

# Seed Tech News



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

**Volume: 43, No. 2, June 2013**

## Science



### ***Caenorhabditis elegans* L.**

This model organism is normally self-fertilizing hermaphrodite soil nematode whose development genetics has been extensively studied. It is not more than 1mm long. Interestingly loss of an X chromosome by meiotic disjunction leads to the production of males. It is an unsegmented pseudocoelomate, lacks a respiratory and a circulatory system. The genetic basis of apoptosis (a process of programmed cell death in multicellular organism) was first shown in *C. elegans* in 1986. It has five pair of equally sized autosomes and one pair of sex chromosomes and it is the first multicellular organism whose whole genome has been sequenced in 1998. The 97mbp genome contains 19,000 genes on 6 chromosomes. About 74% of human genes have their homologues in the *C. elegans* genome.

## Identification of Four *Bromus* Species

An efficient seed certification programme should aim to facilitate seed trade by reducing technical barriers, improving transparency and lowering transaction cost. Quality seed produced in one country should be readily made available for sowing throughout the world. Proper identification of weeds paves way to reduce the risk of spreading weeds and forms the key component of weed management strategies. Identification of weeds is essential to decide whether the seeds produced can be offered for marketing and subsequent action. Other Crop Seeds (OCS) is a component of physical purity as determined by laboratory examination on an officially drawn sample. The type, number and weight of OCS largely depicts the agricultural practices followed during seed production. Among many OCS found in the Proficiency Test sample circulated by International Seed Testing Association (ISTA) under the Accreditation Programme, *Bromus* species (brome grass) are most often encountered. The name 'brome' means 'food' in greek. These four species are cheat/chess (*Bromus secalinus*, Fig. 1), smooth brome (*Bromus inermis*, Fig. 2), soft chess (*Bromus hordeaceus*, Fig. 3) and barren chess (*Bromus sterilis*, Fig. 4). These are commonly seen in cultivated fields, pastures, old fields, road sides, railway lines and disturbed areas.

According to AOSA, soft chess is designated as either crop or weed seed depending on the kind of pure seed it is a contaminant in. Japanese chess is classified as weed seed and cheat & hairy chess are considered noxious weed seeds. These are also highly regulated in Canada and former soviet region. Therefore, it is important for the analyst to identify them correctly. Brome grasses are very similar, fairly large and diagnostic details are visible under low magnification (6X). They have a characteristic rachilla segment. The beak of the rachilla is flat, the front is round and bulged out in the upper portion. The callus tips forward so the plane of the callus tip is parallel to the long axis of the floret. The size of florets may vary depending on their position on the rachilla.

**Secretary : SK Jain**  
**Editor : Manjunath Prasad CT**

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Fig. 1: *Bromus secalinus* (cheat). 1a. Palea view; 1b. Lemma view; 1c. Rachilla; 1d. Lateral view (side); 1e. Awn (rudimentary or 1-6 mm in length) and 1f. Palea with prominent v-shaped cavity

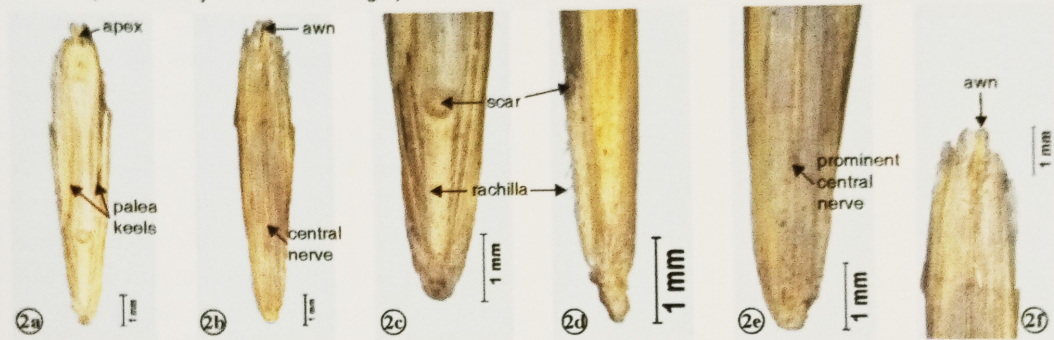


Fig. 2: *Bromus inermis* (smooth brome). 2a. Palea view; 2b. Lemma view; 2c. Rachilla; 2d. Lateral view (side); 2e. Lemma with prominent central nerve and 2f. Awn frequently absent, when present reduced (1-2 mm)

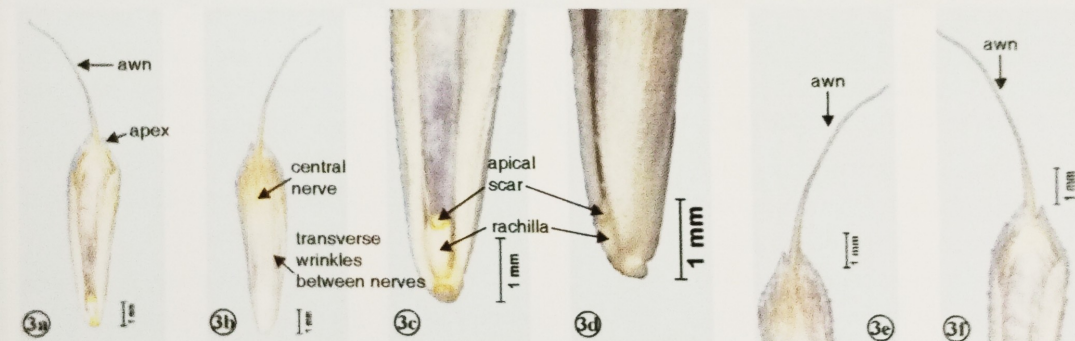


Fig. 3: *Bromus hordeaceus* (soft chess). 3a. Palea view; 3b. Lemma view; 3c. Rachilla-scar at apex of rachilla slants back at about a 45° angle; 3d. Lateral view (side); 3e. Lemma is finely pubescent and short soft hairs over entire surface and 3f. Stout awn (6-9 mm)

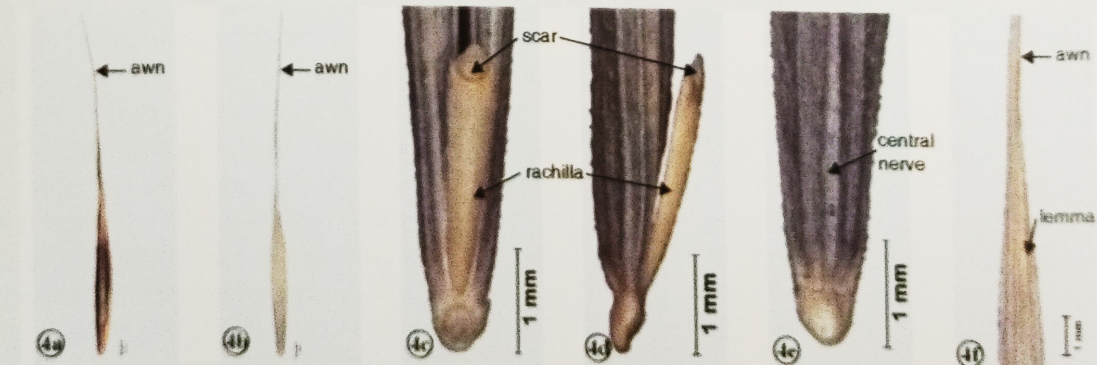


Fig. 4: *Bromus sterilis* (barren chess). 4a. Palea view; 4b. Lemma view; 4c. Rachilla with course stiff hairs; 4d. Lateral view (side); 4e. Lemma with prominent central nerve extending into awn and 4f. Awn and lemma covered with short hispid (stiff) hairs

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 Images taken from Zeiss microscope [Model: EXOM10]. The author acknowledges Dr. Naresh Mishra, Scientist, Division of Entomology, IARI for facilitating imaging of seeds.

Table 1. Seed characteristics of *Bromus* sp for identification

Kind	Shape/colour	Caryopsis	Lemma	Palear	Callus	Rachilla	Awn
<i>Bromus secalinus</i> (Cheat or chess)	Slender, laterally folded, straw to dull brown colour	7-8x1.5-2 mm Thick and rounded, folds towards the center of the palea	6-8x1.5-2 mm, elliptic, obtuse, smooth, tightly attached to caryopsis, seven nerved	As long as lemma and caryopsis, covered by edges of lemma, hairy, teeth stiff and sharp spikes	Glabrous or laterally short haired	1-1.5 mm, rounded, curved inward at the top, stands out further from the seed, hirsute, apical scar oblique*	3-5 mm long to short and rudimentary with an abrupt twist
<i>Bromus inermis</i> (Smooth brome)	Flattened dorso-ventrally, light greenish-purple	7-8 mm long, flat or slightly boat shaped	9-12x2 mm, 3 nerved, short pubescence near the base, exceeding grain or palea	Narrower than caryopsis, hair on keels very short, fine and close spaced	Glabrous	2-3 mm long, bristly pubescent, apical scar oblique or vertical	1-2 mm long or absent
<i>Bromus hordeaceus</i> (Soft chess)	Flat or slightly curved, wider in proportion to length, straw coloured	6-6.5x1.5-2 mm. Thin flattened toward the tip	8-9 mm long, papery, frail appearing with minute transverse wrinkles, obtuse, seven nerved, margin and apex hyaline, apex bifid	3/4 <sup>th</sup> as long as lemma, wrinkled, semi-transparent, teeth long, sharp and curved	Oblique	Short, rounded, curved inward at the top, hirsute*	6-9 mm long, stout and straight
<i>Bromus sterilis</i> (Barren chess)	Stiff, slender, purplish	9-11 mm long, very slender, ventrally furrowed	12-20 mm long, scabrous or pubescent, teeth 2 mm long, 5-7 veins, sharply bifid at apex	Exceeds apex of caryopsis, curved, concavity deep, v-shaped obscured by unrolled lemma	Glabrous, rounded polished	2 mm, slender straight, apex flattened, coarsely hirsute, longer bristles toward the tip	Very long 20-30 mm, scabrous

\*SCAR at the tip of the rachilla slants about a 45° angle

## Glossary

- Apex** : the narrow or pointed terminal end of the seed
- Awn** : slender, straight or bent bristle. In grasses, usually a continuation of the mid-nerve of lemmas or glumes
- Beak** : a long, pointed prolongation of a fruit
- Caryopsis** : naked grass fruit in which the testa is united with the pericarp
- Floret** : an individual flower occurring in a cluster of flowers
- Lemma/Callus** : an outer (lower) bract of a grass floret, sometimes referred to as the flowering glume or the lower or outer palea. Bract enclosing the caryopsis on the outer (dorsal) side
- Palea** : the upper (inner) bract of a grass floret, sometimes called the inner or upper palea. Bract enclosing the caryopsis on the inner (ventral) side
- Scar/Rachilla** : a secondary rachis. In particular grasses the axis that bears the floret
- Rachis** : the main axis of an inflorescence

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- Manjunath Prasad CT, SK Jain, Vilas A Tonapi<sup>1</sup>, SK Chakrabarty and M Dadlani**  
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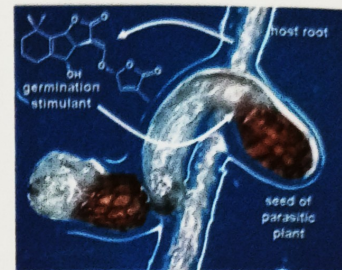
# Seed Tech News

## Strigolactone: Discovery and Physiological Roles

Hormones regulate plant growth and development. Some well known or classical phytohormones are auxin, gibberellins, cytokinin, abscisic acid and ethylene. There are some new lesser known phytohormones viz. brassinosteroids, jasmonic acid, systemins, karrikins etc. Strigolactone is one such less known recently discovered phytohormone. Although strigolactone have been implicated in regulation of many physiological processes, but its role has been confirmed in inhibition of shoot branching, stimulation of parasitic weed seed germination and attracting mycorrhizal fungi. Other physiological processes strigolactone implicated in are root growth, root hair elongation, adventitious rooting, secondary growth, photo-morphogenesis, seed germination, nodulation and protonemal development in mosses. Strigolactone are derived from carotenoids. The chemical structure of Strigolactone comprises of 4 rings, ring A, B, C and D. Of these ring C and D were highly conserved and are necessary for the biological activity. There is considerable variation in ring A and B due to different side groups. As it was isolated as a germination stimulant of root parasitic plant 'Striga', it got the name Strigolactone. The lactone refers to the chemical structure which is a cyclic ester. *Strigol* was the first Strigolactone to be identified. Other examples of Strigolactone are (+)-Orobanchol, (+)-5-Deoxystrigol and GR24 (Synthetic analogue of strigolactone).

*Striga* (*Striga asiatica*) is a common weed plant in dry region of South Asia and Africa. It is a parasitic plant that attacks the roots of monocotyledon plants like sorghum. The striking feature of *Striga* is that its seed germinate only when there is a presence of a compound called Strigolactone in the medium. Strigolactone is secreted from the roots of the host plants. The secretion of Strigolactone was known from decades but 2005 paper showed that Strigolactone was produced from carotenoids like that of branching inhibiting hormones which were produced when carotenoids were cleaved. The researchers correlated the two stories and thus they formed the hypothesis that Strigolactone was the branching inhibiting

hormone. To confirm the hypothesis researchers administered Strigolactone to mutant plants and observed that the excess shoot branching was returned to normal. Thus they have confirmed that Strigolactone was a new plant hormone responsible for inhibition of branching.



Two mutants namely *rms1* and *dad1*, increased branching mutant in gardenpea (Fig. 1) and *Petunia*, respectively were also instrumental in the discovery. In these mutants a mobile signal produced in shoot and root inhibits shoot branching. This signal was referred to as SMS (shoot multiplication signal). Cytokinin and auxin regulate the apical dominance; cytokinin promotes the growth of axillary buds, whereas auxin inhibits the growth. It was believed that the ratio between auxin and cytokinin regulates the growth and branching of the plants. So researchers presumed that cytokinin must be in excess in the increased branching mutants. In order to know the substance involved in the SMS, the indigenous plant hormones like auxin, cytokinin and abscisic acid were measured. It was presumed that indigenous cytokinin concentration would be high as cytokinin promotes the growth of axillary buds. But the result was opposite. Similar measurements were also conducted in other mutants and it was concluded that SMS was a novel plant hormone. SMS moves *acropetally* in shoot and inhibits lateral bud outgrowth. When mutant plant was grafted onto normal plant, shoot branching returned to the normal state. Since then, increased shoot branching mutants were observed in other plants. As the same



Fig. 1. Wild pea (*Pisum sativum*) (left) and SL-deficient mutant (right)

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phenomenon was observed in other plants also it was highly possible that the new plant hormone was involved in the process. The shoot branching process involves the formation of axillary buds in the axil of leaves and subsequent growth of bud. Earlier studies using recessive mutants have shown that an unidentified hormone was inhibiting the outgrowth of axillary buds. These mutants were ramosus (*rms*) of pea (*Pisum sativum*), more axillary growth (*max*) of *Arabidopsis*, decreased apical dominance (*dad*) of petunia (*Petunia hybrida*) and dwarf (*d*) or high-tillering dwarf (*htd*) of rice (*Oryza sativa*). Researchers used three increased branching mutants each with respective deficiencies of D17, D10 and D3 genes. Genes D17 and D10 were shown to produce carotenoid cleavage dioxygenase (CCD), which cleaves pigment called carotenoids. This suggested that branch inhibiting hormone was produced when carotenoids were cleaved. As branch inhibiting hormone was not produced in the mutants D17 and D10, they were showing excess branching. Gene D3 was considered to be the receptor for the shoot branching hormone. It was concluded that D3 gene deficient mutant plant produced branching inhibiting hormones but failed to respond to them leading to excess shoot branching. In order to identify the branching inhibiting hormone researchers conducted bioassays. They administered the mutant plants with the liquid extracts from the tissues of plants that were believed to contain the branching inhibiting hormone. If the extract elicited the expected response, the components of the extract were isolated and administered separately. The cycle of separation, administration and examination was repeated time and again. Still researchers had hard time zeroing in. The deadlock was finally broken when a paper on the root-parasitic plant *Striga* was published in October 2005.

Strigolactone contribute to define plant morphology, in response to environmental cues and communicate with the organisms in the rhizosphere. As a consequence it has great potential in modern agriculture. The technique of controlling branching of plants can be of great use to agriculture and horticulture. For example, the quality and quantity of grains, fruits and flowers is affected by number of branches. More branching is correlated with higher yields in rice and wheat but branching in sorghum is not desired character. Weeds constitute around 10 to 40 % loss to agricultural productivity. Strigolactone can also be of great use in the management of weeds. To explore all these possibilities further research is needed in this area for the benefit of mankind.

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## Editorial Contact Information

Please send us information related to any news, new projects, opinions on policy issues, current happenings, publications, book reviews, foreign visits, new appointments, trainings, seminars, workshops and conferences or other interesting stuff related to seed for the next issue of Seed Tech News.

Suggestions and comments are welcome!

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# Seed Tech News

## Notification

Ministry of Agriculture  
(Department of Agriculture and Co-operation), Govt of India

New Delhi, the 10 April 2013

**S.O. 952 (E)** – In exercise of the power conferred by Section-5 of the Seeds Act, 1966 (54 of 1966), the Central Government, after consultation with the Central Seed Committee, being of the opinion that it is necessary and expedient to regulate the quality of the seeds of the varieties specified in column (2) of the table below of the kind specified in the corresponding entries in column (1) of the said table, hereby declares that the said varieties of seeds shall be the notified varieties to be sold for purpose of agriculture for the States mentioned in column (3) of the said table and shall be the notified varieties for the whole of India for the purpose of seed production and quality control with effect from the date of publication of this notification in the Official Gazette, namely:

Kind (1)	Variety (2)	States (3)
Barley	DWRB 91	PB, HR, UP, DL & RJ
	RD 2786	GJ, MP, CG, RJ & UP
Chickpea	GNG 1958 (Marudhar)	RJ, PB, HR, UP, UT & DL
	Nandyala Sanaga 1 (NBEG 3)	AP
Cotton (GMS Hybrid)	CSHG 1862	HR, PB & RJ
Foxtail millet	SiA 3085	AP, KA, TN, BH, MP & UT
Indian mustard	RH 0749	JK, PB, HR, DL & RJ
Kabuli chickpea	GNG 1969 (Triveni)	PB, HR, RJ, UP, DL & UT
Maize (Hybrid)	BIO 605	JK, HP, UT, SK, AR, ML, MN, MZ, NL, MH, AP, KA, TN & KL
Mesta	Shanti (JBM-71)	OR
Pearlmillet	HHB 234 (MH 1561)	RJ, GJ & HR
Pearlmillet (Hybrid)	MPMH 17 (MH 1663)	RJ, GJ, HR, PB, MP, UP & DL
Pigeonpea	Rajeshwari (Phule 0012)	GJ, MH & MP
	Rudreshwara (WRG-65)	AP
Rice	DRR Dhan-40 (IET 21665)	TN, MH & WB
	(RP 3644-1-9-5-5)	
	Siddhi (WGL-44) (IET-19387)	AP
	Sheetal (WGL-283) (IET-20987)	AP
Sesame	HT 9713 (HT 2)	JK, PB, HP, HR & DL
Sorghum (Hybrid)	CSH 31R (SPH 1666/DJ4005)	MH, KA, GJ & TN
	CSH 30 (SPH 1655)	MH, KA, MP, GJ & AP
Soybean	Pant Soybean-19 (PS 1368)	UT
Sugarcane	Uttara	AP
	Kanakamahalakashmi	AP
Wheat	HPW 349	JK, HP, UT, SK, WB, AS, AR, MN, ML, MZ, TR & NL
	PUSA Mangal (HI 8713)	MP, CG, GJ, RJ & UP
	PUSA Thenmalai (HW 5216)	TN & KA
	WH 1105	PB, HR, DL, RJ, UP, JK, HP & UT

Sd/-

**Atanu Purkayastha, Joint Secretary**  
[F. No. 3-21/2012-SD. IV]

The two letter abbreviations of Indian States & UT's is as per 'ISO-3166-2 Code', where AP-Andhra Pradesh; AR-Arunachal Pradesh; AS-Assam; BR-Bihar; CG-Chhattisgarh; DL-Delhi; GA-Goa; GJ-Gujarat; HR-Haryana; HP-Himachal Pradesh; JK-Jammu & Kashmir; JH-Jharkhand; KA-Karnataka; KL-Kerala; MP-Madhya Pradesh; MH-Maharashtra; MN-Manipur; MG-Meghalaya; MZ-Mizoram; NL-Nagaland; OR-Odisha; PB-Punjab; RJ-Rajasthan; SK-Sikkim; TN-Tamil Nadu; TR-Tripura; UT-Uttarakhand; UP-Uttar Pradesh; WB-West Bengal.

## PhD Thesis Abstracts

### Assessment of distinctiveness and uniformity of the characteristics in farmers' rice varieties and their application for PVP

Sixty Farmers' varieties of rice collected from the different parts of the country were characterized at IARI, New Delhi using morphological descriptors notified by the PPV&FR Authority and subsequently examined for their Distinctiveness, Uniformity and Stability. Among the 46 visually assessed characters, 6 characters were monomorphic, 11 characters were dimorphic and 29 characters were polymorphic indicating their potential for varietal characterization and distinctiveness. No intra-varietal variation was observed for any of the visual characteristics and expression of characters in different varieties remained same for the two consecutive years confirming the uniformity and stability of the varieties for visual characteristics. Combined over the years distinctiveness (COY-D) and combined over the years uniformity (COY-U) analysis was used to establish distinctiveness and uniformity of farmers' varieties based on DUS descriptors. On the basis of grouping characteristics unique morphological profiles were established for maximum varieties. Besides the 60 morphological descriptors listed in the National DUS Testing Guidelines (PPV&FRA, 2007), one new distinctive characteristic (*Very Long Sterile Lemma*) was recorded, which established distinctiveness of two varieties namely, Surajone and Ranikajar. Significant difference with respect to grain dimensions, physicochemical and cooking properties was observed. The length and breadth of milled raw rice varied from 3.99 to 7.65 mm and from 1.43 to 3.09 mm, respectively. Based on the L/B ratio, varieties were grouped into seven classes, short slender (4), short bold (23), medium slender (4), long slender (6), long bold (21), Basmati type (1) and Extra long slender (1). The amylose content ranged from 6.82% in variety Chipdo to 29.69% in Sulendas. The gelatinization temperature (GT) was medium to high in 13 varieties and high in 47 varieties. Molecular characterization was undertaken using SSR primers with 8 primer set showing polymorphism yielding 16 alleles among these 60 varieties. The number of alleles per microsatellite ranged from 1 (RM238, RM119 and RM120) to 3 (RM259, RM234 and RM551) with an average of 2 alleles per locus. Considering the entire genotypic array, the mean value for polymorphic information content (PIC) for all microsatellites was 0.27. The UPGMA cluster analysis grouped varieties into three main clusters with 58% genetic similarity and homing 24, 23 and 13 varieties, respectively. Grain character based clustering was better than molecular markers as accessions were in expected clusters. The diversity analysis suggested the distinct nature of farmers' varieties in a large number of clusters indicating greater diversity, which could be exploited in breeding programmes, particularly with respect to the grain traits.

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Name of the Major Supervisor: **Dr (Ms) Malavika Dadlani**  
**Division of Seed Science and Technology**  
**IARI, New Delhi 110 012**

### Optimization of quality hybrid seed production in pumpkin cv. Pusa Hybrid-1

Morphological characterization, floral biology and post harvest storage practices are most critical in pumpkin hybrid seed production. An experiment at Seed Production Unit, IARI was conducted to optimize quality hybrid seed production technology in pumpkin. The parental lines of pumpkin [Pusa Hybrid-1] was characterized based on morphological characters using NBPGR descriptor. The parental lines showed distinct differences in vegetative characters, flowering behavior and fruit characters. The anthesis began early in the morning between 3.00 and 4.00 AM reaching the peak between 5.00 and 6.00 AM in parental lines. Flowers in both sexes started closing at about 8.00 AM and found completely closed between 11.00 AM and 12.00 noon. The duration of flower anthesis was about 3 hr 30 min and closure duration was about 3-4 hr in flowers of both sexes. The pollen stored in refrigerator recorded higher viability (62.99 %) than the ambient conditions (23.40 %) after 96 hr of storage. The higher fruit set percentage in the flowers pollinated at anthesis (51.12 %) than at 12 hr before anthesis (9.22%) indicated that stigma was being receptive 12 hr before anthesis. Retention of one fruit per vine recorded significantly higher fruit weight (4.46 kg), No. of filled seeds (473.50), 100-seed weight (14.67 g), seed yield per fruit (70.44 g), seed germination (94.27 %) and other seed quality attributes as compared to retention of two fruits per vine. Within the fruit, among the three segments, the seed from the middle segment showed highest number of filled seed (166.40), total number of seed (175.70) and germination (90.64 %) followed by stylar segment with the lowest in peduncular segment.

Fruits harvested at 70 DFA outperformed with respect to fruit development attributes - fruit weight (3.77 kg), fruit length, fruit diameter, cavity length and cavity diameter, whereas fruits harvested at 60 DFA with 10 days post harvest ripening (PHR) showed superiority with respect to number of filled seed (489.85), 100-seed weight (14.68 g), germination (93.44 %), weight of the seed coat, embryo & cotyledons (0.294 g, 0.024 g & 1.413 g) as well as protein (399.5 mg/g) and oil (45.5 %) contents when compared to other treatments indicating highest level of development and metabolic gain of the seed. The seed obtained from 20 days PHR followed by shade drying resulted in the best quality seed with respect to germination (94.33 %), seedling length (34.30 cm), vigour index - I (3236.52), electrical conductivity (17.30  $\mu$  mhos/cm/g) followed by 20 days PHR and mechanical drying.

Name of the student: **Vinod Kumar**  
Name of the Major Supervisor: **Dr. BS Tomar**  
**Division of Seed Science and Technology**  
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1. Dr. Vilas A. Tonapi is relieved as Head, Division of Seed Science and Technology, IARI, New Delhi to relocate back to Directorate of Sorghum Research, Rajendranagar, Hyderabad. He was known for his simplicity, encouragement, support and guidance in discharging duties as Head, DSST, IARI. ISST wishes all the success in his future career.
2. Dr. (Ms) Sangita Yadav, Principal Scientist has the joined the team of scientists at Division of Seed Science and Technology, IARI on May 24, 2013. With her joining, the seed physiology research is further strengthened. ISST welcomes her to the seed fraternity and wishes her all the success in research career.
3. The Division of Seed Science and Technology, IARI is fortunate to have Dr. PK Agrawal, Former Head, DSST, IARI as the Adjunct Faculty of Division of Seed Science and Technology *w.e.f.* January 24, 2013. This forward step by PG School, IARI will significantly contribute in strengthening the teaching and research programme.
4. Ms. Manisha Saini is the new face at the Division of Seed Science and Technology, IARI. A post-graduate in Biotechnology from CCS Meerut University has reported to duties as Technical Officer (T-3) *w.e.f.* January 17, 2013. ISST welcomes her to the Seed Science fraternity and wishes her a fruitful career at DSST, IARI.

### Erratum

The number under the notification of seed varieties dated October 04, 2012 in Page-07 of SeedTechNews Issue No. 43(1) of March 2013 should be read as S.O. 2636(E) instead of S.O. 2125(E). The typographical error is deeply regretted.

## INDIAN SOCIETY OF SEED TECHNOLOGY

### RECEIPTS & PAYMENTS ACCOUNT FOR THE YEAR ENDED 31 MARCH 2013

RECEIPTS	AMOUNT	PAYMENTS	AMOUNT
<b>Opening Balance</b>		<b>Payments</b>	
Cash in Hand	1,897.18	By Salary	94,000.00
Cash at Bank	1,02,306.75	By Reading Proof (Magazine)	4,350.00
Fixed Deposit	34,67,185.30	By Audit Fee	4,494.00
<b>Receipts</b>		By Stationary	6,140.00
Membership & Subscription		By Postage	9,630.00
Ordinary	600.00	By Rental Charges	1,30,000.00
Associates	1,12,000.00	By Misc. Expenses	12,213.00
Life	82,100.00	By Bank Charges	452.00
Sale of Seed Research	20,160.00	By Meeting Expenditure	14,800.00
Reg. Fees	1,085.00	By Kamala Print-N-Publish	1,00,000.00
Grant-in-aid from ICAR	96,250.00	<b>Closing Balance</b>	
Fellowship Fee	200.00	Cash in Hand	32,789.18
Interest on SB A/c	6,140.94	Cash in Bank	13,871.69
		Fixed Deposit	34,67,185.30
			<b>35,13,846.17</b>
			<b>38,89,925.17</b>

Sd/-  
(SK JAIN)  
Secretary

Certified that in our opinion and to the best of our knowledge & belief and according to the books and record presented to us for verification and information and explanation given to us, the above set forth Balance Sheet as on 31-03-2013, Income & Expenditure A/c and Receipts & Payment A/c for the ended on that date are true and correct.

Sd/-  
for Pandey KM & Associates, Chartered Accountants

New Delhi  
01 December 2014

CA KM Pandey

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