The responses noted were moisture content (kg/kg dry matter), hardness (g), crispness (No. of + positive peaks), colour (L a b values) and Expansion ratio (ER). The analysis using response surface method (RSM) revealed that optimal quality product could be obtained by convective drying at 120 °C for 240 s followed by microwave power of 540 W for 60 s with resultant responses of moisture content of 0.0445 kg/kg of dry matter, hardness 210.23 g, crispness 12.585 (Positive peaks) and expansion ratio 2.93 and colour (L-value of 25.64, a-value of -9.15 and b-value of 16.165). It was found that convective drying causes surface moisture removal, leading to case hardening of cold extrudate paving a way for puffing during subsequent microwave heating. The rate of moisture removal were faster during initial convective drying and reduced with beginning and advancement of case hardening, drastically. This ensured entrapping of moisture inside the materials and that helped for imparting puffing due to conversion into vapors, leading to expansion and puffing effect, during subsequent microwave processing. The prepared RTE food product was found to be nutritious due to incorporation of sprouted soy flour and green leafy vegetables that is helpful for growth and development of children.
Gene introduction in "Colored Cotton"

Loyola Academy Degree and PG College, Hyderabad, India

Cotton with naturally colored lint, other than white, is commonly referred as "Colored Cotton". Colors of naturally colored cotton are red, green and shades of brown. During World War 2, commercial colored cotton cultivation took place. But it could not gain much importance due to its short staple length and low yields. The typical white cotton needs to be dyed after its harvesting to attain the respective Colors. But use of solvents like kerosene in dying leads to pollution, irritation to skin, fading of color within a short period of time and increases the cost of fabrication.

To overcome the above mentioned problems, cultivation of colored cotton is to be encouraged. Due to its short staple length in colored cotton, it becomes highly difficult for the newly developed machines for spinning. Due to the presence of virus induced gene it decreases the expression of the GhMML4-D12 gene in colored cotton plants resulted in a significant reduction in epidermal cell prominence and lint fiber production. By arranging GhMML4-D12 gene in tandem with GhMML3 MIXTA genes responsible for lint fiber development essentially increases the staple length of the fiber. This ultimately increases the production of colored cotton among the farmers and reduction in usage of dyes.
Food production has to be significantly increased in order to feed the fast growing global population. All these issues necessitate a second Green Revolution, in which biotechnological engineering of economically and nutritionally important traits should be critically and carefully considered. Such that Plastid transformation in higher plants have been constantly developed.

These applications include
(1) Transplastomic plants producing insecticidal, antibacterial, and antifungal compounds. These plants are therefore resistant to pests and require less pesticides.
(2) Transplastomic plants resistant to cold, drought, salt, chemical, and oxidative stress. Some pollution tolerant plants could even be used for Phytoremediation.
(3) Transplastomic plants having higher productivity as a result of improved photosynthesis.
(4) Transplastomic plants with enhanced mineral, micronutrient, and macronutrient contents.

In order to achieve higher yields transformation of plastids in higher plants is necessary that contribute to sustainable development in agriculture.
The tremendous increase in population, urbanization, industrialization, agricultural production & related product consumption results in accumulation of large quantities of solid wastes. Disposal of these wastes causes economic and environmental problems. Since substantial portion of these wastes are organic in nature and found to contain valuable plant nutrients, they can be converted into useful products. Composting and Vermicomposting can be recommended to convert organic fraction of wastes into manure. Vermicomposting is bio-technological non-thermophilic processes in which earthworms are used to enhance the conversion of waste and to produce a humus like product, while composting include a thermophilic phase (45 to 65°C) during which labile organic matter gets degraded and pathogens are effectively reduced. Therefore the present study was taken up to analyse the chemical composition of raw waste materials and mature vermicomposts and to compare the nutritional quality of vermicomposts with conventional compost. The different bio degradable organic wastes (fruit wastes, vegetable wastes, leaf litter, sugarcane trash, farm wastes) were converted into nutrient rich Vermicompost by employing earthworms. Conventional composting was taken up with vegetable wastes for the purpose of comparison. Vermicomposting resulted in lowering of pH, organic carbon, C/N ratio compared to initial raw materials, while EC, total nitrogen, phosphorus and potassium contents were high. The nutrient content of vermicompost was found to be in the order of farm wastes> vegetable wastes> fruit wastes> leaf litter> sugarcane trash. Further vermicomposts were found to be rich in total N, P, K compared to conventional compost, while pH and EC were found to be low. In addition, the process time for Vermicompost preparation was found to be 50% of conventional compost. Vermicompost was of more nutritional value and less time consuming process than the conventional compost. Hence, vermicomposting proved to be very efficient and effective method for conversion of bio degradable organic wastes into a valuable product.
Interview questionnaires were administered to the general public in Hyderabad during summer 2019 to investigate consumer awareness recognition of 'quality assurance' product logos. Fifty percent of respondents gave a positive rating. The findings show the general public is interested in consumption of milk. The objective to study the behavior of consumes on choices different brands. The study will facilitate the marketing of dairy products by creating awareness about the practices in dairy amongst consumers and also will help to understand the difference in taste, quality and perception which varied from consumer to consumer. The retailers also promotes the brand. The homemakers take the decision of milk brand while buying.
Milk and milk products are essential part of human life, as it gives nutrition to all walks of life. It is a source of income for all the marginal dairy farmers. Consumer behavior can be defined as the behavior that consumer display in searching for, purchasing, using, evaluating and disposing of products and services that they expect will satisfy consumer needs and wants. To elaborate further, it focuses on how individuals make decisions to spend their available resources (time, money, effort) on consumption related items. Consumers are highly influenced by the marketing activities, brands etc. Hence the study focuses on consumer behavior towards various brands of milk and milk products with specific reference to heritage foods limited in Hyderabad.
M.V.R. Prasad  
*Project Director (Retd.) ICAR-DOR, India*

Pongamia pinnata (Karanj) is an important component in afforestation programs, in view of high rate of survival and hardiness in withstanding vagaries of weather including soil aberrations. Considering its ease of maintenance, inclusive nature without any adverse effect on the surrounding vegetation, manurial value of its products, its ability to improve soil and consistent oilseed yield, Karanj tree is finding a niche in agroforestry programs too. Karanj is very amenable to intercropping with wide range of economically important annual and perennial plant species. This attribute of inclusiveness and amenability for intercropping puts Karanj tree on top pedestal in agroforestry programs.

In recent years it has been convincingly shown that Karanj forms a dependable feed stock for biodiesel production in view of its consistent seed & oil yield and its wider adaptability to diverse agro-ecological situations. Due to the potential hazards associated with the soils polluted with heavy metals it is becoming very difficult to propose conventional remediation techniques or new occupation plans. In many contaminated landfills, there is the risk of vertical heavy metal transfer both to the groundwater and to the above ground vegetation.

Pongamia (Karanj) based phytoremediation is non-destructive, in-situ technology, which employs establishment of genetically elite Pongamia saplings (known to be hyper accumulators) forming a vegetative cover to bring about soil amelioration through the inherent mechanisms of Phyto-stabilization & Phyto-extraction for toxic or mine spoils.
Physiological and psychophysical characteristics of hand operated rotary maize sheller in Akola region

S.K. Thakare¹, Kanchan V. Gedam², M.M.deshmukh³, R.K. Kolhe⁴

Anthropometric survey was carried in 4 villages of Akola district of Maharashtra state. From the above data six female agricultural workers were selected for the ergonomical evaluation of hand operated maize sheller. Working heart rate, resting heart rate, increase in heart rate and oxygen consumption rate were observed to be 153.4 beats min⁻¹, 78.8 beats min⁻¹, 74.6 beats min⁻¹ were working on hand operated maize sheller. The psychophysical responses i.e. body-part discomfort score and overall discomfort score were found to be 29.5, 6.77. According to Visual Analogue Discomfort scale the category of hand operated mechanism it was in category more than moderate discomfort. Shelling efficiency and output capacity were found to be 140.57 kg h⁻¹ and 98.19 % on hand operated maize sheller.
Effect of Weedicides on Weed Control Index, Crop Dry Matter Production, Nutrient Uptake and Yield of Maize (Zea Mays L.)

G. Ashoka Chakravarthy¹ and K. Arivukkarasu²

1. Lecturer in Agriculture, Dept. of Agri. Sci. & RD, Loyola Academy
2. Assistant professor, Department of Agronomy, Annamalai University

Low yield of maize under Indian conditions may be attributed by number of factors, among them weeds rank as prime enemy. The yield loss in maize ranges from 28-93% due to severe weed infestation. To minimize the weed losses, several weed control methods are available such as mechanical, cultural, chemical and biological methods. Traditional hand weeding is the most efficient and widely adopted practice of weed control, but it is labour intensive, time consuming and costly due to high wage rates which narrowed down the profits of the cultivation. Keeping in view of these limitations, the use of herbicides is the best way which gives a quick and cost-effective solution for numerous weed problems. With this backdrop, a field experiment was conducted at the experimental farm, department of Agronomy, Faculty of Agriculture, Annamalai University during summer (Feb-May 2016) to know the effect of weedicides on weed control index, crop dry matter production, nutrient uptake and yield of maize (Zea mays l.). The experiment was conducted in RBD with 9 treatments replicated thrice viz., Unweeded control (T1), Twice hand weeding @ 20 and 40 DAS (T2), Alachlor @ 1.5 kg a.i ha-1 (T3), Atrazine @ 1.0 kg a.i ha-1 (T4), Tembotrione @ 100 g a.i. ha-1 (T5), Alachlor @ 1.5 kg a.i ha-1 + Hand weeding (30 DAS) (T6), Atrazine @ 1.0 kg a.i ha-1 + Hand weeding (30 DAS) (T7), Alachlor @ 1.5 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T8), Atrazine @ 1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9). The experimental soil was clay loam. The results of the experiment revealed that weed control index (92.55%), crop dry matter production (13514 kg ha-1) were significantly higher in the plots applied with Atrazine @ 1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9) which was on par with twice hand weeding (T2). Application of Atrazine @ 1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9) registered the highest nutrient uptake of N, P2O5 and K2O (177.12, 42.14 and 126.51 kg). Among the weed management practices tried Application of Atrazine @ 1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9) recorded significantly maximum grain yield of 6518 kg ha-1 and lower grain yield was recorded in unweeded control (2452kg ha-1).
low yield of maize under Indian conditions may be attributed by number of factors, among them weeds rank as prime enemy. The yield loss in maize ranges from 28-93 % due to sever weed infestation. To minimize the weed losses, several weed control methods are available such as mechanical, cultural, chemical and biological methods. Traditional hand weeding is the most efficient and widely adopted practice of weed control, but it is labour intensive, time consuming and costly due to high wage rates which narrowed down the profits of the cultivation. Keeping in view of these limitations, the use of herbicides is the best way which gives a quick and cost-effective control of weed problems. With this backdrop, a field experiment was conducted at the experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University during summer (Feb-May 2016) to know the effect of different weed control methods on weed control index, yield and economics in maize (zea mays l.). The experiment was conducted in RBD with 9 treatments replicated thrice viz., Unweeded control (T1), Twice hand weeding @ 20 and 40 DAS (T2), Alachlor @ 1.5 kg a.i ha-1(T3), Atrazine @1.0 kg a.i ha-1 (T4), Tebrombione @ 100 g a.i. ha-1 (T5), Alachlor @ 1.5 kg a.i ha-1 + Hand weeding (30 DAS) (T6), Atrazine @ 1.0 kg a.i ha-1+ Hand weeding (30 DAS) (T7), Alachlor @ 1.5 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T8), Atrazine @1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9). The experimental soil was clay loam. The results of the experiment revealed that weed control index (92.55%), was significantly higher in the plots applied with Atrazine @ 1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9) which was on par with twice hand weeding (T2). Among the weed management practices tried, application of Atrazine @1.0 kg a.i ha-1 + Tembotrione @ 100 g a.i. ha-1 (T9) recorded significantly maximum grain and stover yield of 6518 kg ha-1 and 8912 kg ha-1 which was on par with twice hand weeding 6420 kg ha-1 and 8839 kg ha-1 and lower grain and stover yield was recorded in unweeded control of 2452 and 3412 kg ha-1 respectively. Among the treatments, higher gross return of Rs. 115262 ha-1, net return of Rs. 76575 ha-1 and benefit cost ratio of 2.97 was registered with atrazine @ 1 kg ha-1 (pre) + tembotrione @ 100 g ha-1 (post). The next best was twice hand weeding where the gross returns of Rs. 113559 ha-1, net returns of Rs. 72597 ha-1 and benefit cost ratio of 2.77. The least gross return of Rs. 43390 ha-1, net return of Rs. 6928 ha-1 and benefit cost ratio of 1.19 was recorded in unweeded control.
Effect of post-harvest application of anti-oxidants on shelf life and biochemical composition of sapota cv. Kalipatti during storage at ambient temperature

1 D. Saritha, 2 Lalitha Kumari. B. Dr. 3 M. Barathi, 4 Dr. K. Krishna Mohan

1-Lecturer in Loyola Academy Hyd, 2- Head, Department of Botany KU, 3- College of Horticulture, RJNR Hyd, 4 - Dean of Sciences, LA Hyd

A laboratory experiment was conducted in the department of Agricultural Sciences and Rural Development, Loyola Academy to know the effect of post-harvest application of anti-oxidants on shelf life and biochemical composition of Sapota Cv. Kalipatti during ambient temperature storage condition. The anti-oxidant treatments in this experiment consist of T0 - control, T1 ascorbic acid (500 ppm), T2 (AA - 1000 ppm), T3 (Sodium Benzoate - 500 ppm), T4 (SB - 1000 ppm), T5 (BA - 25 ppm), T6 (BA - 50 ppm). Sapota fruits were given dip treatment, the results of this experiment revealed that Sapota fruits treated with BA - 50 ppm and kept at ambient temperature recorded the highest shelf life (12.67 days) followed by BA - 25 ppm (12.33 days) compared to other treatments. Untreated fruits recorded the shortest shelf life of 7.34 days. Fruits treated with BA - 50 ppm showed reduced rate of oxidative metabolism through retarded catalase activity followed by BA - 25 ppm (424.34, 438.77 µL of H2O2 decomposed/ml. Enzyme/minute), compared to other treatments. Highest catalase activity was recorded (711.33 µL H2O2) was recorded in fruits under control. Similar results were also observed for reduced peak of ethylene production. The extension of shelf life of Sapota fruits with BA is due to its potential anti-oxidant and free radical scavenging activity.
Effect of dietary inclusion of Condensed Distillers Solubles (CDS) on nutrient utilization in growing calves

Nagireddy Nalini Kumari  
PVNR Telangana Veterinary University, Hyderabad, India

The condensed distillers Solubles (CDS) has high energy, protein and phosphorus and it is relatively inexpensive by product from ethanol production. A growth trial for 120 days was conducted using eighteen growing calves, which were randomly allotted to the three experimental sorghum stover based complete rations at 50:50 roughage to concentrate ratio with varying levels of CDS (DM basis) viz. T0 (0% CDS), T5 (5% CDS) and T10 (10% CDS). A study on storage of CDS was also carried out for 60 days by evaluating the nutrient composition and Aflatoxin level. The proximate composition and fibre fractions viz., dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF), nitrogen free extract (NFE), total ash (TA), neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose, cellulose, calcium and phosphorus of CDS were 34.95, 87.8, 24.52, 13.27, 2.14, 47.87, 12.2, 5.57, 3.23, 2.34, 1.43, 0.12 and 1.28 per cent, respectively. Copper, zinc, manganese, iron (ppm) and elemental Sulphur (%) of CDS was 4.21, 95.52, 21.06, 106.43 and 0.08, respectively. No significant difference was observed in dry matter intake (DMI) among the three experimental complete rations. No significant difference was found statistically (P>0.05) among the CDS supplemented complete ration (T5 and T10) in the digestibility coefficient of DM, OM, CP and NFE and it was comparable to control (T0). The EE intake was significantly (P<0.05) increased in T10 followed by T5 and T0. No significant difference was recorded in the Digestibilities of EE, CF and fibre fractions among the experimental rations. The calves fed T0, T5 and T10 rations were in positive nitrogen balance. The digestible crude protein (DCP), total digestible nutrient (TDN), digestible energy (DE) and metabolizable energy (ME) contents of the three experimental rations were comparable. DCP intake (g/d or g/kg w0.75) and TDN intake (g/d or g/kg w 0.75) was not significantly (P>0.05) different among T0, T5 and T10 rations. There was loss of OM and total carbohydrates on DM per cent and these were increased significantly (P<0.01) with advancement of storage period. There was no significant effect of storage period on CP and EE loss. The DM content was increased significantly (P<0.01) with advancement of storage period. There was increased Aflatoxin levels significantly (P<0.01) with advancement of storage period but, these levels were in safe permissible levels for calves. The results of the study implied that, growing calves fed varying levels of CDS based sorghum stover rations met the nutrient requirements indicating that, CDS is considered as suitable which can replace the traditional feed ingredients. It is concluded that, the CDS could be included in the complete diets of the calves up to 10 per cent on DM basis without affecting the health of the calves. Further the CDS was stored longer, that affected the loss of OM and total carbohydrates. It could be used up to 20 days with minimal loss of nutrients and odour.
Effect of sea weed extracts on seedling vigour of blackgram (Vigna mungo l.)

M. Venkatesan1, A. Parthiban2 and G. Sathiya Narayanann3
Annamalai University, Tamil Nadu, India.

Pulses constitute the major concentrated source of dietary protein. Among the various pulses, blackgram or urdbean scientifically known as Vigna mungo L. belonging to the family leguminaceae, is one of the most important pulse crop in meeting the requirement of dietary protein. A major constraint for storability in poor status and hence seed invigoration treatment plays a major role by using seed extracts. In the present investigation, the blackgram varieties of VBN3, VBN4 AND VBN5 were collected and imposed to accelerated aging best. The aged seeds were treated with sea weed Sargassum (0.75%), Ulva (0.75%) and Turbinaria (0.75%) and studied the seedling vigour. Based on the laboratory experiment, VBN3 treated with sea weed Sargassum (0.75%) showed maximum germination percent, seedling length, seedling fresh weight and seedling vigour index. The cultivar VBN3 treated with sea weed Sargassum (0.75) exhibited higher percentage increase over control for germination percent, drymatter production, seedling vigour index and moderate for seedling length and seedling fresh weight. Based on above results the seeds of VBN 5 and VBN 3 treated with Sargassum (0.75%) could be used for long period storage and used for further research programme.

Keywords: Blackgram, Sea weed extract, Seed vigour.
Effectiveness of lathyrus sativus L. grain as animal feed

Dr. Vandana S. Madke and Dr. Bhavana R. Wankhade
College of Agriculture, Nagpur Dr. P.D.K.V, Akola

Lathyrus (Lathyrus sativus L.) is an important legume crop with low cost and easy cultivation grown in India, Bangladesh, China, Ethiopia, Nepal, and Pakistan for human food and animal feed. Inherently Lathyrus possesses resistance to drought, excess moisture, salinity, diseases, and insect pests. As Lathyrus has an ambivalent reputation due to ODAP content in its plant parts, efforts are on to develop low or ODAP free Lathyrus varieties with high biomass for dual purpose for human food and animal feed. Older published animal feeding studies are of limited use, since the presence and role of ODAP was unknown until the 1960s. More recent feeding studies indicate that low ODAP lines of L. sativus can be safely incorporated at inclusion rates up to 40, 30 and 70% of the diet of poultry, pigs and sheep, respectively, without growth reductions (Hanbury, et.al, 2000). Lathyrus is known as excellent feed and fodder crop for centuries as a main concentrate for horses (Anonymous, 1894). Livestock is a key component of farming systems in South Asia and in Africa, and most particularly with small and marginal farmers, estimated about 678 million, and indicates importance of livestock to their livelihoods (ILRI, 2000). Lathyrus is increasingly recognized as an important feed and fodder crop by their source poor farmers of semi-arid and dry areas. Acceptability of low ODAP varieties by the farmers of non-traditional Lathyrus growing areas and high nutritional composition makes the Lathyrus a perfect dual purpose for crop securing food, feed and fodder security in the region. (Sarkar, et. al., 2010) As world demand for legume feed protein is likely to increase, due to increasing demand for animal food products, L. sativus are crops that should be considered in regions with suitable environments (Hanbury, et.al, 2016).
Salinization of fertile agricultural lands has gained global concern. Globally about 1125 million hectares of lands are salt affected. In India, there are approximately 8.62 million hectares salt-affected lands and 1.93 million hectare kilometers area with ground saline water prevalent in various states. About 40 % of these lands are located in North western states Haryana, Punjab, Rajasthan and Uttar Pradesh. Nature of saline soils differs from state to state. These unproductive lands are new resources and an opportunity for the development of aquaculture which generates income to the farmers whose lands became saline, livelihood, employment, nutritional security and foreign exchange earnings to the nation through exports of marine finfish and shellfish. Inland saline water differs from sea water in ionic composition. Inland saline waters are low in potassium, high in calcium and variable concentrations of magnesium. The inland saline water with low potassium is a common feature in almost all the countries. Therefore, amendment of potassium is essential for certain finfish and shellfish species to culture in inland saline waters.

The concept of aquaculture in inland saline soils was initiated by this institute at Sultanpur, Gurgaon District, Haryana during 1982. Preliminary pilot scale studies were successfully conducted on culture of marine species such as tiger shrimp, milk fish, grey mullet and pearl spot, and freshwater species giant freshwater prawn. These species were cultured successfully without ionic amendment. Later the Center was shifted from Sultanpur to Rohtak, Haryana for development better R & D and HRD facilities. Similar trials on various species are initiated in similar manner as carried at Sultanpur. Certain species such as milkfish, grey mullet, sea bass and carps are survived without ionic amendment. However, tiger shrimp didn't survive in the unfortified inland ground saline water IGSW). After having amended IGSW with potassium equal to the sea water of similar salinity, the tiger shrimp survived. Repeated trials with various levels of potassium amendment revealed that tiger shrimp can survive with 50 % level of potassium amendment equal to the similar salinity of sea water without effecting growth and survival of shrimp. As outbreak of white spot syndrome virus (WSSV) tiger shrimp culture was completely diminished in India.
Later, Pacific white shrimp was introduced on experimental scale as an alternative to tiger shrimp during 2006. Having obtained successful results on pilot scale, Pacific white shrimp was introduced for commercial farming in limited areas by the coastal aquaculture authority (CCA) of India during 2009. For the first time Pacific white shrimp was introduced in inland saline soils using IGSW at ICAR-CIFE Rohtak Regional Centre during 2012. Unlike tiger shrimp, Pacific white shrimp is sensitive to magnesium (Mg2+) ion concentration also. Therefore, it is essential to maintain ratio of calcium (Ca2+) and magnesium (Mg2+) ions at par with sea water. In sea water the ratio of Ca2+ and Mg2+ ranges between 1:3.0 and 1:3.5. Trials carried using Ca2+: Mg2+ at different ratios on culture of Pacific white shrimp revealed that a minimum of 1:2.5 is desirable in IGSW without effecting growth and survival. With the amendment of K+ ion and maintaining Ca2+: Mg2+ ratio a production of 13.50 tons/ha/120 days was achieved in the first demonstration in IGSW. Later the technology was demonstrated to the farmers of Haryana, Punjab and Rajasthan. There are about 2000 acres of inland saline soils brought under Pacific white shrimp farming in these three states. The farmers are getting 2.0 to 3.0 tons/acre /120-130 days with a net income ranging between Rs 3.0 and Rs. 4.0 lakhs/acre.

In addition to shrimp farming, finfish species such as pangasius, genetically improved farmed tilapia (GIFT), red tilapia, Amur carp, cobia and pompano were tested in IGSW. Commercially feasible technologies have been developed for the culture of GIFT and pangasius, the production achieved was 10 and 18 tons/ha/7-8 months with a net income of Rs 2.5 to 3.0 lakhs/acre respectively.

As stated above the texture of saline soils vary from state to state. The saline soils of North western states are different from Maharashtra. In Maharashtra more than 1.0 lakh hectares of sugarcane fields which are black cotton soils became saline in the four western Maharashtra districts Pune, Satara, Sangli and Kolhapur. These soils are idle for the last more than four decades and the salinization is increasing at an alarming rate of 10% every year. Efforts are made to reclaim these saline soils with an innovative integrated technology using aquaculture and sub-surface drainage (SSD) system. With the implementation of the system sugarcane production increased between 45 and 112 tons/acre from baseline production of 0 to 25 tons/acre. Similarly soybean production increased to 16.6 quintals/acre from baseline production of 4-5 quintals/acre. Implementation of these technologies enhances the productivity of saline soils and provides substantial income to the farmers.
Studies on diallel analysis in rice (Oryza sativa l.)

M. Venkatesan¹, A. Parthiban²
Annamalai University, Tamil Nadu, India.

An investigation was carried out at Plant Breeding Farm, Faculty of Agriculture, Annamalai University, Annamalai Nagar, during 2004-2006. Six rice genotypes were involved in this study. Diallel analysis was carried out based on the method I and Model I as suggested by Griffing (1956). Seven economically important traits viz., Days to 50 percent flowering, plant height, Number of productive tillers per plant, Number of filled grains per panicle, panicle length, 100 grain weight and grain yield per plant were evaluated based on per se performance, general combining ability effects, specific combining ability effects, gene action and heterosis.

Analysis of variance showed significant deviation among the parents for all the traits except number of productive tillers per plant. The present investigation also recorded preponderance of additive gene action for all the seven characters studied.

The experimental results showed that the parents NANJING 3678 AND ad 95137 were superior over other parents for most of the traits studied. Based on per se performance and combining ability studies, the crosses AD 95157 X AD 95137 and AD 95137 X NANJING 3678 showed high mean, highly significant sca effects and highly significant heterosis for grain yield and for most of its component traits. Hence, these crosses were recommended for heterosis breeding. The hybrid namely, AD 95128 X NANJING 3678 is quite suitable for recombination breeding, as this hybrid registered high mean, non-significant sca effects and high per cent of heterosis for most of the traits including grain yield per plant.
The present study was undertaken on cows with reproductive disorders like repeat breeding and anoestrous to identify the Uridine-5 Monophosphate Synthase (UMPS) genetic disorder by Polymerase Chain Reaction (PCR) - Restriction Fragment Length Polymorphism (RFLP) in Cytogenetic Investigation Laboratory of Department of Animal Genetics and Breeding at Bombay Veterinary College. Total 102 animals’ blood samples were collected which were subjected to PCR amplification. The UMPS gene amplified PCR product were digested by using Ava I restriction enzyme at 37°C for 4 hours. The final PCR product was electrophoresed on 2% agarose after digestion. The amplified PCR product size was 108 base pair digested by Ava I yielded three bands of 53, 36 and 19 base pair (bp) respectively for wild animals, but due to less size of 19 bp, it was not visible in RFLP. It was found that all the selected animals for the research had shown normal results. As per the previous studies, it is suggested that there is a possibility of mutant gene which is directly related to the reproductive performance of Indian cattle. Therefore, it is important to screen the animals to avoid the increase in the disease prevalence.
Biofertilizers are known to play a number of vital roles in soil fertility, crop productivity and production in agriculture as they are eco friendly. Biofertilizers are compounds of organic matter that are applied to crops for growth and health. Their constituents of micro-organisms biologically interact with the soil, root and seed of plants, promoting the growth of micro-flora that enhances soil fertility. As chemical fertilizers cause a deterioration of the soil vitality over time, biofertilizers are attractive alternatives, benefiting harvests and soil alike. Some Biofertilizers (eg, Rhizobium, BGA, Azotobacter sp) stimulate production of growth promoting substance like vitamin-B complex, Indole acetic acid (IAA) and Gibberellic acids etc. Phosphate mobilizing or phosphorus solubilizing Biofertilizers or microorganisms (bacteria, fungi, mycorrhiza etc.) converts insoluble soil phosphate into soluble forms by secreting several organic acids and under optimum conditions they can solubilize or mobilize about 30-50 kg P2O5/ha due to which crop yield may increase by 10 to 20%. Mycorrhiza or VA-mycorrhiza (VAM fungi) when used as Biofertilizers enhance uptake of P, Zn, S and water, leading to uniform crop growth and increased yield and also enhance resistance to root diseases and improve hardiness of transplant stock. They improve physical properties of soil, soil tilth and soil health in general. They improve soil fertility and soil productivity. The use of bio-fertilizers leads to improved nutrients and water uptake, plant growth and plant tolerance to abiotic and biotic factors. These potential biological fertilizers would play a key role in productivity and sustainability of soil and also in protecting the environment as eco-friendly.

Key words: Biofertilizers, Microorganisms, Rhizobium, Mycorrhiza, Soil fertility, Soil Productivity.
In agricultural pest control the use of chemical pesticide and its consequent damage to environment has led to study about the nano formulation to control over pest with very low amount of pesticide and consequently less damage to environment. Nanotechnology is a new field that has been come in various applied sciences; it can further improve our understanding of the biology of different crops and thus potentially enhance yields. It can offer routes to plant disease diagnostics, insect pest management and efficient pesticides utilization. Using nanotechnology to design and prepare novel formulation in agricultural pest management. Nanotechnology deals with the particle at nano scale (1-100nm). These particles at nanoscale show some properties which are different from macro scale, thus enabling unique properties for agriculture there are many preparation for controlled release formulations, such as- Nanosphere, Nano Capsules, Nanogels and micelles. Some of the techniques such as matrix-capsulation and micro-encapsulation used for nano formulation. The specific properties of these nano-scale materials, such as their ability to dissolve in water more effectively than the existing products or their increased stability, are designed to maximize the effectiveness of these pesticides. Beta-cypermethrin, Imidacloprid, Pyridalyl and Triazophos emulsion are important nano formulation incorporated into nano emulsion have shown excellent results as compare to their macrosize. One of the most promising aspects of nano technology is to promote a more efficient active compound in a matrix in order to protect core materials from adverse reaction due to factors like air or light. The benefits of nanoinsecticides intended for reduction of the insecticides quantity per hectare, costs, and the toxicity in soil and groundwater and increase in the quality of treatments, and enhancement of properties such as efficacy, specificity, and increase of the yield.

Key words: Nano, Particle, Capsules, Technology, Chemical, Formulation and Pest management.
Species composition of thrips infesting chilli crop

G. Venu Gopal, K. Vijaya Lakshmi, B. Sarath Babu, P. Kishore Varma and V. Shashi Bhushan
PJTS Agricultural University, Hyderabad

Field experiments were conducted during 2014-15, Kharif to study the species composition of chilli thrips. The species composition of chilli thrips was studied by collecting the thrips from leaves, flowers and fruits and identified by using the taxonomic keys. The thrips species inhabiting the leaves and fruits were identified as Scirtothrips dorsalis, while the flowers were colonized by four species of thrips, of which three species viz., Frankliniella schultzei, Thrips palmi and Thrips hawaiiensis belong to the family Thripidae of Terebrantia sub order and the fourth species Haplothrips verbasci belongs to the Tubulifera sub order of phi neothripidae family. Among blossom thrips, F. schultzei was the predominant species constituting 84.4% of the total population followed by H. verbasci (10.80%) and T. hawaiiensis (4.20%). T. palmi was found in very low numbers (4) and it constituted 0.60% of the total population.
Green synthesis of silver nanoparticles using different plant leaf extract for Nagpur mandarin coating - An Ecofriendly Approach

S. D. Deshmukh1*, S. R. Patil2, Shilpa D. Deshmukh3 and A. P. Gedam4
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS)

Green or ecofriendly synthesis of nanoparticles is new, safe, speedy and emerging trend in field of Nano-technology. The present study conducted at Post harvest technology laboratory, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola and aimed to synthesis of silver nanoparticles from silver nitrate solution using leaf extracts of Neem, Tulsi, Custard apple and Guava. The reason of using leaf extracts was the biomolecules present in the plants act as reducing and stabilizing agents and increase the rate of reduction of silver metal and synthesis of nanoparticles. The characterization and detection of synthesized nanoparticles were confirmed using the SPR optical absorption band peak ranges from 420 to 560 nm by UV- vis Spectrophotometer and screening of antimicrobial potential against citrus fruit pathogen by disk diffusion method. These biosynthesized silver nanoparticles were mixed with guargum as a sticking agent and used as a coating material for Nagpur mandarin to increase the shelf life of mandarin fruits. It was found that green synthesized silver nanoparticles increase the shelf life of Nagpur mandarin by arresting weight loss, fruit decay rate and microbial count due to antimicrobial activity of silver nanoparticles without affecting quality of fruits for two months.

Key words – Nagpur mandarin, Silver nanoparticles, Shelf life, Spectrophotometer
Marketing of goats around Nagpur city

Sachin Rajaram Todkar  
Sharad College of Agriculture, Jainapur, India

This study was undertaken in Nagpur (Mominpura), Kamthee, Pardi and Bhiwapur goat markets of Nagpur district. The data were collected from 100 sellers, 100 purchasers and 100 brokers selecting randomly. The specific objectives of the study were i) To evaluate the marketing systems of goat. ii) To study the price structure of goat iii) To find out the problems in marketing system of goat. Seller – broker – Purchaser marketing channel was observed in these selected markets while few transactions were observed through direct channel. Price structures of goat were observed on the basis of age, weight, health and physical appearance. In case of goat for milk i.e. doe attachment and placement of udder point was considered with above criteria’s. Average marketing cost per goat age of up to 6 months, 6 to 12 months and above 12 months age goats were highest, medium and lowest respectively were observed, due to which subsequent results were seen in price received by seller and price paid by purchaser. The prices of goat were affected due to middlemen, transportation and market charges. Major reason of sale was to generate the income and problems like financial and shortage of fodder were found. Malpractices in the markets were observed as the broker plays major role in goat transactions, these malpractices should be avoided by making control on brokers or if possible eliminate the brokers from the market. It is found that market committees are unable to provide basic facilities in market like adequate land, goat shed, fodder, clean water, etc. these facilities should be available in the market in order improve the marketing system of goats.
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Phone: +91-40-27892790 Email: contact@pasuracropcare.com