

Seed Tech News



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

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INTERNATIONAL YEAR OF
**RANGELANDS AND
PASTORALISTS**
2026

The United Nations declared 2026 the *International Year of Rangelands and Pastoralists* (IYRP 2026) to raise global awareness of how critical rangelands and pastoral communities are to food security, environmental conservation, and climate action. Seed plays an important role in the rejuvenation of rangelands and helps in their sustainability. Several seed ecological studies on rangeland species have helped in better understanding of various seed physiological and dispersal mechanisms.

Secretary : Shiv K Yadav
Editor : Manjunath Prasad
Associate Editor : Sanjay Kumar

From President's Desk...

Dear Members,

Greetings and best wishes.

As I write my final message, I reflect with gratitude and confidence. Serving the Society has been a privilege. I thank our members, Executive Council colleagues, editorial teams and collaborating institutions for their support throughout the 2023–2026 tenure.

Among our achievements was the regularisation of *Seed Research* through the dedicated editorial leadership of Dr. Malavika Dadlani and, subsequently, Dr. Sherry Rachel Jacob. Our collaborative national conference at Parbhani, the addition of 60 life members and four corporate members, and improved audiovisual facilities for online meetings strengthened the Society's scientific engagement and organisational capacity. These accomplishments belong to the entire team and demonstrate the value of sustained cooperation. Equally significant was our contribution to deliberations on the draft Seeds Bill, 2025. ISST submitted suggestions independently and jointly with TAAS, NAAS, ISGPB and ISPGR. The NAAS expert consultation in November 2025 examined performance evaluation, seed testing, traceability and harmonisation with the plant variety protection framework. This engagement reaffirmed scientific societies' responsibility to bring professional experience and evidence into policy formulation.

Regulatory discussion continued during the opening quarter. On 6 February, the Government informed the Rajya Sabha that more than 14,000 suggestions and observations on the draft Bill had been received and examined. Proposals concerning registration and quality assurance, alongside safeguards for farmers' traditional rights, deserve careful consideration. Our objective should remain a regulatory system that protects farmers, encourages responsible innovation and enables dependable access to quality seed.

International developments reminded us that seed security cannot be considered in isolation. FAO's warning on 26 March highlighted disruptions to energy, fertiliser and shipping flows through the Strait of Hormuz amid the conflict in West Asia. For seed production and international trade, these could raise costs and make deliveries less predictable. Contingency planning and closer coordination among producers and trading partners are therefore essential, particularly when consignments must reach farmers within narrow sowing windows.

The successful elections and handover on 31 March marked a welcome institutional transition. I warmly congratulate Dr. D. K. Yadava and the newly elected Executive Council. I also thank Returning Officer Dr. Sandeep Kumar Lal and colleagues who facilitated the elections and transfer of responsibilities. The incoming team's commitment to stronger publications, wider participation and closer stakeholder interaction gives me confidence in the Society's future.

The next phase offers opportunities to restore regular publication of *Seed Tech News*, enhance the standing of *Seed Research* and expand scientific exchanges. I urge members to support these endeavours as generously as they supported our Council. Although my presidential responsibilities conclude, my commitment remains unchanged. I leave office grateful for your trust and confident that our shared efforts will strengthen seed science and serve Indian agriculture.

With warm regards,

H. S. Gupta
President, ISST

ISST elects Executive Council for 2026-2029

The Indian Society of Seed Technology (ISST) has successfully completed elections to its Executive Council for the 2026-2029 term. Dr. D. K. Yadava was elected President, with Dr. Kalyanrao Patil and Dr. Praveen Kumar Singh as Vice-Presidents.

The election was supervised by a committee comprising Dr. Sandeep Kumar Lal, Principal Scientist, Division of Seed Science and Technology (DSST), ICAR-IARI, New Delhi, as Returning Officer; Dr. Sushil Pandey, Principal Scientist, ICAR-NBPGR, New Delhi; and Mr. Manjunath Prasad C. T., Scientist, DSST, ICAR-IARI, New Delhi, as members.

Most posts were filled unopposed following the nomination and withdrawal process. Five candidates contested the two Vice-President posts, for which online voting was held from 17 to 24 February 2026. Eligible members received secure login credentials



and ballot access by email through the ISST Secretariat.

ISST congratulates the elected office bearers and councillors and looks forward to their leadership in advancing seed science and technology during the new term.

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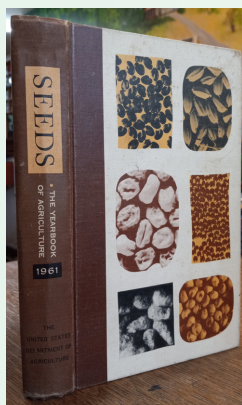
Fascinating Facts from the World of Seeds

Dr. V. Sankaran

Retd GM [P]/Consultant [P&M], NSC, New Delhi and Retd Director [PE&QM], Krishidhan Seeds Ltd, Jalna

1 1961-World Seed Year

FAO declared 1961 as the World Seed Year. To mark the occasion, the USDA published 'Seeds' in the 1961 Yearbook of Agriculture, a reference volume that became well known among seed professionals.



USDA Yearbook of Agriculture, 1961

2 1966-International Rice Year

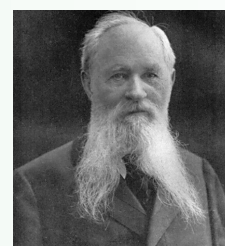
FAO observed 1966 as the International Rice Year. In the same period, NSC began early largescale paddy seed production using Taichung Native 1 (TN1) during 1966-67.



Rice (Taichung Native 1) with mature panicles

3 The First Seed Testing Station

The world's first seed testing station was established in 1869 by Friedrich Nobbe at Tharandt, Saxony, Germany.



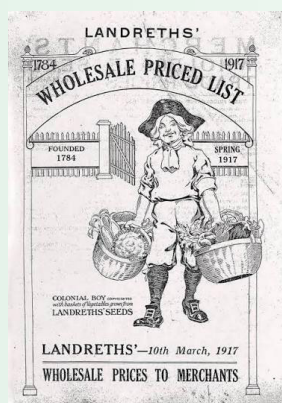
Prof. Friedrich Nobbe
(1830-1910)



Seed Testing Station, Tharandt, Saxony, Germany

4 1784 - First Seed Catalogue

One of the earliest printed seed catalogues is reported from Germany in 1784.



Early Seed Catalogue, 1784 (Germany)

5 The term 'Green Revolution'

William S. Gaud, Director of USAID, popularised the term in 1968-69 while describing major gains in cereal productivity in developing countries, including India.



Dr. William S. Gaud
Fr. Director, USAID

6 Largest Seed Import (1966)

NSC imported about 18,000 tonnes of Mexican wheat seed, mainly Lerma Rojo 64A and Sonora 64, for the 1966 Rabi season. The episode is remembered as a major landmark in India's seed programme.



Wheat seed (imported from Mexico, 1966)

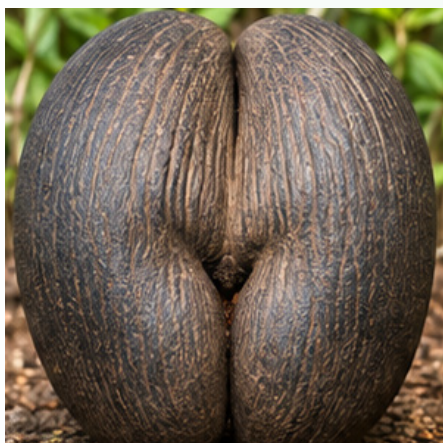
Fascinating Facts from the World of Seeds

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7 Largest and Heaviest Seed

The seed of Double Coconut (*Lodoicea javanica*), a palm native to Seychelles, is perhaps the largest and heaviest seed known, weighing about 8 to 15 kg. Botanically, it is a drupe.



Double Coconut (*Lodoicea javanica*)

8 First Fertile Wheat x Rye Hybrid

The first fertile cross of wheat x rye resulting in Triticale (*Triticum x Secale*) was produced in Germany in 1880. *Triticale* combines the traits of wheat and rye.



Wheat
(*Triticum*)



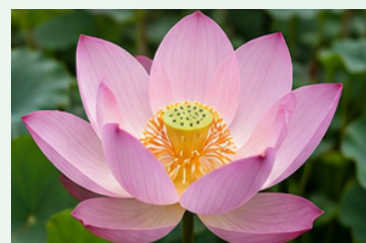
Triticale
(*Triticum x Secale*)



Rye
(*Secale*)

9 Longevity of Lotus Seeds

Seeds of Indian lotus (*Nelumbo* sp.) were found viable in a drained lake bed in Manchuria, where they were suspected to have remained buried for at least 160 years and perhaps up to 250 years.



Indian lotus (*Nelumbo* sp.) - flower (top) and seed pod (bottom)

10 Worlds largest Seed Collection

The Svalbard Global Seed Vault in the Arctic stores seed samples at about -18°C for long-term conservation of crop diversity. Capacity is often cited at 4.5 million seed samples.



Svalbard Global Seed Vault, Norway

11 Fire-stimulated Germination

Certain native species such as *Eriostemon australasius*, Rutaceae are known to germinate better after exposure to bush-fire related cues such as smoke or heat.



Eriostemon australasius

12 Number of Hybrids from Inbred lines

Number of hybrids that can be developed with a given number of inbred lines.

No. of inbreds	Top crosses	Single crosses	Double crosses
5	5	10	15
10	10	45	630
20	20	190	14,535
100	100	4,950	11,763,625
500	500	124,750	77,190,933,725

Scientific Breakthroughs

Before the Heat Arrives: Resetting the Rice Flowering Clock

A rice gene offers breeders a way to move flowering into cooler hours, while revealing why precise timing matters as much as heat tolerance.

Heat during rice flowering can disrupt pollen release and fertilisation, reducing seed set. Advancing flower opening into cooler morning hours offers an alternative to increasing heat tolerance. In *Plant Biotechnology Journal*, Takuma Ishizaki and colleagues identified EARLY-MORNING FLOWERING 3 (EMF3), providing a defined genetic target for adjusting this critical reproductive window across diverse rice backgrounds.

The researchers mapped the previously identified qEMF3 region using more than 7,000 segregating plants. They traced early flowering to *emf3-1D*, an allele carrying a single nucleotide substitution that changes one amino acid. This substitution was absent from the original wild-rice donor examined, suggesting that it arose during development of the breeding material. Additional EMF3 substitutions produced earlier or later opening, generally with semi-dominant effects, meaning that plants carrying one altered copy showed intermediate responses.

EMF3 encodes a membrane-localised protein expressed specifically in anthers, beginning during the night preceding flowering. Its effects extended to gene expression in both anthers and lodicules, the structures whose expansion opens the flower. These findings reveal anther-based control of flowering time, although the signals coordinating the two tissues remain unresolved. Completely disabling EMF3 disrupted flowering synchrony and anther opening, sharply reducing fertility; useful breeding therefore requires selected alleles rather than gene removal.

Controlled heat experiments demonstrated the value of this adjustment. In Toyomeki, early-flowering alleles allowed flowering to finish at least two hours earlier, while temperatures remained below 35°C. In a separate experiment, where morning temperature increased from 25 to 37°C, Caiapo carrying *emf3-1D* achieved 88.0% seed setting, compared with 47.4% in its recurrent parent. The significant improvement resulted from avoiding the hottest flowering period, not from demonstrated increases in intrinsic heat tolerance.

The response depended on genetic background.

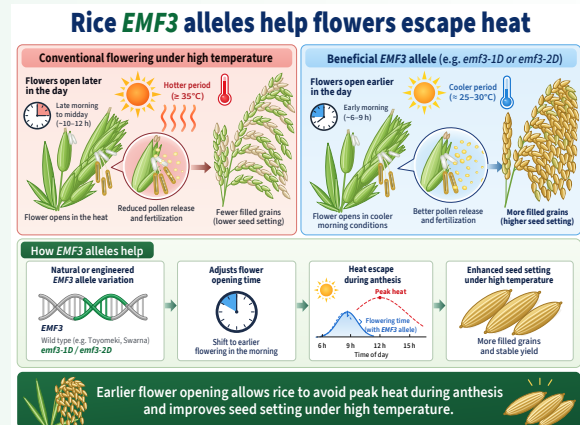


Figure 1. Selected EMF3 alleles advance rice flowering into cooler hours, improving seed set under heat stress in responsive cultivars.

Swarna carrying *emf3-1D* recorded 78.4% seed setting compared with 67.5% in the parent, but this difference was not statistically significant. Swarna already flowers relatively early and is more heat tolerant than Caiapo. Consequently, the breeding value of an earlier schedule depends on the cultivar's starting flowering time, susceptibility and local temperature pattern. A favourable allele cannot be assumed to provide identical benefits in every production environment.

Beyond protecting seed set, EMF3 offers opportunities to improve flowering overlap between parents used in hybrid seed production. Earlier or later alleles could help align parental schedules, including combinations from different rice subspecies. Marker-assisted introgression demonstrated that flowering could be advanced in several widely grown cultivars, providing useful material for further breeding and evaluation. Selected early-flowering lines also showed no significant changes in yield components under normal temperate field conditions.

For research institutions and seed companies, the next step is to match alleles with parental combinations and target environments while monitoring fertility and agronomic performance. Commercial improvements in hybrid seed yield still require validation, but EMF3 establishes a precise route to reproductive heat avoidance and better flowering synchronisation.

Research source

Ishizaki, T., Hashida, Y., Hirabayashi, H., Sasaki, K., Tokunaga, H., et al. (2026). Rice EMF3 Alleles Adjust Flower Opening Time to Enhance the Seed Setting Rate Under High Temperature Stress. *Plant Biotechnology Journal*, 24, 4780-4798. DOI: 10.1111/pbi.70653

Scientific Breakthroughs

Maternal Control Links Rice Dormancy and Grain Nutrition

A maternally expressed endosperm regulator connects the decision to germinate with development of the grain's nutrient-rich aleurone, revealing both a breeding opportunity and a trade-off.

Rice improvement must balance reliable germination with protection against sprouting before harvest. Research by Xiaojun Cheng and colleagues in The Plant Cell connects this balance with development of the nutrient-rich aleurone. The study identifies maternally expressed **FERTILIZATION-INDEPENDENT ENDOSPERM1 (OsFIE1)** as a regulator linking endosperm-imposed dormancy, hormone production and grain composition, revealing both an opportunity and a trade-off for breeding.

OsFIE1 forms part of Polycomb repressive complex 2 (PRC2), which suppresses selected genes through H3K27me3 marks on histones, the proteins around which DNA is packaged. In rice endosperm, OsFIE1-containing PRC2 represses gibberellin-biosynthesis genes. Gibberellins promote germination, so restricting their accumulation helps establish dormancy. This mechanism links epigenetic regulation to the restraint imposed by tissues surrounding the embryo, rather than treating germination as an embryo-only decision.

Plants lacking functional OsFIE1 showed preharvest sprouting, and freshly harvested seeds germinated more readily than the normal Kitaake parent. Increasing OsFIE1 expression strengthened dormancy. Once dormancy had been removed through after-ripening and treatment, most germination differences disappeared, indicating that OsFIE1 primarily affects dormancy acquisition rather than the fundamental capacity to germinate. Mutant endosperm extracts also promoted germination, supporting an endosperm-derived hormonal effect.

Hormone measurements and chromatin analyses linked the mutant phenotype to increased gibberellin accumulation and reduced repression of biosynthesis-related genes. Disrupting *OsGA20ox1*, a gibberellin-biosynthesis gene, partly corrected the defects, demonstrating its importance while implicating additional pathways. OsFIE1-containing PRC2 also targeted *OsCR4*, a regulator of aleurone identity. Loss of OsFIE1 increased aleurone cell layers particularly on the grain's dorsal side, connecting hormonal regulation with differentiation of this specialised endosperm tissue.

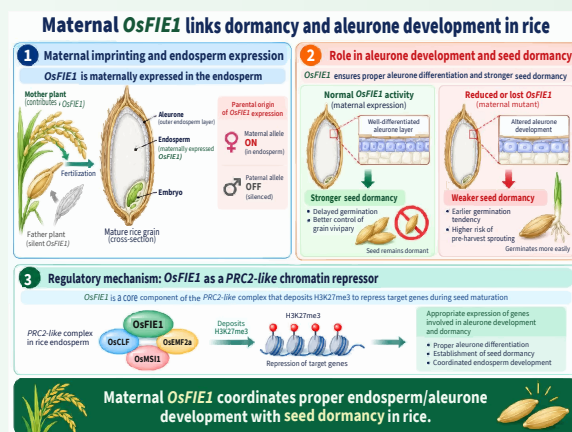


Figure 2. Maternal OsFIE1 regulates gibberellin production and dorsal aleurone development, linking rice dormancy with grain composition.

Reciprocal crosses established the parental effect. Seeds inheriting mutant OsFIE1 from the mother germinated more readily and developed thicker dorsal aleurone than those inheriting it from the father. Only maternal OsFIE1 transcripts were detected in the germinating endosperm examined. However, experimentally increasing expression of a paternal copy overcame the maternal defect, showing that the difference reflects genomic imprinting and gene regulation, not an inherently inactive paternal protein.

The thicker aleurone accompanied measurable compositional benefits in brown rice. Mutants contained more lipids, free amino acids, several vitamins and minerals, including iron and zinc. Lysine increased, while phytic acid declined to approximately 55% of the normal level. Total storage protein did not increase markedly overall, although individual fractions changed. These findings concern grain composition; benefits in polished rice or human nutrient absorption were not demonstrated.

For seed and nutrition breeding, the challenge is to retain compositional gains without increasing preharvest sprouting or developmental abnormalities observed in some mutant embryos. Adjusting expression or identifying milder alleles warrants investigation, but an optimal combination remains unproven. The study establishes maternal epigenetic regulation as a shared control point for dormancy and endosperm differentiation, emphasising that nutritional improvement must be assessed alongside seed quality and harvest stability.

Research source

Cheng, X., Zhang, S., E, Z., Yang, Z., Cao, S., et al. (2025). Maternally expressed FERTILIZATION-INDEPENDENT ENDOSPERM1 regulates seed dormancy and aleurone development in rice. *The Plant Cell*, 37, koae304. DOI: 10.1093/plcell/koae304

In Memoriam

The Indian Society of Seed Technology (ISST) pays tribute to two respected seed scientists whose contributions to seed science and technology will be remembered with gratitude.

Professor Stan Matthews

Died 16 March 2026 | Aged 84



Professor Stan Matthews, an internationally respected seed physiologist and Emeritus Professor at the University of Aberdeen, United Kingdom, passed away on 16 March 2026, aged 84.

His research advanced understanding of seed vigour, ageing and the metabolic repair processes that occur during early germination. He helped connect seed physiology with practical assessments of seed quality, notably through the development of radicle emergence and controlled deterioration tests used in international seed testing.

Through his long association with the International Seed Testing Association (ISTA), and collaborations with Professor Alison Powell and other colleagues, he contributed to research, method development and international training. His legacy endures in the testing methods he helped establish and in the researchers and seed analysts whose work he influenced.

Dr. P. K. Agrawal

12 February 1938 – 23 March 2026



Dr. P. K. Agrawal, a respected seed scientist who devoted his professional life to seed science and technology, passed away on 23 March 2026, aged 88.

His published research included studies of seed viability and storage, examining how temperature and relative humidity influence the preservation of seed quality. This work addressed a central practical concern of seed technology: maintaining viable seed from harvest to the next planting season.

He worked as Head, Division of Seed Science and Technology, ICAR-IARI and also as a coordinator for designing various courses when the division was first established. He generously donated Rs. 10 Lakhs for awarding Gold Medal to Best MSc and PhD students from the Division of Seed Science and Technology, ICAR-IARI, New Delhi.

ISST remembers his lifelong commitment to the discipline with respect and gratitude, and honours his contribution to the seed science community.

ISST extends its heartfelt condolences to the families, friends, students and colleagues of both scientists.

NOTE:

All the ISST members are requested to contribute to various columns of Seed Tech News by providing information on a) Awards and Honours received; b) Upcoming trainings/ events; c) Recommendations of scientific gatherings; d) Latest research findings etc. In addition, brief technical notes may also be submitted for fast dissemination.

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