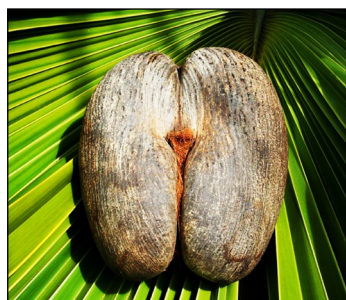


Seed Tech News



ISST:
**Disseminating Knowledge of
Seed Science & Technology**

**Volume: 49, No. 3 & 4
July-December 2019**



Double coconut seed



Double Coconut Fruit

The world's largest and heaviest seed is produced on the female double coconut palm. It is almost one foot long, three feet in circumference and 20 kg in weight. The nut takes one year to germinate and another year to form first leaf. It takes 6.5 to 7 years from pollination to seed maturation. The male flower is present in catkin inflorescence of 1 m long and produces pollen continuously for 10 years and is the longest living inflorescence known. The sole species, *Lodoicea maldivica*, is endemic to the islands of Praslin and Curieuse in the Seychelles. In India only one tree is present in the Indian botanical garden of Kolkata, which was artificially pollinated in 2013 with the pollen brought from Thailand and two matured fruits were harvested in Feb 2020.

Secretary : Sandeep Kumar Lal
Chief Editor : Shiv K. Yadav
Editor : D. Vijay

From President's Desk...

Dear Members,

Greetings from the Secretariat!

The 32nd ISTA Congress, along with Pre- and Post-Congress seminar and workshops as the side events provided a rare opportunity of participation in the deliberations, as well as learning, interacting and collaborating with the world-renowned seed professionals. While the main deliberations during the Congress will be accessible on ISTA platforms, some important issues which emerged during the Pre-Congress Workshop on "Seed Production, Quality Control and Marketing", organised by the Department of Agriculture & Cooperation, Govt. of India in collaboration with Food and Agriculture Organization (FAO), Rome, are worth sharing with you all.

The focus of the workshop was on South-South cooperation in improving the seed quality assurance and seed delivery systems in Asia and Africa, learning and benefitting from each other's strengths and taking advantage of the market opportunities. Speakers included renowned experts, planners and policymakers from India and abroad. India's strength and potential to become a lead player in the international seed trade were recognised and lauded by all, but the need to introduce a new revised Seed Regulation for strengthening the quality assurance system was also noted. The role of seed technologists and academicians in harmonising seed policies, rules and revising the procedures were asserted, while grave concerns were expressed about the spurious seeds in trade and expertise of seed scientists were sought to eradicate this menace. Many speakers brought out the gaps between demand and supply of quality seeds in all major crops in many African countries, where 70-90% seed is supplied by the informal chains (30-40% farm-saved seed), and identified the opportunities in meeting the massive demand for quality seeds.

Technical deliberations during ISTA Congress and the National Seed Congress held later in the year reaffirmed the crucial role of seed technologists in the agricultural system. Seed technologists have an advantage over other agriculture specialists due to the fact that being trained in multiple disciplines, they develop a comprehensive and holistic understanding of the factors determining the quality of seed produced and performance of seed under different sets of conditions. One area where seed scientists are expected to play a central role is designing effective seed treatment technologies for favourable and stress conditions. Seed treatments are going to be the key driver for the future growth of the seed sector. Indian agriculture is passing through a phase of policy uncertainties. On the one hand, a group is advocating mass adoption of organic / near the organic farming system, on the other, plant breeders are concerned that the potential of molecular breeding technologies in designing environment resilient crop varieties remain untapped, as appropriate policy guidelines and safety protocols are still awaited. It is hoped that seed specialists will play a proactive and assertive role in assessing the pros and cons of these technologies.

Looking forward to your views and suggestions and with warm personal regards.

Malavika Dadlani

AWARDS AND HONOURS

Dr. Basave Gowda, Special Officer (Seeds), University of Agricultural Sciences, Raichur received the **Certificate of Appreciation**, during the 11th Foundation Day of UAS Raichur on 22-11-2019 for his outstanding contribution in the field of seed science and technology. He received the award from the hands of Shri. H. M. Maheshwaraiah, Hon'ble Vice Chancellor, Central University of Karnataka, Kalburgi.



Dr. K. Keshavulu, Managing Director, Telangana State Seed Corporation and Director, Telangana State Seed and Organic Certification Authority got elected as the Vice President of International Seed Testing Association from

2019-2022 during ISTA Congress at Hyderabad held from 25 Jun 2019 to 3 July 2019. He is the first Indian got elected as Vice President of this prestigious international seed body, ISTA in its 95 years of existence. Before this he was the first Indian to be the member of executive committee ISTA and the key person to organize the ISTA congress for the first time in India.



Dr. Malavika Dadlani, Former Joint Director of Research, Indian Agricultural Research Institute (IARI) and Head, Division of Seed Science and Technology, IARI and presently President, ISST has been nominated as the member of Seed Science Advisory Group

(SSAG) of International Seed Testing Association (ISTA), Zurich, Switzerland. The SSAG aims to provide a link between fundamental research and the use of that research to meet the needs of ISTA members. This will include identifying fundamental research results that have applicability to ISTA, and facilitating collaboration between the researcher and the end user.

Dr. Nagamani Sandra, Scientist from Division of Seed Science and Technology, IARI Received the Best Paper Award in the International Seed Symposium of ISTA on 28-06-2019 at Hyderabad. She studied the seed transmission nature of soybean yellow mottle mosaic virus and presented her research work as oral presentation entitled "Seed transmission of Soybean yellow mottle mosaic virus in natural and experimental host" in the seed pathology section of the symposium.



NEWS ITEMS

Seed that could bring clean water to millions

The seed of common drumstick (*Moringa oleifera*) tree, which is native to India is generally used to temporarily purify water for ages. However, this traditional method of purification has a disadvantage of high amounts of dissolved organic carbon (DOC) from the seeds, allowing bacteria to regrow after just 24 hours. This leaves only a short window in which the water is drinkable. A study by a team of Carnegie Mellon researchers recently succeeded in combining sand and Moringa plant materials “readily available in many developing nations to create a cheap and effective water filtration medium, termed ‘f-sand’”. By extracting the seed proteins and adhering them to the surface of silica particles in sand, Stephanie Velegol, a professor of chemical engineering at Penn State University and former student at Carnegie Mellon, first created f-sand. The compound kills microorganisms, reduces turbidity, and can be reused multiple times. The undesirable contaminants and DOC can be washed out, leaving the water clean for longer, and the f-sand ready for reuse.

Source: <https://www.globalcitizen.org/en/content/seed-clean-water-millions-india/>

Global exploration of germplasm

A six-year quest to collect thousands of wild seeds that could play an important role in feeding a rising global population at a time when global warming is jeopardizing crop production has resulted in securing 4,644 seed samples of 371 wild relatives, many endangered, of 28 globally important crops. This task was taken up by more than 100 scientists from 25 countries across four continents, travelling by foot, four-wheel drive, canoe, horse and even elephant to reach remote corners of the world. The project, managed by the Crop Trust in partnership with the Royal Botanic Gardens and Kew’s Millennium Seed Bank (MSB) and with Norwegian funding, is the most ambitious coordinated global effort yet to collect and conserve crops’ wild

relatives. The sturdier cousins of widely grown crops have evolved to survive harsh conditions such as low rainfall, flooding, temperature extremes and poor soils, and offer a largely untapped source of diversity for climate-proofing crops.

Source: <https://www.producer.com/2019/12/indiana-jones-scientists-collect-seeds-in-wild-for-climate-change-fight/>

Seed Traceability

The Government of India is likely to come out with a technology that would facilitate the traceability of seeds by June 2020. “The government is coming out with a software system in association with seed manufacturers associations and we expect it by June 2020,” Sanjay Agarwal, Secretary, Ministry of Agriculture said. Seed traceability is mainly aimed to help farmers during their purchase of seeds, helping them to identify the seed’s origin such as from where the seed has arrived or produced and to purchase the intended seed. The objective of seed traceability is to put in place an easy to use, secure, integrated information technology system, covering the various stakeholders of the supply chain starting from seed growers, seed producing companies, seed processing units, seed testing laboratory, seed certification agencies, distributors and the terminal link, retailers who supply the seed to farmers. It may be mostly based on a 2D barcode system which can be read by using simple software on mobile phones. Once it is in place it will reduce the spurious seed in the market and will benefit the farmers.

Source: <https://www.theweek.in/news/sci-tech/2019/06/28/Government-working-on-seed-traceability-solutions.html>

Update of soybean genome to golden reference

The Institute of Genetics and Developmental Biology, Chinese Academy of Science, updated the *Glycine max* Zhonghuang 13 (Gmax_ZH13) genome to a golden reference genome Gmax_ZH13_v2.0. Based on the Gmax_ZH13, the finally assembled Gmax_ZH13_v2.0 has a length of 1,011,174,350

bp by adding more sequence data and refreshing the assembly pipeline. When compared to Gmax_ZH13, the Contig N50 size of Gmax_ZH13_v2.0 increased 6.5 times (from 3.46 Mb to 22.6 Mb), gap number decreased 1.8 times (from 815 to 448) and gap length decreased 8.8 times (from 20.49 Mb to 2.33Mb). Meanwhile, the un-anchored contig number decreased 17 times (from 549 to 36), resulting in the ratio of sequences that anchored to 20 chromosomes reaching 98%. To improve the accuracy of gene annotation, they performed RNA-seq for 27 Zhonghuang 13 samples, collected from different tissues at different developmental stages and produced a total of 353 Gb reads. These RNA-seq data was used to predict protein coding genes using MAKER pipeline along with the previously used Iso-seq reads for annotation in the last version. A total of 55,443 protein coding genes containing 96,366 mRNAs in the nuclear genome were annotated. All the sequencing data used for genome assembly and annotation have been deposited into the Genome Sequence Archive (GSA) database in BIG Data Center under Accession Number CRA001810.

Source: <https://phys.org/news/2019-09-scientists-soybean-genome-golden.html>

Closed Transfer System: A safe transfer of pesticides

The agriculture industry leaders, ADAMA, BASF, Corteva Agriscience, Nufarm and Syngenta join forces to further improve the way crop protection products are handled in Europe by promoting the use of closed transfer system (CTS) technology. Developed by BASF in collaboration with third-party equipment manufacturers, easyconnect, a CTS technology, has been extensively tested on-farm in selected countries since 2015. Based on farmers' feedback, the system has been steadily improved in terms of handling and speed, making the filling faster than via the commonly used induction hopper. A CTS, such as easyconnect, allows crop protection products to be directly transferred from their original container to the spray tank and to accurately measure the volume

of the chemical being transferred. This significantly reduces operator exposure and environmental risks from splashing or spilling. The easyconnect system consists of two components: a unique screw cap, pre-fitted on the containers and a coupler, which together establish the CTS. By 2021/2022, a broad range of containers (IS 63 industry standard) is planned to be equipped with the standardized pre-mounted screw cap and offered to farmers in Denmark, Germany, France, the Netherlands and the United Kingdom, with other countries likely to follow.

Source: <https://agriculture.basf.com/global/en/media/press-releases/2019/easyconnect-.html>

SCIENTIFIC BREAKTHROUGH

New insights into seed germination

The energy metabolism in the seed is a less known phenomenon particularly during germination. When seeds came into contact with water, energy metabolism was established in a matter of minutes, and the plant cells' "power stations", known as mitochondria are activated their respiration. The efficient energy release mechanism is controlled by so-called thiol-redox switches, which plays a central role during this process. The thiol redox switches act as traffic signals to control the rush of metabolites during the germination process. For germination and seedling establishment the embryo relies fully on its stored energy resources. The researchers from Germany, France and Denmark led by Markus Schwarzländer reported a sharp transition in mitochondrial metabolic activity and thiol redox status that coincides with seed rehydration. Hundreds of Cys-based redox switches are operated, providing early and direct metabolic regulation, long before gene expression-based control is established to underpin hormonal checkpoints. By developing fluorescent protein biosensing in intact seeds, they observed ATP accumulation and oxygen uptake within minutes, indicating rapid activation of mitochondrial respiration, which coincided with a sharp transition from an oxidizing to a more reducing thiol redox environment in

the mitochondrial matrix. Germination of seeds lacking the redox proteins was associated with markedly enhanced respiration and deregulated TCA cycle dynamics suggesting decreased resource efficiency of energy metabolism. They identified a global operation of thiol redox switches that is required for optimal usage of energy stores by the mitochondria to drive efficient germination. The research was first published in PNAS in December 2019 and can be obtained at <https://www.pnas.org/content/117/1/741>

Agriculture on marginal lands through coated seeds

Seeds with protective coating that also supplies nutrients to germinating plant makes it possible to grow crops in otherwise unproductive soils as per research from Massachusetts Institute of Technology, USA. In the present study a biomaterial-based approach was used to engineer the microenvironment of seeds through the preservation and delivery of plant growth promoting rhizobacteria (PGPRs) that are able to fix nitrogen and mitigate soil salinity. PGPRs are encapsulated in silk–trehalose (ST) coatings that achieve bacterial preservation and delivery upon sowing. They designed a biomaterial based on silk fibron extracted from *Bombyx mori* cocoons and trehalose. The biomaterial mixed with rhizobacteria was applied on the surface of seeds, retrofitting currently used techniques for seed coating, such as dip coating or spray drying. The combination of a polymorphic protein as silk fibron and of a disaccharide used by living systems to tolerate abiotic stressors provides a beneficial environment for the survival of nonspore forming rhizobacteria outside the soil and in anhydrous conditions. Using *Rhizobium tropici* CIAT 899 and *Phaseolus vulgaris* as working models, the researchers demonstrated that rhizobacteria delivered in the soil after coating dissolution infect seedlings' roots, form root nodules, enhance yield, boost germination, and mitigate soil salinity. The ST-coated seeds yielded plants that grew faster and stronger in the presence of saline soil. More broadly, their study opens the door to the application of advanced materials to precision agriculture, introducing new concepts that are in

general used in drug delivery for development of innovative technologies for enhanced food production even in marginal soils. For more details of the research refer to the published paper in the December, 2019 issue of PNAS Journal at <https://doi.org/10.1073/pnas.1915902116>

Doubling sorghum seed yield

The novel genetic variations through a single base pair mutation that occurred in sorghum's *MSD2* gene, increased the grain yield 200 percent. *MSD2* (*multiseeded 2*) is part of a gene line that catalyzes the jasmonic acid (JA) pathway in developing floral meristems and by lowering the amount of JA, a hormone that controls the development of seeds and flowers the boost in flower fertility was achieved. When JA is decreased it allows for the full formation of the female sex organs in these flowers, which then allows for increased fertility. *MSD2* is regulated by *MSD1*, a gene discovered last year. Manipulating either gene increases seed and flower production. *MSD2* encodes a 13-lipoxygenase (LOX) that catalyses the conversion of free α -linolenic acid (18:3) to 13(S)-hydroperoxylinolenic acid (13-Hpot), the first committed step of the JA biosynthetic pathway. As with *msd1*, mutants in *msd2* exhibit complete spikelet fertility for both sessile spikelets and pedicellate spikelets, resulting in seed formation from both flower types. Multiple independent alleles were discovered for *msd2*, including nonsense and missense mutations within the LOX functional domain. Mutants in *msd1* and *msd2* exhibit similar regulatory network profiles, including downregulation of JA pathway genes and other expression cascades related to developmental and cellular restructuring. Finally, *MSD1* is capable of activating *MSD2* expression, as well as regulating other gene networks in trans, leading to the multiseeded phenotype. This gene that plays an important role controlling the sorghum yield may also help in improving the yield of other crops like maize or rice. These genetic analyses actually give the molecular mechanisms that provide more opportunities to engineer crops in the future. For more details of the research refer to the published paper in the October, 2019 issue of Int. J. Mol. Sci. at <https://doi.org/10.3390/ijms20194951>

UP COMING EVENTS

ISTA Workshop on Germination, viability and vigour tests

The International Seed Testing Association is going to organize a workshop on Germination, viability and vigour tests in Bornova, Izmir, Turkey from 25-27 March 2020. The workshop aims to provide an overview of the Germination, Viability and Vigour Tests in vegetable and field crop species by explaining the basis of the tests and the methodology for testing and evaluation. The maximum number of participants is restricted to 20 and the participation fee is 500 EUR for ISTA members and 750 EUR for ISTA non-members. The last date for registration is 15 February 2020. For more information visit their site at <https://www.seedtest.org/en/event-detail-0-0-0-114.html>

ISTA Workshop on Tetrazolium Testing and ERH

The International Seed Testing Association is going to organize a workshop on Tetrazolium testing, Equilibrium Relative Humidity determination for wild species and flowers in Peri, Italy from 20-22 May 2020. The workshop aim is detecting some quality parameters of wild species and flowers outside of the ISTA Rules and it is focused on the needs of seed testing laboratories that would like to work according to the ISTA Methods, standardizing testing methods for determining viability of seeds and Equilibrium relative humidity (ERH), a new test method, alternative to moisture content, for small seed lots or precious seeds. The maximum number of participants is restricted to 27 and the participation fee is 450 EUR for ISTA members and 675 EUR for ISTA non-members. The last date for registration is 30 April 2020. For more information visit their site at <https://www.seedtest.org/en/event-detail-0-0-0-115.html>

Asian Seed Congress 2019

The 26th Asian Seed Congress will be held in Kuala Lumpur, Malaysia from 25-27 November 2019 at the Kuala Lumpur Convention Center. The congress is

co-organized by the Asia and Pacific Seed Alliance, Ltd. and the National Seed Association of Malaysia (NSAM) as the National Organizing Committee. The congress comprises two workshops one on intellectual property rights protection on 25th November and the other on ITPGR for food and agriculture on 27th November. The special interest group meetings on cover crops & field crops, hybrid rice and vegetables and ornamentals will be there during the congress period. Standing committee meetings on seed technology, international trade and quarantine and on intellectual property and biodiversity will be there during the congress. The registration ends on 1 Nov 2019. Those who are interested to participate in this congress may visit their website at <https://www.apsaseed.org/asian-seed-congress/asc-2019-kuala-lumpur-malaysia/>

MEETINGS

Proceedings of 88th Executive council meeting of ISST

PROCEEDINGS, 88th ISST Executive Council Meeting

A meeting of the ISST Executive Council was held on **16.12.2019** at **11.30AM** at F-5, A-Block NASC Complex, Dev Prakash Shastri Marg, ICAR, New Delhi under the Chairmanship of Dr. Malavika Dadlani, President, ISST.

The following agenda items were discussed in the meeting.

1. Confirmation of the proceedings of the 87th EC Meeting held on 20.03.2019
2. Organisation of International Seed Seminar
3. Guidelines for institutionalization of new awards
4. Publication of pending issues of Seed Tech News
5. Nomination of returning officer for the conduct of elections of EC
6. Any other item with the permission of the chair

The following members were present:

1. Dr. Malavika Dadlani–President
2. Dr. Sandeep K. Lal –Secretary
3. Dr. Zakir Hussain – Treasurer
4. Dr. Shiv Kr. Yadav- Chief Editor

*four members conveyed that even though they could not attend the meeting, they principally concurred the decisions taken.

At the outset, Dr. Malavika Dadlani, President, ISST welcomed all the members. Dr. S.K. Lal, Secretary welcomed all the members and briefed about the agenda of the meeting. The following issues were deliberated and decisions taken.

The proceedings of the 87th EC Meeting held on 20.03.2019 were confirmed and accepted unanimously. **(Action: Secretary, ISST)**

Item No. 2: Organisation of International Seed Seminar

It was decided to constitute a Core Committee to initiate the groundwork for the organisation of International Seed Seminar - 2021. The details of the committee are as under-

1. Dr. (Mrs.) M. Dadlani - President, ISST (Chairperson)
2. Dr. S. Rajendra Prasad - Vice-chancellor, GKVK, Bengaluru (Member)
3. Dr. M. Bhaskaran - Vice President, ISS (Member)
4. Dr. D. K. Yadava - ADG (Seed), ICAR (Member)
5. Dr. Vilas A. Tonapi - Director, ICAR-IIMR, Hyderabad (Member)
6. Dr. K. Keshvulu - Director, TSSOCA, Hyderabad (Member)
7. Dr. J. K. Sharma - Vice President, ISST (Member)
8. Dr. Shiv K. Yadav - Chief Editor, ISST (Member)
9. Dr. S. K. Lal - Secretary, ISST (Member-Secretary)

Dr. R.S. Paroda will be the Advisor to the Core Committee

Further it was suggested to constitute an International Advisory Group and National Steering Committee for necessary guidance

regarding successful organisation of International Seed Seminar 2021. **(Action: President, ISST)**

Item No. 3: Guidelines for institutionalization of new awards

It was decided to institute a new award “Padma Bhushan Dr. R.S. Paroda Award for the Best Research in Seed Science and Technology” from the proceeds of Ch. Amir Singh Memorial Award conferred on him during 2019. A matching contribution of Rs. 1,00,000.00 has been received from Dr. R.S. Paroda, which will be utilised for the expenditure related to this award. The guidelines for the award will be finalised by a committee constituted for this purpose. which will be conferred annually for the best Ph.D. thesis in Seed Science and Technology, based on the work done in India. Further, it was decided to enhance the contribution for Ch. Amir Singh Memorial Award due to reduced interest rates on fixed deposits. **(Action: Secretary and Dr. S.K. Yadav, ISST)**

Item No. 4: Publication of pending issues of Seed Tech News

Chairman reiterated about the pending issues of Quarterly Newsletter, Seed Tech News. It was decided to publish combined issues i.e. Volume 49 - 1 & 2 and 3 & 4, which will be submitted to press on or before 30.12.2019 and 30.01.2020, respectively.

Recommendations of National Seed Congress

The 10th National seed congress on the theme “*Quality Seed for Farmers’ Prosperity*” was organized from 14-16 October, 2019 by Division of Seed Science and Technology, IARI in collaboration with National Seed Research and Training Centre, Varanasi at ICAR-Indian Agricultural Research Institute, New Delhi. In total, there were six Technical Sessions besides; Inaugural Session, Panel Discussion Session and Plenary-cum-Prize Distribution Session. The Congress was inaugurated by Dr. Trilochan Mohapatra, Secretary, DARE & DG, ICAR. The Secretary, DAC, MoA & FW, GoI, Shri Sanjay Agarwal presided over the function. Some of the major recommendations emerged from the congress are as listed below.

Recommendations:

1. A strict enforcement mechanism is required to ensure complete compliance regarding the varietal protection for common public knowledge.
2. Intense awareness programme is needed to be carried out among farmers for educating them about their rights and privileges under PPV&FR Act, particularly in context of benefit sharing with respect to varieties protected as farmers' varieties/ traditional varieties and land races.
3. Awareness shall be created among crop breeders about nuances of essential derivation, dependency and legal consequences arising out of these circumstances.
4. There is an urgent need to explore and develop ways and means to integrate modern biotechnological techniques based on sequence variation, haplotyping, molecular bar-coding, machine vision etc. With existing tools for ascertaining varietal identity.
5. Harmonization between various Acts is MUST to avoid differences between them
6. A policy decision is needed for maintaining buffer stocks of valuable breeder seed by the producing institutes to meet the sudden surges in the seed demand.
7. World Seed Day should be declared to highlight the importance of seed
8. The subsidy to old varieties may be taken up based on case to case basis rather than on uniform period from release date.
9. A regular meeting between, DAC, Environment ministry, commerce ministry and ICAR is needed to sort out and harmonise various issues related to seed trade and regulations
10. Active collaboration is recommended between private and public sections in research and development
11. A public-private seed consortium is to be formulated involving DAC, ICAR, SAU, NSC, SSSDC and Private sector to sort out various seed related issues amicably.
12. An industry internship program for the students in collaboration with Academic Institutes and Seed Industry is to be taken up immediately for developing entrepreneurship skills and increasing the job opportunities to the well-trained student community.
13. The public-private partnership should be developed on mutual trust and maintenance of business ethics, equally applicable to both the sectors.
14. Seed Production Units of ICAR and SAUs should have advance seed enhancement units in their Institutes/Universities.
15. ICAR-IARI should take lead in having active collaborations with SAUs and private industries in different areas of seed production and quality enhancement.
16. It was emphasized to Identify new potential seed production zones in India and also seed processing and protective technology on a scientific basis and to establish state-of-art laboratories in each state to reap the actual benefits of the advanced technologies.
17. The Seed Bill 2004 has to be taken forward and given a due place for consideration and passage
18. The private sector has to be taken as an effective partner for making available quality seed of superior varieties to farmers. Their problems in seed production and distribution / marketing have to be looked into and justified changes, if any, made in executing the Seeds Act as well as the other Acts and regulations
19. Existing treaty of ITPGRFA 2001 should include all the crops for Access & Benefit Sharing (ABS) to share with treaty partners for conservation and sustainable use.
20. A transparent system has to be developed for the quality regulation of TFL seed being produced by many agencies.
21. Revision and revalidation of certification standards for many seed-borne diseases under network mode is required.

22. Cost effective diagnostic tools for detection of major seed borne diseases need to be adopted by seed testing laboratories to ensure disease free supply of seeds/planting material.
23. The eco-friendly sustainable seed health management strategies against major diseases/pests as an alternative to use of harmful chemicals/pesticides should be promoted.
24. Zero tolerance on use of virus infected planting material in horticultural crops.
25. Regulatory measures for the commercial mass production of biological control agents and bio-pesticides should be strictly followed.

SIGNIFICANT RESEARCH FINDINGS

Sweating of freshly cut *Brachiaria* seed heads improves seed filling

In natural condition, majority of the pasture or range grasses exhibit indeterminacy for flowering and maturity and shed a significant quantity of seeds before and during harvest if we wait for an optimum maturity level. It is difficult to decide their harvest date that can avoid seed loss. Research efforts have been often made to harvest seed heads (panicle) before they mature in the field and subsequently allow them to pass through the remaining stages of maturation under managed conditions so that the seeds can be collected without loss. Sweating, a practice of covering the freshly cut seed heads (panicle) in air-tight conditions is a widely followed practise to allow the partially matured seed to develop and shed without additional efforts. Also, it is believed that sweating improves seed quality in pasture grasses by enhancing seed filling and reducing dormancy, but allows fungal infection during subsequent storage. However, the duration of sweating varies among different species and also depends on the stage of harvesting. We examined the suitability of the sweating technique for *Brachiaria brizantha* seeds in Central Indian condition and tried to identify suitable sweating duration. The seed heads (panicles) were cut freshly when the seeds in the

first spike had started maturing in the field and covered with black tarpaulin for sweating under shade in eight replications alongside control of seed heads in an open condition. Samples were collected on each day of sweating to check the 100-seed weight as compared to control which was sampled at the end of the experiment (4 days). One day of sweating increased the temperature inside the cover to about 50° C, which reduced subsequently, but again with a sharp increase on the third day. Sweating for 1-day allowed maximum matured seeds to detach from rachis and improved the 100-seed weight to 121 mg while open air-drying led to 115 mg which was at par with sweating for 2-day (Fig.1). The anthesis and seed development of all the racemes in the panicle is not uniform leading to various stages of seed development at the time of harvest. The sweating helps in maturation of the seeds in the spikelet which are going to mature in a day or two under natural conditions. Further this also helps in the recovery of seeds from matured spikelet and avoid the shattering loss. Increase in sweating after two days successively reduced the 100-seed weight and promoted heavy fungal growth. We recommend that sweating of freshly cut *B. brizantha* seed heads (panicle) for one day will improve the seed filling and allow maximum seed collection without loss.

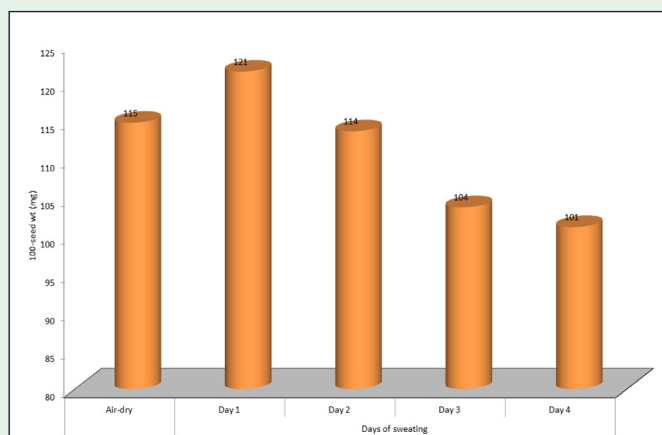


Fig.1: Seed weight in relation to sweating duration

Maity A, Wasnik VK, Manjunatha N,
Vijay D and Kumar S
ICAR-IGFRI, Jhansi

Consequences of dehusking of spikelet on germination and viability in *Cenchrus* grasses

Cenchrus ciliaris (CC) and *C. setigerus* (CS) are range grasses of arid and semi-arid regions and are components of *Dichanthium- Cenchrus- Lasiurus* pasture cover of western India. Grass species spikelets may or may not contain true seed (caryopsis). To check the longevity of dehusked seed freshly harvested spikelets and manually dehusked seed were stored in paper bags under ambient condition. Germination test was conducted at three months interval up to one year and after that at six months interval for the next two years. The true seed proportion was 32% and 54% in *C. ciliaris* and *C. setigerus*, respectively. Therefore, germination percentage of spikelets was adjusted as per cent filled spikelets. Germination pattern differed significantly ($P < 0.05$) due to dehusking and storage. In both the species germination was extremely low at the initial stage within one month after harvest indicating the presence of dormancy. The dormancy declined naturally during storage as indicated by an increase of germination of stored seed. After six months of storage, germination increased to ~45% in spikelets, and 65-71% in the dehusked seed. Highest germination was attained after nine months in spikelets (48%) and later started declining. Whereas, in dehusked seed germination began to decrease after six months of storage and wholly lost after 36 months (Fig.1). The fall in germination was rapid in dehusked seed compared to spikelets. Thus, it can be inferred that dormancy

of freshly harvested spikelets may be overcome by dehusking them within three months; however, for more extended storage, spikelets (Fig. 2a) are better than dehusked seed (Fig. 2b).



Fig. 2a: Spikelets of *Cenchrus ciliaris*



Fig. 2b: Dehusked seeds of *Cenchrus ciliaris*

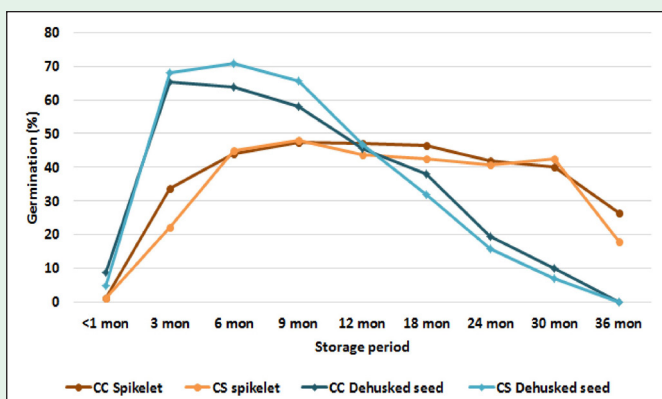


Fig.1: Effect of dehusking and storage period on germination in *Cenchrus* species

Meena SS and Nagar RP

ICAR-IGFRI, Western Regional Research Station,
Avikanagar

Micro and nano powders of Indian spices reduce seed pathogen infection in fodder crops

Seed treatment with a fine powder of spices such as chilli and turmeric for increasing seed longevity in ambient storage condition is an age-old practice (indigenous traditional knowledge or ITK) in India and as well as other countries. It is always important to know how the ITKs have been so persistent among farming communities, especially in the marginal section, while several modern technologies have already come into practice. Given the recent usage of nanoscience in the agricultural

field, we investigated the antifungal effect of micro- and nanosized chilli, turmeric, and fenugreek powders on oat, sorghum, cowpea, and berseem seeds in the Department of Nanoscience and Technology, Tamil Nadu Agriculture University-Coimbatore. Commercial powders of the spices obtained from the market were examined for their size with the particle size analyser and scanning electron microscope. Though the particle size was inconsistent and ranged from nano- (<100 nm in any of the dimension) to macro size (>1000 nm in any of the dimension), >80% of the sample particles fell under micro size (100 – 1000 nm). Powders were ultrasonicated for 30 minutes to disperse the particles for maximum singulation before size measurement and seed treatment. Seeds of the four crops were treated with three different doses of the powders, viz., 1, 2, and 3 g/kg of seed. On the next day, they were subjected to Blotter test

at 20±2° C in 12/12 h alternating cycles under UV light and darkness for seven days along with control to assess seed pathogen infection. At the end of the test, per cent pathogen infection was recorded. The infected seed percentage varied across the powders and as well as doses. Chilli powder exhibited the best antifungal effect at 3 g/kg of seed in all the four crops, whereas turmeric at 2 g/kg, and fenugreek at 1 g/kg of seed (Table 1). In the germination test conducted immediately and after three months of storage, none of the powders showed any detrimental effects on seed viability and seedling growth, rather there was marginal increase in germination (%) as compared to control. Results of this experiment will be helpful to decide the optimum dose of these organic powders for maintaining seed health and seed viability in ambient storage conditions.

Table 1. Effect of spice powders on seed pathogen infection of four crop species

Spice powder	Dose (g/kg seed)	Per cent infected seed after 7-day incubation			
		Oat	Sorghum	Cowpea	Berseem
No powder (Control)	0	100	100	100	100
Chilli	1	52	57	32	61
	2	59	64	36	68
	3	44	46	25	50
Turmeric	1	80	83	48	86
	2	57	60	33	64
	3	62	66	37	70
Fenugreek	1	39	44	24	48
	2	50	55	31	59
	3	81	86	49	90

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OPINION

Draft Seed Bill 2019- An overview

After the 'Green Revolution', India was quick to introduce the Seed Act 1966 as the first act to govern matters of seed and seed quality. It was modelled on the US legislation and aided by a later enactment

of the Seed Rules 1968, which were also developed with the collaboration of the US. In general, the seed industry has been governed by the Seed Act (1966), Seed Rules (1968), Seed (Control) Order (1983), New Policy on Seed Development (1988), Plants, Fruits & Seeds (Regulation of Import into India),

Seed Tech News

1989, the PPV & FR Act (2001), and the Essential Commodities Act including Seeds (1955) and National Seed Policy (2002), all aimed at supplying quality seeds and planting material to the farmer. The New Seed Bill (2019) was proposed to replace the Seed Act (1966) to regulate quality of the seeds produced and distributed to cater the advancement in technology and the growth of the seed industry.

Highlights of Draft Seed Bill 2019

- Compulsory registration of seed varieties based on VCU (value for cultivation and use), evaluation and licensing of seed producers and processors.
- There are also provisions for seed price control in the event of an emergency, monopolisation or profiteering
- The seeds are required to meet certain prescribed minimum standards especially more emphasis was given on seed health and crop performance.
- Provision has been made to register transgenic varieties as per the Environment Protection Act, 1986.
- Farmers can use seeds of registered varieties and farmers are allowed to sow, exchange or sell their farm seeds and planting material without having to conform to the prescribed minimum limits of germination, physical purity and genetic purity. However, farmers cannot sell any seeds under a brand name.
- Farmers are exempted from obtaining registration for varieties developed by them.
- The Bill keeps seed certification voluntary and provision for accreditation of other agencies for the purpose of seed certification.
- Bill proposes registration/licenses for seed companies, seed processing plants, seed producers, seed dealers and nurseries.
- Proposes to use the Consumer Protection Act to deal with complaints of non-performance of seed.

Modifications desired/suggested in the Draft Seed Bill 2019

Chapter No	Section/ sub section	Existing	Modifications suggested
I	12	Fruit nursery means any place, where fruit plants are, in the regular course of business, produced, or propagated and sold for transplantation	Nursery means “any orchard or any other place, facility, glass house, green house, shade net and polyhouse utilized for raised seedlings/grafts/plants”.
I	28	Seed processing means the process by which seeds and planting materials are dried, threshed, shelled, ginned or delinted (in cotton), cleaned, graded, treated.	Seed processing means the physical and mechanical process by which seeds and planting materials are dried, threshed, shelled, ginned or delinted (in cotton), cleaned, graded, treated and stored.
II	4 (xi)	Central Seed Committee has not included ADG (Seeds) and Representatives from SAU'S	All seed aspects are considered by ADG (seeds). It is suggested to include ADG (seeds) as one of the members of the proposed committee and Nominate one or two Vice-Chancellors of SAU's in the country on central seed committee on rotation basis.
II	5e	Central Seed Committee is entrusted with Seed registration and its enforcement	Seed registration and its enforcement re-titled as plant/kind/variety registration and its enforcement

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II	11(c) and (d)	Registration of only fruit nurseries	Horticulture nurseries has to be retained instead of fruit nurseries as more than 95 % of the vegetable growers use seedlings produced by the private nurseries. Hence, horticulture and forest nurseries need to be registered.
II	14/4	A registration made under this act shall be valid for a period of ten years in the case of annual and biennial crops and twelve years for long duration perennials.	A registration made under this act shall be valid for a period of ten years in the case of annual and biennial crops except for perennial fruit/forest/ kind/variety and should be exempted from re-registration.
III	15/2	Procedure for Registration of kind/ variety is given.	The procedure for registration of local varieties in their existing form is not specified which may be considered since, several such varieties are used for organic cultivation etc. and some of them have Geographical Indication (GI)
III	21	Where the seeds of registered kind or variety is sold to a farmer, the producer, distributor, or vendor, as the case may be, shall disclose the expected performance of such kind or variety to the farmer under given conditions and if such registered seed fails to provide the expected performance under such given conditions, the farmer may claim compensation under Consumer protection act, 1986	There is lot of dichotomy in the section. However, to protect the interests of the farmers section may be rephrased as follows "Where the seed of registered kind or variety is sold to a farmer, the producer, distributor, or vendor, as the case may be, shall disclose all the minimum standards prescribed for the seed under the act and rules including expected performance under label claim. A separate independent scientific system needs to established for giving justice to farmers if the registered variety fails in expected performance.
III	22/3	Validity period of registration of seed producers and seed processing units has not defined	Validity period of registration of seed producers and seed processing units may be defined
III	24	Provision for registration of the fruit nurseries exceeding one hectare for doing seed/planting material business is permitted	Irrespective of the size/area the nursery may be considered for registration since, size of the nurseries varies depending on the type of seedling dealt
IV	29 (1)	The state government may, with the previous approval of the central government, accredit the organisations owned or controlled by the central government or the state governments to carry out certification, on the fulfilment of such criteria, as may be prescribed.	It is suggested that, the private institutes may also be accredited for certification provided they satisfy prescribed criteria by central govt. for the purpose of uniformity across the country

	35/2	Every central seed testing laboratory established or declared under sub-section (1) of section 34 and every state seed testing laboratory established or declared under sub-section (2) of that section shall have as many seed analysts as the central Govt. or the state Govt, as the case may be, specify.	Every central seed testing laboratory established or declared under sub-section (1) of section 34 and every state seed testing laboratory established or declared under sub-section (2) of that section shall have one chief analyst as the central Govt. or the state Govt, as the case may be, specify.
VI	39	The powers of seed inspectors have been cleared. However, the procedure to draw samples from nursery has not been spelt out.	The procedure to draw samples from nurseries has not been spelt out with which may be considered.
VI	39/1/c	The possession of stock is for a period of 15 days in respect of which the offence has been or being committed.	The earlier period of possession of stock for a period of 30 days may be retained as the procedure to be followed includes cumbersome process
X	53	The seed control order was not considered in the proposed bill.	In the new seed bill, there is no reference of seed control order 1983. In fact the seed control order 1983 was promulgated under section 3 of ECA of 1955 giving the seed status of essential commodity. Therefore, the relevant provisions of seed control order 1983 will have to be incorporated into new seed bill. It is essential to remove the ambiguity in enforcement of seed laws.

Summary of limitations of the proposed New Seed Bill

- The new draft seed bill does not have the right definition of who is a farmer. The given definition is that a farmer is anyone who owns cultivable land. With this provision any seed company which owns a land can claim itself as a farmer and become eligible for utilization of provisions really meant for farmers leading to deprivation of benefits of varietal development by the original company/institution.
- If such registered seed fails to provide the expected performance under such given conditions, the farmer needs to claim compensation under Consumer protection act, 1986 by lodging a complaint. This process takes long time to give justice to the farmers.

- As per the act, varieties/kinds need to be compulsory registered after checking their performance by ICAR institutes/SAU's/registered institutes. It is very difficult to do this task with limited facilities.
- Seed certification by the other institutions is permitted in the proposed bill. This may lead to mismanagement and certification is voluntary and that may be as compulsory to maintain the quality of the seeds supplied to the farmers.

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USEFUL TIDINGS

New ISTA RULES

The International Seed Testing Association has published the International Rules for Seed Testing 2020 edition which is available online with some chapters for free download. Some of the major changes in the new rules are,

1. The species *Malva sylvestris* has been shifted from tree and shrub seeds group to 'flower, spice, herb and medicinal species' group in various tables.
2. Inclusion of new species *Salvia hispanica* in the 'flower, spice, herb and medicinal species' group for different parameters after validation studies.
3. Certain changes in the rules due to adoption of 7th Edition of the ISTA List of Stabilised Plant Names
4. Inclusion of organic growing media as the primary media for germination in case of *Glycine max* and *Phaseolus vulgaris* along with *Helianthus annuus* and *Vicia faba* where it was approved earlier.
5. Inclusion of Top of the paper method for *Zea mays* germination test. However, it is restricted only to crepe cellulose paper.
6. The GA₃ treatment was included as dormancy breaking treatment for *Avena sativa* along with prechill and preheat in the germination methods table. Even though it was already mentioned in the text on procedures for breaking physiological dormancy in earlier versions it was obscured because the germination methods table was the most commonly referred one for knowing the germination tests of species.
7. In the radicle emergence test for seed vigour, from 2020, the *Triticum aestivum* was also included along with *Zea mays*, *Brassica napus* and *Raphanus sativus*.

ISTA Sampling Calculator

The ISTA Bulking and Sampling Committee has created a Sampling Calculator, which may be installed as an application on a Desktop, Android or iOS device. This application is highly useful for

samples as they can know the sampling intensity on their mobile itself and there is no need to carry the ISTA Rules with them while sampling the seed lots. This application automatically calculates the number of primary samples required for sampling (including for heterogeneity testing) of all kinds of seeds, all sizes and types of containers and packaging, as well as the seed stream. For more information and to download the application to your desktop/ android/ ios refer to ISTA site at this link https://www.seedtest.org/en/sampling-calculator-_content-1-3512.html

ISTA Moisture Calculator

The ISTA Moisture Committee has developed a simple calculator that facilitates moisture calculations. The tool is an excel file and is available for download from the ISTA site. This tool can be used for calculation of moisture content values, including calculations for moisture tests that require pre-drying. The calculator highlights whether two replicates are within tolerance or not by colour change of the cell. It also rounds up the final moisture content result following the correct rules. This is a simple excel file with two worksheets one for moisture on fresh weight basis and other for pre-drying. This tool is highly useful for routine moisture calculation as per ISTA rules. For more information and to download the application refer the ISTA site at https://www.seedtest.org/en/moisture-calculator-_content-1-3514.html

ISTA list of stabilized plant names

The 7th edition of ISTA list of stabilized plant names was available for download at ISTA site. This will come into force from 01 Jan., 2020. The current edition includes 3044 entries, comprising 2388 accepted names and 656 synonyms, and representing 185 different vascular plant families. The approved list includes changes to names for 468 entries, or around 14.5% of the 3044 entries included in edition 6 of the Stabilised List. For the first time, the approved list includes 16 names that are accepted at the rank of subspecies and six at

the rank of variety. Up on request from attendees of nomenclature committee of ISTA, corresponding codes from the International Union for the Protection of New Varieties of Plants (UPOV) are

also included. To download the pdf version of the latest edition of ISTA list of stabilized plant names, use the link <https://www.seedtest.org/upload/cms/user/ISTAListofStabilisedPlantNamesed.7final2.pdf>

ISST ELECTION ANNOUNCEMENT

The Indian Society of Seed Technology (ISST) will elect its new Executive Council for the next three-year period (2020-2023), as the current executive council term is going to end in 2020. The office bearers of the executive council are President, Vice Presidents (Two), Secretary, Joint Secretary, Treasurer, Councillors (Six, one each from Delhi, East, North, South, and two from West-Central Zone).

An election committee was identified with Dr. Akshay Talukdar, Principal Scientist, Division of Genetics, ICAR-Indian Agricultural Research Institute, New Delhi as Returning Officer and Dr Sushil Pandey (NBPGR) and Dr. Monica A. Joshi (IARI) as its members. The election committee announced the following election schedule:

Activity	Date
Call for nomination	Jan 16, 2020 (Thu)
Last date of receipt of nominations	Jan 31, 2020 (Fri)
Last date of withdrawal of nomination	Feb 15, 2020 (Sat)
Publication of the final list of eligible candidates	Feb 18, 2020 (Tue)
Last date of dispatch of ballot papers to the members	Feb 26, 2020 (Mon)
Last date of receipt of ballot papers from voters	Mar 25, 2020 (Wed)
Counting of votes and declaration of the results	Mar 28, 2020, (Sat)

For more updates on the ISST election, keep visiting <http://www.isst-india.com> regularly

IMPORTANT ANNOUNCEMENT

As per the decision in the 34th General Body Meeting at Imphal, the Seed Tech News and Seed Research Journal will be delivered in the digital format (pdf) to members. The ISST members who still wish to have the hard copy and those who want to shift to a digital format may kindly indicate their choice to the ISST Secretariat through email (isst1971@gmail.com)/postal letter. Based on the response, the decision will be taken by the executive council. All the members are requested to respond to this for the betterment of society. If there is no response within a month of the receipt of this edition of Seed Tech News (hard/soft copy) it will be assumed that you have accepted for the digital format.

Note: All the ISST members are requested to contribute to various columns of the Seed Tech News by providing information on Awards and honours received; News items; Upcoming trainings, workshops, seminar and symposia; Job vacancies; Recommendations of scientific gatherings with one or two photographs; One-page note on latest novel research findings of students and scientists with good pictures etc. for wider dissemination of the information and knowledge among the seed community including both public and private sectors..

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