

Seed Tech News



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**Recommendations of
XIV National Seed Seminar
"Food Security through Augmented Seed
Supply under Climate Uncertainties"
(January 28-30, 2017)
ICAR-Indian Agricultural Research
Institute, New Delhi, India
(Venue: Dr. B.P. Pal Auditorium**

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RECOMMENDATIONS

The XIV National Seed Seminar (NSS) was organized by the Indian Society of Seed Technology (ISST), New Delhi in association with Indian Council of Agricultural Research (ICAR), New Delhi, ICAR-Indian Agricultural Research Institute, New Delhi and Department of Agriculture Co-operation & Farmers Welfare, Govt. of India at the Dr. B.P. Pal Auditorium, IARI, New Delhi during 28 to 30 January, 2017. In total, there were nine Technical Sessions besides; Inaugural Session, Ch. Amir Singh Memorial Lifetime Achievement Award Lecture Session, Panel Discussion Session, ISST Young Scientist Award Presentation Session and Plenary-cum-Prize Distribution Session were held during this seminar. Concurrent with Technical Sessions, the Poster Sessions were also held.



The Seminar was inaugurated by Shri Parshottam Rupala ji, Hon. Minister of State for Agriculture and Farmers Welfare and Panchayati Raj, Govt. of India. The Session was chaired by Dr. R. S. Paroda, Chairman, TAAS. Dr. T. Mohapatra, Secretary, DARE & DG, ICAR, Dr. Gurbachan Singh, Chairman, ASRB and Dr. R.R. Hanchinal, Chairperson, PPV&FRA graced the occasion as the guests of honour. The ISST President, Dr. S. Rajendra Prasad welcomed the guests and delegates. Dr. K.V. Prabhu, Joint Director (Research), ICAR-IARI and Chairman, Local Organization Committee presented the themes of the seminar and vote of thanks was proposed by Dr. D.K. Yadav, Head, Division of Seed Science and Technology, ICAR-IARI, New Delhi.

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A. Recommendations/Suggestions to Ministry of Agriculture, Cooperation and Farmers Welfare: (11 Nos)

1. Concerted efforts are needed for early clearance and passage of New/Revised Seed Bill (*pending for more than a decade*) and the Biotechnology Regulatory Authority of India Bill.
2. The Intellectual Property landscape should be smoothed / relaxed for the seed industry with reference to issues related to NBA/IPR/PVP&FRA, especially in the context of export/import and patents.
3. The current business environment for seed sector should be re-assessed and adequate policy support should be provided, so to achieve the target of doubling farmers' income by 2022.
4. A robust mechanism with stringent monitoring system should be put in place to check /prevent sale of spurious seed, along with a provision for heavy penalty in case of contravention of such provision. It should also take into account the basis for truthful labeling by the companies, ensuring that the basic infrastructure and trained manpower for seed testing are in place.
5. A specific day in a year should be designated as **National Seed Day (Rashtriya Beej Diwas)** and organized at national/ regional/ state and district levels to create awareness about the benefits of using quality seeds, suitable crop varieties, reliable seed sources and other seed-related technologies; -16th October or 29th December can be an option –as these coincide with 'World Food Day' or "the Day of Enactment of the Seeds Act".

Specific recommendations focused to boost up seed exports :

6. There should be a National Body at Division of Seed Science and Technology, ICAR-IARI with the provisions for accreditation to other national seed testing laboratories similar to ISTA
7. A separate body needs to be instituted, exclusively for boosting seed exports (Seed Export Promotion Council).
8. An effective single window system (SWS) is required to be established for clearance of export proposals.
9. There is an urgent need for improvement in Intellectual Property Protection legislation and enforcement. .
10. Predictable regulatory system is needed for approval of new traits, including biotech traits.
11. The process of completion of Pest Risk Analysis for key crops is entailed.

B. Recommendations on Policy Issues: (12 Nos)

1. The strengthening of DUS testing centers, harmonizing the guidelines as well as reducing the time period for granting PPV&FR registration, by cutting down the number of DUS trials and adopting European/international norms is required.
2. Public sector should develop proper biotechnology policy framework and regulatory arrangements for ensuring required compliances.
3. The scope and benefits of germplasm exchange / sharing between and within public-private sectors should be deliberated and policies /guidelines developed in the interest of timely and proper use of the valuable germplasm available in the seed sector . There should be a simple and transparent procedure for the movement of germplasm for R&D.
4. Farmers' participatory seed production, development of seed hubs, and identification of alternate areas for seed production have to be continuous activities.
5. The establishment of Community Seed Banks for conservation of local genetic material and interlinking the Seed Banks with seed business (especially in the north east) should be a periodical exercise.
6. Novel local seed systems and alternative seed delivery models should be strengthened, A system of bringing the popular local / traditional / farmer's varieties in the formal seed chain needs to be considered, on the basis of at least one year field trial conducted by the location specific SAUs / ICAR institutes. NSC and other SSCs may be entrusted with the responsibility of seed production, quality assurance and marketing.
7. A provision should be made for deputing Seed Technologists in *Krishi Vigyan Kendras (KVKs)* for seed production activities and location specific seed research trials.
8. The competence in Human Resource should be ensured for the seed sector by imparting appropriate higher education, specialization and training; including strict and critical evaluation of the syllabi and facilities with the Institutions and Universities for PG programs in Seed Science & Technology.
9. The seed professionals and qualified seed technologists should only be considered for selection and promotion in areas involving Seed Science and Technology; and a level playing field should be allowed for seed technologists in other disciplines.
10. Climate Smart Agriculture (CSA) needs immediate implementation by way of special Schemes to adopt

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various means and technologies, such as seed treatments, known to mitigate' the impacts of climate change.

11. The strength of public and private sectors should be capitalized by 'synergistic approaches' many of which are already known, for facilitating effective public-private partnership (PPP).
12. The policy issues pertaining to all the seed related laws and regulations have to be periodically reviewed (at least once in ten years) and updated, keeping in view the developments (including the technological advances) in the seed sector.

C. Recommendations on Seed Program, Seed Research and Education: (10 Nos.)

1. Maintenance breeding is crucial for an effective system of quality seed production. Hence, it should be an integral component of the seed production chain and monitored meticulously as a routine.
2. In view of the shifts in the weather patterns, old varieties need to be evaluated under different changing weather conditions instead of discarding.
3. Modern methods of seed quality assessment need to be adopted for higher precision and uniformity, using advanced technologies and appropriate instruments. Necessary instrumentation, infrastructure development and trainings need to be given priority. Standard procedure (s) / formulae for calculating SRR and VRR (also referred as CRR-Cultivar Replacement Rate) to be developed and published regularly for different zones and crops.
4. Standard seed vigor testing methods (and instruments if required) have to be identified, catalogued and recommended (crop wise) with well defined protocols for uniform adoption by all concerned. Reporting of 'seed vigour status' should be made compulsory in case of revalidated seed lots for ensuring satisfactory field performance of a seed lot. Quantification of 'seed vigour' should be the aim and 'minimum required vigor status' should be prescribed (crop wise and test method wise, as may be relevant). A special/ Core Group must be formed, including researchers from the leading laboratories in the public sector research institutions and representatives from the select labs in the public/private sector seed industry to develop and recommend appropriate Vigour tests for major food crops.
5. Seed testing procedures and Minimum Seed Certification Standards should be standardized for such pasture legumes, medicinal plant species, seed spices

and other crops, which are not available in ISTA.

6. Efforts should be intensified to explore and promote the use of biologicals, nano-formulations and patented technologies as seed treatments to combat abiotic stresses.
7. Research on the development of Post Priming technologies for prolonged storability, RNAi and chemical signalling for seed quality enhancement need special focus.
8. Molecular techniques / procedures for testing 'Seed Vigour', 'Genetic Purity' and 'Seed Health' should be standardized and included in the official gazette relating to seed testing procedures for uniform adoption. Research on the use of molecular markers to test 'essentially derived varieties' should be given priority. For finger printing of varieties protected / registered under PPV&FRA, a core set of markers should be identified and notified by NBPGR.
9. The studies on the role of maternal genes in seed development and integration of maturation and germination pathways in seed through genetic controls with focus on using modern tools is required to understand the molecular aspects of seed longevity and seed quality parameters.
10. Modern post-harvest management technologies to combat storage losses should be standardized and practiced.

Follow up Committee Proposed

The members of proposed follow-up committee will be; Dr. K. V. Prabhu, Joint Director (Res.), ICAR-IARI, New Delhi, Dr. S. Rajendra Prasad, President, ISST, New Delhi, Dr. Malavika Dadlani, Former Joint Director (Res.), ICAR-IARI, New Delhi, Dr. D.K. Yadava, Head, DSST, ICAR-IARI, New Delhi, Dr. Arvind Kapoor, MD, Rasi HyVeg (P) Ltd, Gurgaon, Mr. Rajvir Rathi, Vice President, Bayer Crop Science Ltd., Dr. Sandeep Kumar Lal, Treasurer, ISST, New Delhi and Dr. Shiv K. Yadav, Secretary, ISST, New Delhi.

Session Wise Proceedings

1. Inaugural Session -28th Jan : 0930-1045 h

Following points emerged out of deliberations during this session.

- Hon. Minister desired that all the key recommendations may be presented to him by a committee or group led by the Secretary, DARE & DG, ICAR, New Delhi for initiating policy related discussions / directions;

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- The Seed Bill 2004 has to be taken forward and given a due place for consideration and passage in the current Lok Sabha;
- The private sector should be involved as an effective partner for making available quality seed of superior varieties to the farmers. Their problems related to seed production and distribution / marketing have to be looked into and required changes, if any, be made in executing the Seeds Act as well as the other Acts and regulations;
- New technologies such as 'GM Bt' have to be considered with due reference to their overall merits and the values they add and then promoted; and
- Buffer stock for seed is to be made mandatory; and space / infrastructure for the food grain buffer stock need to be suitably modified and utilized for 'seed buffers; instead of new setup.

2. **Ch. Amir Singh Memorial Lifetime Achievement Award Lecture Session -28th Jan : 10.45-11.30 h**

After the formal welcome, Dr. K.V. Prabhu briefed about the contributions by Late Ch. Amir Singh and expressed thanks to Mr. Narender Singh, son of Late Ch. Amir Singh Ji for the financial support of Rs. 5.00 lakh to initiate the life time achievement award. Ch. Amir Singh Memorial Lecture was given by Dr. S. A. Patil, Former Director, IARI, New Delhi & Vice-Chancellor, UAS, Dharwad. Dr. Patil shared his experience and suggested that:

- The seed program should be independent of the breeding program; but, the necessary linkages with the breeding program should be ensured;
- Maintenance breeding is crucial for success in seed production program. Hence, it should be suitably in-built within the system and compulsorily/meticulously carried out as a matter of routine;
- Multilocation testing of varieties is essential to evaluate the adaptability, potentiality and variability;
- Certified seed production of each variety/hybrid in seed production chain should be taken up by individual institute/university/company. The public sector organization/s may take the variety/hybrid which is not taken up by private players;
- In view of the shifts in the weather patterns, old varieties have to be evaluated under various changed weather situations now, instead of discarding them as such;
- Seed farms / firms should have the essential facilities and equipments, particularly for establishing the basis for truthful labeling by the firms/companies;
- Farmers must be actively associated in the seed programs. Effective partnerships with them are a must in seed programs;
- Panchayats should be involved in seed production and basic data generation; and

- Dry lands /areas have to be explored for economically viable seed programs for which appropriate policy formulations are required.

3. **Panel Discussion Session (Emerging needs for research in seed science and technology and challenges for seed industry) -28th Jan : 12.00-13.30 h**

Eleven scientists and seed professionals from public and private sectors, in addition to Chair and Co-chair of session participated in the deliberations. Salient points surfaced from the Panel discussion are summarized below:

- Close/strong partnership between public and private sectors is needed to enhance availability of quality seed;
- R&D programs should have a mandatory provision for robust Maintenance Breeding activities with adequate financial support;
- Seed quality assessment methods and the required instruments have to be identified, standardized and published for uniform adoption by all concerned;
- Policy issues pertaining to all the seed related laws and regulations have to be periodically reviewed (at least once in ten years) and updated keeping the developments (including the technological advances) in the seed sector;
- Diseases / pathogens listed as 'Designated' from seed certification view point have to be reviewed; and updated/ revised;
- Seed Multiplication Rates (SMR) may vary among varieties / hybrids, depending on the 'seed rates and seed yields'. Realistic SMRs should be used in planning and arranging 'seed production';
- Standard procedure(s) / formulae for calculating SRR and VRR (also referred as CRR-Cultivar Replacement Rate) have to be developed and published for uniform adoption by all concerned;
- One specific day in a year should be designated as National Seed Day (Rashtriya Beej Diwas); 16 October or 29 December can be an option –as it coincide with 'World Food Day' or "the Day of Enactment of the Seeds Act".
- Standard seed vigor testing methods (and instruments, if any required) have to be identified, catalogued and recommended (crop wise) with well defined protocols for uniform adoption by all concerned;
- Seed vigour testing and reporting on 'seed vigour status' should now become a routine – as is the case with Germination;
- Quantification of 'seed vigour' should be the aim and 'minimum required vigor status' should be prescribed (crop wise – as may be needed);

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- A robust mechanism should be followed to check / prevent sale of spurious seed ; with provision for heavy penalty;
- Public sector should develop proper biotechnology policy framework and regulatory arrangements ensuring required compliances;
- Scope and benefits of germplasm exchange / sharing between and within public-private sectors should be deliberated and policies /guidelines developed in the interest of timely and proper use of the valuable germplasm available in the seed sector (before germination/vigour decline sets in); and
- Simplified procedure for testing the homo / heterogeneity of seed lots should be developed and made available for uniform adoption by all concerned.

The deliberations during the panel discussions identified the undernoted constraints in increasing the availability of hybrid seeds:

- Inferior grain quality of F1s; low seed yields affecting economic viability of seed production; limited information on 'seed production agronomy' to enhance F1 seed yields; instability-breakdowns in male sterility; inconsistencies in fertility restoration; genetically impure parental lines; inadequate availability of quality seeds of parent lines; high cost of parent seed; and occasional breakdowns in disease/insect resistance of F1 hybrids. Limited exchange/sharing of germplasm has also hampered the progress of hybrid development. Climatic variability/changes, especially in the recent years, and the consequent impact of biotic and abiotic stresses further confound the problems;
- Initial breeding efforts for developing hybrids are expensive and strenuous. F1 seed production costs are also comparatively high. Further, the present level of knowledge and preparedness are inadequate to prevent the occasional loss of entire seed crops owing to environment factors;
- Hybrid development in temperate vegetables and flowers and their F1 seed production are still limited and need thrust and promotion. New challenges can be expected to emerge with them too; and
- With the periodical mergers and acquisitions, the seed industry is marked by occasional structural changes and transitions resulting in small seed businesses giving way to larger enterprises that integrate breeding, seed production, conditioning and marketing functions. Similarly, F1 hybrids particularly in vegetable crops and GMOs are mostly owned / patented by larger companies. This again limits the growth and development of small enterprises.

4. Technical Session-I: Sustainable quality seed production under changing climate -28th Jan: 14.30-16.15 h

The perspectives that became apparent based on the presentations are listed below:

- Infrastructure for seed processing and storage needs strengthening;
- Identification of alternate areas for seed production has to be a continuous activity;
- Farmers' participatory seed production and seed hubs development should be encouraged;
- Climate Smart Agriculture (CSA) needs immediate implementation by way of special schemes to adopt the various measures and steps known to 'over smart/mitigate' the impacts of climate change;
- Strengths of public and private sectors should be capitalized by 'synergistic approaches 'many of which are already known. Now, giving effect to them remains; and
- An oral presentation on 'Traditional rice varieties for rainfed ecosystems of Assam' emphasized the urgency to establish Community Seed Bank in the region to conserve the local genetic material with suitable interlinking of those Banks with seed business.

5. Technical Session-II: Seed quality enhancement technologies for meeting the challenges of abiotic and biotic stresses -28th Jan : 16.30-18.15 h.

The noticeable perceptions based on the lead and oral presentations in this session are listed below:

- Efforts should be intensified to explore bio-agents, nano-formulations and patented technologies for use in seed treatments/coating to combat unfavorable conditions;
- More research is required to understand the application of modern techniques such as Post Priming Technology, RNAi and chemical signaling for seed quality enhancement;
- Arrangements are needed to implement farmer/field level, simple, seed priming/coating methods to withstand unfavorable weather conditions, especially for high volume seeds handled by the industry;
- Nano-particles coated seeds should be supplied by IARI through 'Beej India', on trial basis;
- Hydrogel coating developed at IARI needs to be tested at field/farmer level for its affectivity and efficiency, especially for drought mitigation; and
- Scope for adopting various known priming/hardening techniques, including thermal hardening need to be explored through 'field level' trials.

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6. **Technical Session-III: Advances in seed quality evaluation technologies in agri-horticultural crops including medicinal plants -29th Jan : 09.30-11.00 h.**

The conspicuous suggestions based on the lead and oral presentations in this session are listed below:

- Seed testing procedures and Minimum Seed Certification Standards should be finalized for those pasture legumes, medicinal plant species and seed spices, which are still left out in this regard.
- Proven techniques/procedures for testing 'Seed Vigour', 'Genetic Purity' and 'Seed Health' should be identified and included in the official gazette relating to seed testing procedures for uniform adoption by all concerned. Apart from 'Uniformity', it will help in providing them the 'legal recognition/validity' required in 'seed businesses'.

7. **Technical Session-IV: Application of modern biotech and biological sciences in seed technology -29th Jan : 11.15-13.00 h.**

Two lead presentations followed by three oral presentations were made in this session. Points that emerged from the discussions are:

- Use of molecular markers to test 'essentially derived varieties' should be given priority;
- Restorer linked marker gene testing may be used for hybridity confirmation;
- For finger printing of varieties protected /registered under PPV&FRA, a core set of markers should be identified and notified by NBPGR;
- Focus on using modern tools is needed to understand molecular aspects of seed storability and seed quality parameters;
- Use of the term 'Research Variety', routinely and indiscriminately, in the seed industry, should be discouraged through appropriate provisions/amendments/notifications;
- Studies should be intensified on the role of maternal genes in seed development and integration of maturation and germination pathways in seed through genetic controls;
- Use of markers in characterization of maize hybrids in Kashmir and marker assisted development and identification of promising restorer lines in rice from Indica-Japonica materials with Rf_3 , Rf_4 genes are examples for moving forward; and

- Studies should be pursued on the possibility of using markers to transfer various pathways, including Ascorbate Glutathione cycle in important varieties of soybean.

8. **ISST Young Scientist Award Presentation Session - 29th Jan : 14.00-15.00 h..**

To recognize and promote excellence in research, education and innovation in area of Seed Science and Technology, the society invited applications for the award of "ISST Young Scientist" from researchers below 40 years of age as on 31st March of the year for which the award is to be given. Of the total applications received and screened for the calendar years 2014, 2015 and 2016, the award was bestowed for the years, 2014 and 2015 only as per the criteria set by the committee constituted for the purpose. Dr. D. Vijay, Senior Scientist, Indian Grassland and Fodder Research Institute, Jhansi highlighted his main contributions: (i) Developing the germination and dormancy protocols; and seed standards for forage crops; (ii) Identifying physico-chemical reasons for the viability loss in soybean; (iii) Biochemical markers tests for varietal identification in rice and (iv) Technologies to enhance seed production and seed yields in forage crops in his presentation of work for the year 2014. Dr. Shivanagouda R Doddagoudar, Assistant Professor, Dept. of Seed Science & Technology, Agriculture College, Raichur, UAS, Raichur presented his work for the year 2015. His main contributions are: (i) Morphological standardization of rice seedlings for transplantation and (ii) Active involvement in training the farming community, under the RAW Program, on seed testing procedures before sowing in field to enhance seed production and yield.

9. **Technical Session-V: Management of seed transmitted pests and diseases under conditions of climate change -29th Jan: 15.00-16.45 h.**

The lead presentation was focused on survey, surveillance, epidemiology and management of seed borne diseases and storage pests of rice, wheat, soybean and mung bean. It was followed by five oral presentations. Points emerged from the presentations and discussions are:

- Systematic survey and surveillance program on seed borne diseases should be strengthened in different agro-climatic regions of the country.
- Seed health testing laboratories with advanced facilities should be established as referral labs in the country.
- By the year 2020, 100 % seed treatment should be ensured with special emphasis on wheat and rice seeds.

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10. Technical Session-VI: Seed Processing and Storage options for Sustainability of Seed Supply System -29th Jan: 17.00-18.45 h.

To curtail post harvest losses, suitable technologies need to be employed; through thermoseeds, bio-fumigation, hermetic storage, modified atmospheric storage, use of insecticides, impregnated bags, seed treatment with nano-particles and also molecular and biochemical markers for seed deterioration. The practices and technological issues related to processing and storage for sustainability of seed supply system discussed in lead as well as oral presentations have been listed below:

- To combat post harvest storage losses, the scope for applying the following emerging technologies need consideration/ evaluation;
 - Seed image analysis for sorting and grading,
 - Thermo seed – control of seed borne pathogens without using pesticides,
 - Biofumigation – control of insect infestation using synthetic gaseous insecticides, e.g. Coumaran (5-30 µl/l) for 1 day to 7 days at 27±2°C,
 - Hermetic storage – seed preservatives under airtight conditions,
 - Triple layer bags –two layers of polythene or polypropylene and conventional jute,
 - Modified atmospheric storage,
 - Use of insecticide impregnated bags,
 - Seed treatment with nano particles like silver, gold, zinc and magnesium, and
 - Using zeolites beads.
- It is suggested to increasing the slope of the deck; lowdensity seeds can be successfully eliminated which are brunched infested by using specific gravity separator;
- By modulating temperature and relative humidity, the storability of the seeds can be extended in different ways by storage of seeds in different storage structures viz., conventional seed storage, rack storage, block jumbo cold storage;
- For germplasm bank, -23°C is most ideal for extending the viability of seeds;
- By appropriate mapping, it is possible to know the temperature and relative humidity at any given time and place;
- Using thermal camera, trouble / hotspots within the storehouse can be tracked; and
- Mean kinetic temperature can be employed through arithmetic mean by employing dry bulb and wet bulb temperatures for better management of storage conditions. This will facilitate in making the storage 'rodents and pests free'.

11. Technical Session-VII: Agro extension services and local supply systems for seed security -30th Jan: 09.30-11.00 h.

The issues related to practicing novel seed supply systems for seed security were discussed in lead as well as oral presentations. The major points that came to light have been listed below:

- 70% of seeds used by farmers is saved seed; and only 30% is contributed by formal seed supply system;
- There is an apparent gap in quality seeds availability *vis-a-vis* demand. This calls for innovative methods by integrating informal players in the seed system. *Rayatu Sampark Kendras* (RSK), university farms, NGOs, SHGs, KVKs, etc. should be involved to augment seed supply in participatory mode on profit sharing basis;
- Extension services and strategies offered by the department of agriculture are not adequate; and they are mostly involved in subsidy schemes;
- Bulk of the seed sold by the local agents is from 'grain'; and not strictly 'seed';
- Consortium of all stake holders proved to be an effective informal supply system;
- The problem encountered related to the effect of climate on seed production, cooperation and co-ordination among partners and SAU's, social issues of village, replacement of old varieties, SRR and fund flow;
- These constraints can be overcome by varietal denotification, enhancing SRR, adapting mission-mode approach, and adequate policy and financial support;
- Greater role of extension services is needed to meet the seed requirement – especially in reaching seed to the remote areas;
- Local seed systems should be based on farmer's needs;
- Dependable data / information base relating to the seed sector is needed- with built-in arrangement for 'real-time' updating;
- Success stories related to popularizing varieties or skill development among the small and marginal farmers for seed security through technology intervention in seed production need to be publicized.

12. Technical Session-VIII: Role of seed legislations, policies and forecasting in seed trade -30th Jan: 11.15-12.45 h.

The following issues during the lead as well as oral presentations were flagged for attention:

- Passage of the new seed bill at the earliest to regulate the seed quality;
- Some more qualitative and quantitative characters should be included in DUS testing in different crops in general and cotton in particular;

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- Registration of parents of hybrids for protection under PPV&FRA should be given priority; and
- Harmonization between various Acts is MUST to avoid any inconsistencies between them.

13. Technical Session-IX: Scope of Public-private partnerships in seed research, production, quality assurance, supply chain and extension -30th Jan: 12.45-14.15 h.

The following action points were suggested from the presentations and discussions during this session:

- Gaps in public-private-farmers partnerships need to be identified and addressed;
- An effective platform is needed for seed research and technology development, including public-private-farmers participation;
- Some Institutes/ Universities should be identified and made responsible to take lead in seed research and technology development;
- Seed entrepreneurship mechanism should be developed and operated within Institutes;
- Accredited seed testing labs should be developed and strengthened;
- Seed Technologists should be posted in *Krishi Vigyan Kendra* (KVKs) for seed production and seed research related trials;
- More emeritus scientist positions should be created in seed research and technology development; and
- The participatory seed production under seed village schemes involving SAUs, ICAR Institutes, KVKs, NGOs, SHGs need to be strengthened.

14. Plenary-Cum-Prize Distribution Session -30th Jan: 15.15-17.00 h.

After the formal welcome by Dr. Vilas A Tonapi, Vice President, ISST, Dr. K.V. Prabhu, Joint Director (Research.), ICAR-IARI, New Delhi presented the overall summary of the 3-days seminar, followed by brief listing of the recommendations of

the nine technical sessions by Dr. S. Rajendra Prasad, President, ISST. Dr. Mangala Rai, Chief Guest, distributed the awards and addressed the gathering. In his address, he appreciated the efforts, hard work and contributions made by the seed scientists and seed professionals. He elaborated the various seed plans and programs that strengthened the production and distribution of quality seeds of agricultural crops in the country. On the issues relating to 'Sustainable Seed Production Under Changing Climate' he advocated several options as brought out in his Paper on the subject appearing in *the XIV NSS Souvenir- p.2-8*. He also highlighted the IARI's significant contribution in the development of hybrid rice technology in India besides the practical application of sizeable seed production and supply. He dealt on the merits of Molecular Assisted Breeding for developing high yielding varieties / hybrids. He emphasized on continuous 'Team Building' for better results; and advised for workable guidelines for seed related ventures under Public Private Partnership (PPP). Noticeable points were also made by the delegates during deliberations;

- There is an urgency to develop competent Human Resource for the seed sector, including strict evaluation of the syllabi and facilities with the Institutions and Universities for PG programs in Seed Science & Technology (Dr. V. Sankaran, Former GM (QC), NSC); and
- More weightage should be given to Seed Science & Technology syllabi in the UG curriculum under ICAR system. For this, the existing syllabi may be redesigned and submitted to ICAR for incorporation. It was also suggested that as a Policy decision, professionals who are qualified seed technologists should only be considered for selection and promotion in areas involving seed science and technology and a level playing field should be allowed for seed technologists as in other disciplines (Observation from UAS-Raichur).

The Plenary Session ended with vote of thanks by Dr. Shiv K. Yadav, Secretary, ISST & Organizing Secretary, XIV-NSS 2017.

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