ISSN 0970-6747

Seed Tech News

ISST:
Disseminating Knowledge of Seed Science & Technology

Volume: 48, No. 3
July-Sept 2018

Seed of *Indigofera astragalina*

Indigofera astragalina (silky indigo) is an erect herb with angular branches belongs to leguminosae family. It is a common plant in tropical Asia and Africa. Under Indian System of Medicine various parts of this plant are used to treat various illnesses such as rheumatism, arthritis, inflammation. The seeds of this plant are unique in shape and have dormancy like other leguminous plants. Scarification removes the dormancy.

From President's Desk…

Dear Members,

Greetings from the Secretariat!

Seed is the vehicle to transfer the benefits of genetic improvements of a variety to the farmers. There had been significant advancements in the field of plant breeding in the past 100 years, which made tremendous impact on the global seed sector. Plant breeding and seed production, which were mostly limited to a few academic and research institutions, individual plant breeders, garden enthusiasts or amateur breeders in the early part of the last century, became more organized and specialized. seed multiplication and marketing, on the other hand, expanded from family business to commercial ventures both in the private and public sectors. Success of seed business depends on the strength of access to a large number of diverse germplasm and their proper utilization in variety improvement. Precision in plant breeding grew considerably with the advancements from conventional to molecular breeding. The establishment of the National Seeds Corporation in 1963 and implementation of the seed legislation through the Seeds Act, 1966 played vital roles. Today the country has a strong seed supply system with active participation of the formal as well as informal seed sectors. The formal sector comprises of both public and private sector players. There are about 500 small, medium and big private seed companies on one hand and NSC and State Seed Corporations, KRIBHCO, Seed Production Units under SAUs, ICAR institutes and KVKs on the other. Though the contribution of the informal sector is difficult to assess, it is estimated to account for not less than 50-60% of the total seed requirement.

In spite of such impressive advancements achieved in the seed sector, timely availability and accessibility of seeds of the right varieties at affordable costs remains a problematic issue in several parts of the country, particularly the hilly regions and difficult to reach places. Farmers in these places largely depend on their own farm-saved seeds or those available with the community managed units. The choice of varieties is limited and mostly there is no or little scope for quality assurance. However, these spots are often rich with variety diversity and have valuable genepools, since farmers have a tradition of consuming and conserving the local crop varieties. With the encouragement and support provided by the PPV&FR Authority to register Farmers' Varieties, and incentives offered to the Gene Saviors, many individuals and communities have been identified and valuable FVs protected. Some of these varieties have commercial value and seeds for these could have a market demand, whereas others may be useful resources for the future breeding programme. Many pockets in the hilly states of the North Eastern Region and Uttarakhand, Himachal Pradesh and J&K have the physical potential to be developed as sites for organic seed production, provided necessary policy support, certification system for organic seed, and trained manpower are available. Mainstreaming the traditional varieties in the seed market is likely to enhance farmers' income considerably. The ISST is planning a Seminar at Imphal, Manipur in the coming months to address many of these issues. Details can be found on the ISST website. Your active participation is solicited.

Though the Gene Bank at NBPGR, with its near 5 million accession, must be having most of these local germplasm, the fact that by growing these varieties on a regular basis, farmers have also exposed these varieties to the climate change. Therefore, performance of such materials compared with the accessions preserved in the Gene Bank may provide valuable insight into the impact of climate change on various attributes. We the seed scientists, have an important responsibility to spread awareness and train farmers helping farmers' groups to grow as entrepreneurs.

Looking forward to your views and suggestions and with warm personal regards and happy Diwali wishes,

Malavika Dadlani

AWARDS AND HONOURS

Prof. Rame Gowda, former Associate Director of Research, University of Agricultural Sciences, Bengaluru has been honoured with "Life Time Achievement Award - 2018" at the 7th International Conference on Agriculture, Horticulture and Plant Sciences organized by the Society of Tropical Agriculture, New Delhi, India held from 28th to 29th June 2018 at Shimla, Himachal Pradesh for his outstanding contributions in the field of Seed Science & Technology. He has served in the University for about 36 years, involved in teaching, research and extension aspects of seeds and guided 25 MSc and 12 PhD students. He has contributed a lot in terms of quality seed production and distribution to the farming community and was instrumental in creating required infrastructure in the University for the same.

Dr. D. K. Yadava, Head, Division of Seed Science and Technology, IARI and ADG (Seed) acting, ICAR, New Delhi received the prestigious "Rafi Ahmed Kidwai Award" of ICAR under Crop & Horticultural Sciences category for his outstanding research in agricultural sciences for the year 2017. He received this award on 16th July 2018 from the Union Agriculture and Farmers Welfare Minister, Government of India and President ICAR during 90th ICAR Foundation day ceremony. He addressed several strategic issues in mustard resulting into amalgamation of high yield, quality and adaptation to diverse cropping systems. He released 19 crop varieties including 16 mustard varieties and 3 pulse varieties. He bred five low erucic acid mustard varieties and first double zero Indian mustard variety.

Dr. Balraj Singh, Vice Chancellor, Agriculture University, Jodhpur received the prestigious "Veer Durgadas Rathore Award" for his significant contributions in Agriculture Science and Research from the Maharaja Gaj Singh II of Marwar-Jodhpur on 25th August 2018. He is an expert in vegetable science and seed spices and guided several MSc and PhD students. He has vast research experience on hi-tech horticulture and has more than 145 research publications to his credit. Before taking charge as Vice Chancellor of Agriculture University, Jodhpur, he headed ICAR-National Research Centre, Seed Spices and Centre for Protected Cultivation Technology (CPCT) of ICAR-Indian Agricultural Research Institute, New Delhi.

Dr. S. Rajendra Prasad, Dean (Agri), GKVK Agriculture College, UAS Bengaluru and former Director, ICAR-Indian Institute of Seed Science, Mau has been appointed as Vice Chancellor of prestigious University of Agricultural Sciences, Bengaluru for a four year term on 19th September 2018. He is an expert in Seed Production and has more than 200 scientific publications to his credit. He guided several MSc and PhD students and contributed a lot in sunflower and paddy hybrid seed production technology. As a special officer (seed) in UAS, Bengaluru, he played a crucial role in quantum jump of quality seed production of several crops.

NEWS ITEMS

CRISPR plants are also GM crops?

The plants produced using precise gene editing CRISPR technology are considered to be Non Genetically Modified (GM) crops and are free from GM regulations as no alien gene is inserted during the editing process. The USDA confirmed this in April 2018. However, the Europe's highest court, Court of Justice of the European Union (ECJ), Luxembourg in its ruling on 25 July 2018 categorized them under GM crops. This ruling may have several implications including reduced funding for CRISPR technology. Many plant breeders and scientists contend that the new gene editing technology is similar to mutagenesis through irradiation and should be exempted from stringent GM regulations. However, people opposed to GM organisms contend that since this technology involves deliberate alteration of genes, it should fall under the 2001 EU directive related to GM organisms. For more information on this topic refer https://www.Nature.com/articles/d41586-018-05814-6

BASF acquires Bayer's vegetable seed business

BASF (Badische Anilin und Soda Fabrik) acquired vegetable seed business from Bayer as part of divestment process of latter due to acquisition of Monsanto. On August 16, 2018 BASF closed the acquisition of Bayer's global vegetable seeds business, mainly operating under the brand Nunhems. The acquired vegetable seed business comprises 24 crops and 2600 varieties for an all cash purchase price of €7.6 billion. During this process BASF also acquires Liberty link canola and soybean seed portfolios and Bayer's digital farming platform, Xarvio. This marks BASF's formal entry into the market for seed, non-selective herbicides, and nematicide seed treatments. BASF group comprises 115000 employees working in five segments viz., Chemicals, Performance products, Functional materials & solutions, Agricultural solutions and Oil & gas. For more information refer the BASF website at https://www.basf.com/en/company/news-and-media/news-releases/2018/08/p-18-288.html

State of the World's Plants Report

The Kew Royal Botanic Gardens has released the first annual report on the State of the World's Plants, a baseline assessment of current knowledge on the diversity of plants on earth, the global threats these plants currently face, as well as the policies in place and their effectiveness in dealing with threats. The status of plants included in the report is based on the most updated knowledge from around the world as of 2016, and is divided into three sections: description of the world's plants, global threats to plants, and policies and international trade. The report's first section focuses on plant diversity on earth, noting that there are now 391,000 vascular plants known to science, of which 369,000 are flowering plants. The whole genome data of more than 225 plant species is available. The report also collates data indicating at least 31,000 plant species have documented use for medicines, food and materials. The report also identifies the focus of collection efforts to include plant species of critical importance to global food security and wild relatives of crops. For detailed report visit the website http://stateoftheworldsplants.org/

State of World's fungi Report

This report aims to provide an overview of the current knowledge of the world's fungi. The report highlights the importance of fungi to all life on Earth, examining their diversity and distribution, their uses in everyday life, the global impact of positive plant fungal interactions and the challenges associated with fungi including plant diseases and climate change. During 2017, 2189 new fungi species were described. It is estimated that 90% of the living plant species have mycorrhizal fungi associated with their roots. The whole genome data of more than 1500 species of fungi is available. At least 350 species of fungi are consumed as food. The global market for edible mushrooms is around US$42 billion per year. Fungal diseases due to their rapid spread around the world are damaging several natural ecosystems. For the detailed report visit the website https://stateoftheworldsfungi.org/

Extant notified variety registration dead line

The time limit for registration of extant notified varieties of *Piper nigram, Elettaria cardamomum, Brassica juncea, Brassica carinata, Brassica rapa, Brassica napus, Helianthus annus, Carthamus tinctorius, Ricinus communis, Sesamum indicum, Linum usitatissimum, Arachis hypogea* and *Glycine max* crops is ending by 30th April, 2019. Research institutes/SAUs/crop coordinators may speed up the registration of notified varieties to meet the dead line. For more details visit the PPVFRA website http://www.plantauthority.gov.in/

SCIENTIFIC BREAKTHROUGHS

Highly complex sugarcane genome sequenced

Sugarcane is the last major cultivated crop to be sequenced. This is because of huge complexity of its genome which comprises 10 and 12 copies of each chromosome. i.e. polyploidy. The International team led by CIRAD, France has reported the sequence on 6 July 2018 in Nature communications journal. The collinearity of sugarcane with sorghum was exploited to produce a BAC based monoploid genome sequence of sugarcane. This is the first assembly of the sugarcane genome with 382 Mb of sequence in 3965 high-quality contigs. A total of 25,316 protein-coding gene models are predicted, 17% of which display no colinearity with their sorghum orthologs. The polyploidy resulted into a huge genome size of about 10 Gb for sugarcane cultivars, while the monoploid genome size is about 800-900 Mb, close to that of sorghum (750 Mb). The sequencing was done in R570 cultivar which has the best-characterized sugarcane genome to date. The genome of this cultivar has about 115 chromosomes, including 10% of whole chromosomes derived from *S. spontaneum* and 10% from *S. officinarum*/*S. spontaneum* recombinant chromosomes, with the remaining being whole chromosomes from *S. Officinarum*. This sequence assembly is proposed as a reference for the euchromatin gene-rich part of the genome, known to account for most of the recombination, and thus representing the most useful part for breeding. For more details refer the full-length article at https://www.nature.com/articles/s41467-018-05051-5.

A step towards development of nitrogen fixing ability in crop plants

Biological nitrogen fixation is catalysed by nitrogenase enzyme. Synthesis and expression of nitrogenase are exquisitely sensitive to the presence of oxygen. Thus, engineering nitrogen fixation activity in photosynthetic organisms that produce oxygen is challenging. Recent study showed that an active NifH component can be formed in tobacco chloroplasts, indicating that expression of active nitrogenase in chloroplasts might be a viable way to engineer crop plants to fix nitrogen in the future. Since it is widely accepted that a cyanobacterial ancestor was the progenitor of chloroplasts, engineering a cyanobacterium to fix nitrogen may pave the way to achieving the final goal of engineering nitrogen-fixing ability into crop plants. The scientists from Washington University engineered the nondiazotrophic cyanobacterium *Synechocystis* sp. PCC 6803 to produce nitrogenase enzyme by transferring cluster of 35 *nif* genes from unicellular diazotrophic cyanobacterium *Cyanothece* sp. ATCC 51142. These studies have established the highest rate of engineered nitrogen fixation activity (30% of ATCC 51142) in any nondiazotrophic oxygenic organism till date. This is one positive step towards the development of nitrogen fixing crop plants. Crops that can make use of nitrogen from the air will be most effective for subsistence farmers throughout the world. For more details refer the full-length article at https://mbio.asm.org/content/9/3/e01029-18.

Pollen limitation effects the seed germination?

The seed production is limited by pollen availability is a known fact across several species in the plant kingdom. Baskin and Baskin recently reviewed the effect of pollen limitation on seed germination from 30 case studies containing 18 species from 16 genera belonging to 1 monocot and 14 dicot families. Pollen limitation had either positive or negative effect on seed germination in 63.3% out of 30 case studies. The real significance of pollen limitation is how it affects population growth rate (λ), a global measure of fitness. From the present studies it was clear that pollen supplementation is having an influence on the structure of the population and none of the studies on population growth rate includes it. For more details refer the article at https://doi.org/10.1017/ S0960258518000272.

First 48 hours are crucial for a seedling to survive

During germination, the highly protected embryo transforms into a fragile seedling. At this stage it cannot perform photosynthesis and completely dependent on storage reserves which will be depleted in 48 hours. It must therefore rapidly create functional chloroplasts, cellular organelles that will enable it to produce sugars to ensure its survival. Researchers from the University of Geneva and the University of Neuchâtel, Switzerland, have revealed the key elements that control the formation of chloroplasts from proplastids. This depends on the import of thousands of different preproteins into the developing organelle by the chloroplast protein import machinery. The protein import receptor TOC159 is essential in the process and is regulated by DELLA proteins and GA concentration. For more details of this research findings refer the full-length article at https://www.cell.com/current-biology/fulltext/S0960-9822(18)30768-1.

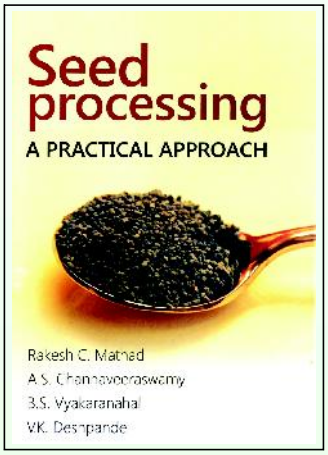
BOOK REVIEW

Seed Processing a Practical Approach

(ISBN: 9789385516085)

Rakesh C. Mathad, A. S. Channaveeraswamy, B. S. Vyakaranahal and V. K. Deshpande

New India Publishing Agency, New Delhi



Physical purity is one of the essential characters of quality seed. The legal sanctity for quality seed ensures physical purity. The standards for physical purity can be achieved through processing. Thus, seed processing is an integral part of quality assurance system. Seed technologists require the practical knowledge of processing as they have to assure the quality of seed.

The present title, basically a practical manual comprising thirty practicals along with seed processing terminology spread over 30 pages, wherein the authors have addressed various aspects of seed processing and testing. The practicals covers various seed extraction methods, estimation of physical properties of seeds, effect of screen sizes on seed quality, seed blending, various equipment for processing, seed drying, seed priming, seed pelleting, fumigation, moisture estimation, quantification of processing efficiency, sampling and estimation of post-harvest seed losses. The book is useful both to lecturers and students for conducting practical classes and to gain knowledge on various practical aspects of processing respectively. It is priced at Rs. 1595.00 which is considerably on higher side. Further, it was perceived that certain chapters like seed blending, seed drying, seed pelleting, seed treatment should have dealt in detail explaining the principle. The example crop species for various methods or machines is missing and may be incorporated in the next revised edition. Overall, the book is a good compilation of information and may be used as a practical manual for undergraduate and post graduate students taking seed processing courses.

Reviewed by: **Dr. D. Vijay**
Senior Scientist (Seed Technology), ICAR-IARI, New Delhi

UPCOMING EVENTS

XIV Agricultural Science Congress

The National Academy of Agricultural Sciences and ICAR-Indian Agricultural Research Institute, New Delhi jointly organizing the 14th Agricultural Science Congress on the theme "Innovations for Agricultural Transformation" from February 20-23, 2019 at IARI, New Delhi. The congress would cover all the major areas of agriculture including Plant Sciences, Natural Resource Management, Plant Protection, Food Science and Value addition, Animal Sciences-Livestock, Dairy and Poultry, Fisheries, Engineering and IT, Social Sciences and Agricultural Education. Apart from these ten thematic areas, sessions on student elocution, Panel Discussion, Farmers and Posters are also there. The last date for submission of abstracts is 15 Nov 2018. For more information about the congress, visit their website http://14agricongress 2019.in.

ISTA Seed Symposium 2019

The seed symposiumof the 32nd International Seed Testing Association Congress under the theme "Seed Technology and Quality in a changing world" is going to be held in Hyderabad, Telangana from 26-28 June 2019. The symposium provides opportunity for the seed analysts, technologists, researchers and managers from universities, research institutes, government and the seed trade to discuss various aspects of seed quality and its technological application in seed testing. The last date for the submission of the abstract has been extended to 15 November 2018. For more details, visit the website https://www.seedtest.org/en/seed-symposium-_content---1--3400.html.

NSRTC trainings

The National Seed Research and Training Centre, Varanasi is conducting training programs on seed testing and seed certification for improving the skill of manpower. Officers involved in seed testing, certification, processing, quality regulation and marketing can apply for the trainings. Each training course is limited to 30 participants on first come first serve basis. Training on Advancement in seed testing from Nov. 12-16 at NSRTC Varanasi; Special Training on Advancement in Seed Testing for NEH region from Dec. 3-8 at ICAR Research Complex for NEH Region, Manipur, Imphal and Training on Seed Certification, Seed quality regulation and Law enforcement from Dec. 10-15 at NSRTC, Varanasi will be conducted. For more details visit the NSRTC website www.nsrtc.nic.in.

SPECIAL INVITED ARTICLE

ORGANIC SEED PRODUCTION TECHNOLOGY

R. L. Agrawal

Ex-Director, Uttarakhand State Organic Certification Agency

Development of organized seed programmes is usually associated with the development of improved crop varieties and planting materials. The area under organic farming has been increasing steadily all over the country, besides many state(s) and regions are being declared/identified as organic State/or Region. However, there has been neither any organised effort in regard to the development of improved crop varieties specifically suited to organic farming conditions; nor any attention has been paid towards organized 'certified organic' seed production and distribution. A well-organized organic crop-breeding and 'certified organic' seed network shall go a long way to promote organic agriculture, and export of organic products from India. The present article deals with the principal requirements of '*Breeding Crop Varieties for specific adaptation to organic farming conditions*' and production guidelines for '*Certified Organic*' seeds.

There is urgent need to draft and notify 'Certified Organic' Seed Regulations under the Seeds Act, 1966. The Regulations may be drafted by the Ministry of Agriculture in consultation with the Ministry of Commerce, consistent with National Programme for Organic Production (NPOP). Regulations are needed in respect of the system of registration of organic crop varieties, heirloom varieties, organic seed production procedures and quality standards. These Regulations shall be the mandatory requirements that '*Certified Organic*' seed processors, and seed dealers would need to comply with, besides National Standards for Organic Crop Production.

Seed Regulations Order may be issued under Seeds Act, 1966; in a manner similar to Food Safety and Standards (Organic Foods) Regulations, 2017 which has been issued under the Food Safety and Standards Act, 2006.

The need of 'certified organic' seeds and planting material

Organic seeds and planting materials are needed for raising crops under certified organic management conditions. National Standards for Organic Crop Production (NSOP) requires that all seeds and plant materials shall be '*Certified Organic*'. When organic seed and plant materials are available they shall be used.

It is only when '*Certified Organic*' seed and plant materials are not available; chemically untreated conventional seed and plant material shall be used. Thus, the demand for organic seeds and/or propagating materials is clearly established.

The use of genetically engineered seeds, transgenic plants or plant material is prohibited in organic agriculture.

Distinction between 'Certified Organic' and 'Certified Seeds'

A distinction between '*Certified Organic*' seeds and 'Certified Seed', needs to be understood.' *Certified Organic*' seed denotes seeds that have been produced under organic crop management, and are in compliance with the National Standards of Organic Crop Production (NSOP). It gives no indication of seed quality. It may be noted here that '*Certified Organic*' implies the production system (certified organic crop management system) and not the product quality (seed quality) *per se*. The need to establish quality standards for organic seed thus cannot be over emphasized.

Whereas, '*Certified Seed'* is the produce of conventional agriculture, that is following the Minimum Seed Certification Standards (seed quality standards) prescribed under the Seeds Act, 1966.

Development of crop varieties for organic farming

Breeding of crop varieties for organic farming implies breeding of crop varieties for specific adaptations, i.e., organic farming conditions. The fact that crop varieties being grown on organic farms are the same as those grown on conventional farms does not necessarily mean that they are the best varieties for cultivation under organic management too. The crop breeding methodologies for development of varieties suitable for organic farming must be consistent with the principles and requirements of organic farming. There is need to breed varieties that accounts both for ecological and socio-economic aspects.

A greater emphasis would need to be placed on identification and improvement of traditional varieties (*heirloom* varieties), well-known for their specific taste, aroma and other food quality characteristics. These varieties, such as traditional varieties of aromatic rice, *desi* wheat varieties, spices and many others such varieties of various other crops do have significant demand in certified organic export market.

Characterisation of varieties suitable for Organic Farming

Organic environment, that is, the organic farming and handling practices characterise the requirements of varieties that are suitable for organic farming.

1. ***Soil Management*** **:** The soil fertility at organic farms is enhanced through closed nutrient cycle (crop production and livestock mixed system). The soil health is managed through a system of recycling of nutrients, crop rotations, green manures and cultivation practices, besides limited application of substances permitted in organic farming, wherever necessary.

a. There are quantitative restrictions too on application of nitrogenous manures.
b. The application of synthetic fertilizers is prohibited.
c. Crop yields are neither calculated in terms of response to increased application of fertilizers and irrigation; nor manures are applied on this basis.
d. The need to conserve soil and water resources is considered. There is greater emphasis on optimum utilization of natural resources.

It is thus apparent that organic farmer needs varieties that fits well in the cropping scheme; performs well under specific soils; moderate soil fertility conditions; and limited irrigation(s) that can be managed at organic farms.

2. ***Ecology and Human Health*** **:** In the terminology of ecology, the factors, namely optimum use of natural

resources (land and water), maximum biodiversity, continuous soil cover, circulatory flows of energy and minerals within the ecosystem, and adaptation of species to the local ecosystem to ensure maximum, long-term biomass production characterize organic farming system. Therefore,

a. The crop varieties should have good early vigour and ability to compete with weeds, more particularly in the early stages of crop growth is vital for good stand establishment and optimal crop growth.

b. The crop variety needs to cover more ground area to discourage weeds. The duration of crop variety should fit well in the cropping scheme.

c. From the view-point of human health the organic management practices involve control of pollution, prohibition on use of synthetic fertilizers, pharmaceuticals, pesticides, weedicides; and growth regulators which may adversely affect human health.

d. The crop varieties must possess effective and durable resistance against important diseases and pests.

e. Organic agriculture prohibits the use of products of genetic engineering and ionizing radiations from ethical view-point and long-term human health considerations.

Plant ideotype for breeding crop varieties for organic farming

'*Plant Ideotype*' is a concept about the plant type, which facilitates selection of suitable plants for organic farming in the breeding programme. All the attributes of an ideotype are morphological characters, but are based on physiological considerations.

Organic Crop Breeding Methodology

Organic crop breeding methodologies shall be consistent with the principles of organic agriculture. *Inter-alia* these include:

- Species authenticity must not be violated. Qualities such as, taste, colour, form, nutritive value, and keeping quality must be retained and improved. Every effort should be made to ensure the optimal development of general and regional characteristics.
- Organic breeding methodology is based on fertile plants that can establish a viable relationship with the living soil. It should rely on natural reproductive ability.
- Crop breeding methods and materials should minimize depletion of natural resources. It should enhance genetic diversity.
- From an organic point of view the development of varieties which depends upon human intervention is unethical. Organic farming respects natural crossing barriers.
- When vegetative propagation is used solely to secure certain characteristics, periodic 'refresher' generative phases should be included in the breeding programme to ensure sufficient resistance and vigour.
- Organic crop varieties shall be developed using methods of breeding consistent with the fundamental principles of organic agriculture.

Crossing and Selection Methods (open pollinated varieties, composites and synthetics):

- Crossing techniques may be applied, if pollination and seed formation occurs on plants.
- Selection methods at crop/plant level needs to be appropriate.

***Hybrids*:** Hybrids may be developed and used in organic farming only if F_1 progeny is fertile. Inbreeding beyond what is strictly necessarily, needs to be discouraged. Parent lines must be maintained under organic management. CMS may be used only when restorer lines are available. *Demeter* standards do not permit cereals of hybrids except that of maize.

Prohibited Techniques:

- Breeding techniques at cell level are not allowed
- Genetic- engineering is not allowed.

DNA diagnostic methods might complement other selection methods.

Prohibited Practices :

- Production of *single-use seeds* of hybrids is prohibited.
- The use of CMS lines for hybrid seed production of ereals with the exception of maize is not permitted.
- The use of CMS lines in other crops is permitted provided a restorer line is used to restore fertility.
- Seed production of transgenic varieties/GMOs is prohibited in organic agriculture.

Objectives	Trait	Morphological Traits
Weed reduction	Rapid early growth	Rapid germination, Good seedling vigour, Good tillering, Firmness, Ground coverage
Adaptation to soil, and soil fertility level	Plant's active nutrient mobilization	Longer crop roots
Resistance to pests and diseases	Polygenic resistance	Incidence of individual pests and diseases
Quality of end product	-	Taste, keeping quality, form, structure and colour of the product, others (malting/baking quality)
Low fertility conditions	-	Good stand establishment, Thin pale green leaves, long growth duration, extensive root system, short grain filling period, a low harvest index

- The use of chemical gametocytes and other such measures is not permitted.

General Guidelines for 'Certified Organic' seed production

- Seed production/and propagation of planting materials must be done under certified organic management conditions. Organic seed may need to run a two-year cycle on a certified organic farm before they can be traded as 'certified organic' seeds. The Organic Certification Body may permit reduction to one year under specified circumstances.
- Rogueing's during the seed production cycle may be limited to the exclusion of undesirable types, i.e., those differing in desired quality characteristics; off-types and plants affected by seed borne diseases.
- Seed crops would need to be isolated from various sources of contamination. Special attention is needed to prevent contamination from GMOs, and seed borne diseases. Isolation distance up to 6 km may be needed to prevent contamination from GMOs.
- In case of maintenance of inbred lines for hybrid seed production, the number of generations of periodic refresher cycle of self-pollination may be kept to minimum; instead sib-pollination may be resorted to.
- In case of vegetatively propagated crops refresher propagation through meristem culture may be resorted to, if it becomes necessary to control disease; to make available disease- free stocks of the propagating materials.

Harvesting, threshing and further handling of seeds

The '*organic integrity*' would need to be maintained. All sources of contamination would need to be controlled so as to avoid contamination and to maintain organic integrity.

a. All Organic Control Points (OCPs) would need to be identified and necessary control measures needs to be undertaken.
b. It would be necessary to maintain Chain-of-Custody throughout harvest in, post-harvesting and seed handling operations.
c. The precautions and procedures followed for handling organic produce would need to be followed.

Seed crops would need to be harvested soon after they reach physiological maturity; appropriately dried and safely stored to maintain high germination, and early seed vigour.

a. The procedures and controls followed for transport, and drying of organic produce should be in place. All Organic Control Points (OCPs) during drying of seed crops would need to be identified and necessary control measures undertaken.
b. Sanitary conditions would need to be maintained.
c. Biological measures for rodent control should be in place, where needed.

Processing of organic seeds

It is my considered view that processing of organic seeds should be done at seed processing plants that are fully dedicated to processing of organic seeds. This is necessary to maintain organic integrity and avoid contamination due to the presence of prohibited substances and conventional seed produce. The seed processing plant shall be well equipped, well-maintained. All requirements required under NSOP standard for processing facilities, packaging and labelling would need to be complied with. Storage facilities should be practically free of infestation by storage insect-pests and rodents.

Storage of seeds

For safe storage of seeds adequate attention must be placed on:

a. Drying of the seeds to safe moisture content.
b. It needs to be checked that seeds are free from insect-pest infestation to start with. Regular monitoring and surveillance are needed for timely detection of any damage to the structure or presence of pests. In case of infestation immediate non-chemical control measures should be taken to prevent further losses in accordance with organic agriculture practices.

Adequate attention is needed to maintain sanitary conditions in the storage.

Seed Sampling and Testing

Organic Seed Processors/traders at their own should prefer to draw representative samples and got them tested in an ISO 17025 approved Seed Testing Laboratory for germination and purity test, freedom from infection of seed borne diseases, insect infestation, and seed vigour. The First Count Germination, and seedling vigour may be regarded as seed vigour test. Both of these attributes are important characteristics of varieties/and the seeds suitable for organic farming.

Note: Readers may refer the title "Organic Agriculture" authored by Dr. R. L. Agrawal, published by Kalyani Publishers, New Delhi for detailed information on various aspects of organic seed production.

'Seed Tech News' is provided complimentary to the subscribers of 'Seed Research'

Compiled and Edited by : **Dr. D.Vijay** and *Published by* **Indian Society of Seed Technology**,
F-5, First Floor, A Block, NASC Complex, Dev Prakash Shastri Marg, New Delhi 110 012
e-mail: **seedtechnews@gmail.com**
Printed at: M/s Kamala Print-n-Publish, O 96 New Mahavir Nagar, New Delhi 110 018

ISST Registration No. 21893/71