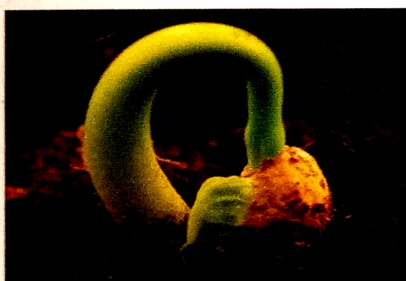


# Seed Tech News



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

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## Appeal

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

Suggestions and comments are welcome!

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## Upgrading of Directorate of Seed Research to Indian Institute of Seed Science

Considering the importance of quality seed in catapulting agricultural and horticultural crops productivity to the next higher level and excellent quality seed production, coordination and research work being carried out at directorate of Seed Research, Mau: the Indian Council of Agricultural Research in its 235<sup>th</sup> Governing Body Meeting held on 1<sup>st</sup> December, 2015 has upgraded as **ICAR-Indian Institute of Seed Science, Mau (UP)** vide order No. CS.17/1/2016IA-III, dated 16.02.2016. The effected change is anticipated to usher in a significant expansion in the sphere of scientific activities and boost up the morale of all seed research workers in the country.

## POWER POINT PRESENTATION



- Dr Atul Kumar, Senior Scientist and Nodal Officer Hindi was awarded with second prize in Power Point Presentation Competition in Hindi on “**Genetically Modified Crops: Samay Se Pahle Hi Mrityu**” on October 06, 2015. He was felicitated by the Director IARI Dr T Mohapatra in function organized at Dr BP Pal Auditorium on November 07, 2015 with certificate and a cash prize of Rs 7000.

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## RESEARCH PROGRAMME [2014-2019]

Division of Seed Science and Technology  
ICAR-Indian Agricultural Research Institute  
New Delhi 110012

### Research Programme 1

Development of technologies/ methodologies for quality seed production, maintenance of seed purity and varietal identification - (CRSCIARISIL2014012)

#### Projects

1. To undertake basic studies and to develop hybrid seed production technology of rice, maize, pearl millet, Indian mustard, pigeon pea and cauliflower.
2. To understand effect of high temperature on seed yield and quality in parental lines of wheat hybrid

### Research Programme 2

Seed quality enhancement by processing, packaging and storage options in high volume seed crops - (CRSCIARISIL2014013)

#### Projects

1. Evaluation of seed vigour and dormancy traits in rice
2. To study the basis of differential response of seed quality traits in conventional and quality Indian mustard genotypes
3. To understand the relation of seed composition with seed vigour and storability in speciality maize
4. To understand the physiological and molecular mechanisms of seed priming in pigeonpea and soybean under various abiotic stresses
5. To evaluate morphological, physiological and molecular traits associated with seed vigour and longevity in mini-core collections of soybean
6. To standardize the machine and crop variables for multi-stage mechanical seed processing
7. To develop seed quality enhancement technology for direct seeded rice, summer mungbean, chickpea and pigeon pea

### Research Programme 3

Seed quality enhancement by processing, packaging and storage options in low volume seed crops - [CRSCIARISIL2014014]

#### Projects

1. To access seed quality changes during seed development & maturation under changing climatic conditions
2. Improving planting value of seed through priming, coating and pelleting technologies and evaluation of their effect on seed longevity in selected vegetable crops
3. Effect of seed moisture content and packaging material on seed storage and vigour assessment
4. Optimization of mechanical processing parameters for up gradation of seed quality

### Research Programme 4

Development of protocols, validation and execution for quality seed production through farmers for sustainable truthfully labeled seed production system - [CRSCIARISIL2014015]

#### Projects

1. Development of efficient quality seed production programme of cereal crops
2. Development of efficient quality seed production programme of pulses and oilseed crops
3. Development of efficient quality seed production programme of vegetable crops
4. Standardization of postharvest handling of seeds



Seed coating can be a carrier of fungicides, bactericides and insecticides that protect the seed and emerging seedling. Seed coatings also may consist of polymer coatings to delay germination, pH modifiers and various nutrients.

## THESIS ABSTRACTS

Division of Seed Science and Technology, ICAR-Indian Agricultural Research Institute, New Delhi

### a. Seed Production Technology

#### Optimization of Quality Seed Production in Onion

The present investigation was conducted in onion (*Allium cepa* L.) cv. Pusa Riddhi at Seed Production Unit, IARI during *rabi* seasons 2013-14 and 2014-15 with the following objectives: i) to study the effect of planting time and crop geometry as well foliar application of different mineral nutrients on growth, seed yield and seed quality and ii) to study effect of different plant growth retardants on onion seed scape height, seed yield and seed quality. Among the time of planting, 15 October planting ( $T_1$ ) showed significantly higher values for growth characters *viz.*, seed scape height (101.74 cm), umbel diameter (6.54 cm) productive umbellates per umbel (414.73), seed yield attributes such as seed setting (83.69%), seed yield per plant (8.71 g) and seed yield/ha (6.86 q). Higher seed quality attributes *viz.*, seedling length (9.48 cm), seedling dry weight (1.90 mg/seedling), germination (88.33%), vigour index-I (833.32), vigour index-II (167.08) and lower disease infection (38.06%) were observed in 15 October planting. Among the treatments spacing 60×30 cm had recorded significantly higher number of leaves/plant (40.89), seed scape height (102.26 cm), productive seed scapes per plant (8.35), productive umbellates per umbel (419.4), seed setting (83.24%), seed yield per plant (12.43 g) and 1000-seed weight (3.01 g). The seedling length (10.37 cm), seedling dry weight (1.95 mg/seedling), germination (89.76%), vigour index-I (918.56) and vigour index-II (172.96) were significantly higher in  $S_3$  (60×30 cm). The lower disease incidence (27.65%), PDI (5.81%) and EC of seed leachates (2.19  $\mu$ hos/cm/g) were also recorded in  $S_3$ . Whereas, seed yield/ha (7.17 q) was maximum in 60×10cm spacing ( $S_1$ ). The chlorophyll content was also recorded higher in 15 October planting and 60×30 cm spacing.

The foliar spray in combination of B+Zn+Ca+Mg (@ 30 & 60 DAP) showed superiority in productive umbellates per umbel (579.35), umbel diameter (7.38 cm), 1000-seed weight (3.87 g), seed yield per umbel (4.18 g), seed yield per plant (16.70 g) and seed yield/ha (8.35 q). The paclobutrazol treatment ( $T_6$ ) showed

significant lower number of leaves per plant (24.58) and lower seed scape height (69.9 cm) than other treatments. The  $T_6$  also showed higher umbel diameter (7.31 cm), number of umbellates per umbel (628.05), 1000-seed weight (3.32 g) and seed yield/umbel (3.48 g). The triadimefon treatments  $T_{13}$  and  $T_{14}$  significantly reduced the disease incidence (16.5% & 17%) and severity (4.50% & 5.16%), respectively resulting into higher seed yield per plant (12.67 g) and seed yield/ha (6.34 q) than other treatments.

*Name of the student: Sanjay Kumar*  
*Chairman : Dr BS Tomar*

#### Seed Morphology, Seed Anatomy and Dormancy Characteristics of some Common Weeds of Delhi

Government of India enacted the Seeds Act so that seed sold should conform to the minimum limits of physical and genetic purity, germination, moisture content and seed health. Since, weed seed constitutes as one of the most important domain in physical purity testing; hence, its flawless identification to level of species is a prerequisite for seed quality regulation. In view of the above, the present study was undertaken for characterization of seed and seedling related traits in 111 crop associated weed taxa of Delhi to develop an illustrated weed seed atlas for facilitating the process of identification.

Seed morphological characteristics *viz.*, seed size, area, shape, testa ornamentation, colour and nature of attached appendages were recorded. Seed morphometrically and analytically derived seed shapes (eccentricity, flatness and sphericity indices) provided ample evidences for distinctive identification of weed seed. Among 111 taxa, 25 seed shapes and six basic colour groups (further divided into subgroups and codes) were recorded. Testa micro-morphology description provided enough evidence for interspecific variation, thereby substantiating its worthiness in reliable identification. Hierarchical clustering based on seed morphological characteristics grouped 111 taxa into nine clusters. Seedling morphological traits *viz.*, germination type, root system, hypocotyl (looped/non-looped), collet and number of cotyledons demonstrated least

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dissimilarity among taxa of same family thereby suggesting minimum practicality of these characteristics in consistent identification. However, a few seedling based features viz., hypocotyl (haired/non-haired, colour) and primary leaf characters exhibited sufficient variations, which can effectively supplement the seed morphological observations for reliable identification of weed seed. Seed internal morphological characterization showed eight embryo types among 111 taxa. The species belonging to Malvaceae, Fabaceae, Asteraceae displayed higher embryo to seed ratio and level of embryo differentiation. Members of family Amaranthaceae, Chenopodiaceae, Euphorbiaceae, Caryophyllaceae and Solanaceae recorded higher values for embryo to endosperm ratio, whereas species of family Commelinaceae, Cyperaceae and Poaceae documented lower values. Germination studies conducted on ten weed species registered the presence of seed dormancy. Two species *Melilotus indica* and *Trigonella polycerata* exhibited physical dormancy; whereas non-deep type-1 physiological dormancy was observed in *Echinocloa crusgalli* and *Trianthema portulacastrum* and non-deep type-2 physiological dormancy was observed in *Sisymbrium irio*, *Heliotropium indicum*, *Spergula arvensis*, *Phalaris minor*, *Solanum nigrum* and *Asphodelus tenuifolius*.

**Name of the student: Sripathy  
Chairman : Dr SSparihar/ Dr Monika A Joshi**

## Seed Vigour Traits in Wheat for Drought Tolerance

The majority of drought tolerance traits are associated with seed vigour such as 1000-seed weight, early germination, seedling emergence, coleoptile length, root growth mainly root length, root number and root volume. These traits often make the difference between high and low vigour seed lot. In addition, research programme focused on drought tolerance following seed vigour traits need to be approached by enhancing knowledge on phenotyping and genotyping, especially the genetic analysis of plant genome using molecular markers. Thus two RIL populations developed for drought tolerance in wheat (*Triticum aestivum*) were used for screening for seed vigour traits along with validation of known QTLs reported for their contribution to drought tolerance. Experiments were conducted in laboratory, glasshouse and field conditions under control and water-deficit stress

or rain-fed conditions. In first set of RIL (WL711×C306) field experiment was conducted in two consecutive *rabi* seasons from 2012-13 and 2013-14. Parent C306 performed better than the parent WL711 for NDVI, CTD, and SPAD-readings in water-deficit stress condition. 1000-seed weight, seedling traits, like shoot length, primary root length, secondary root length, seedling vigour index I (SVI I), seedling vigour index II (SVI II) were higher in C306 indicated the drought tolerant characteristics. Root weight density in this population at different soil depths (0-15 cm, 15-30 cm and 30-45 cm) showed positive association between root weight density (at all the depths) with grain yield. Reduction in grain yield was higher in WL711 than C306 during both the seasons, under rain-fed condition. Direct and significant association was established between grain yield with biomass, harvest index, 1000-seed weight, root weight density and total root dry mass. In second set of RIL population, parent HI1500 exhibited higher root length than DBW43. Total root length as measured with the help of root image analyzer in DBW43 was higher than HI1500, as there was more roots. Further, root and shoot parameters were evaluated both under field and glasshouse conditions under irrigated and simulated water-deficit stress by withholding irrigation water to 50%. Under PEG solution and normal condition parent HI1500 showed higher speed of germination than those to DBW43, further due to water-deficit stress coleoptile length increased under PEG solution in HI1500 parent thus these traits were highly adapted to the drought tolerance. Under irrigated and rain-fed conditions, significant and direct associations were established between GY with BIO, TSW and HI. Out of many QTLs reported for drought tolerance from earlier reports three QTLs were validated in second set of RIL population for example, Xbarc184 (root length), Xbarc156 (root numbers) and CFA2099 (coleoptile length); these QTLs could be further used for marker assisted breeding for drought tolerance in wheat. The present study indicated important key traits such as root length, root number and root volume, speed of germination, vigour index I and II, could be considered for selection of drought tolerant lines under laboratory and glasshouse conditions.

**Name of the student: Vinod Kumar SB  
Chairman : Dr PC Nautiyal**

## Phenotyping of Soybean Genotypes for Seed Quality

One of the major constraints, in soybean [*Glycine max* (L.) Merrill] cultivation is the non-availability of good quality seed and post-harvest maintenance up to prescribed level of seed germination and vigour until immediate planting season. Hence, the present study was conducted on phenotyping of soybean genotypes for seed quality and seed vigour, where seeds of 129 soybean genotypes were procured from one cycle of multiplication and used for morphological characterization. The results registered a genotypic variability with respect to seed quality and vigour. 100-seed weight was found to be negatively correlated with seed quality. There was a positive and significant but weak association registered between field emergence and seed storability ( $r=0.38$ ); plant height and seed storability ( $r=0.52$ ); days-to-50% flowering and seed storability ( $r=0.35$ ). Of these 59 soybean genotypes, having sufficient quantity of seeds, were stored for eight months under laboratory ambient environment (av  $25\pm 2^{\circ}\text{C}$  &  $65\pm 5\%$  RH). Based on various physiological parameters, 10 genotypes each from good and poor storer were chosen and used for detailed physical, physiological, biochemical and molecular parameters. Seed germination, seedling growth, seedling dry weight, vigour indices, in general, decreased with increased period of seed storage or seed deterioration. EC and MDA contents registered higher values in poor storer than those to good storer genotypes. Significantly higher antioxidant enzymes activity was recorded in good storer genotypes. Of 46 SSR markers used, 23 were polymorphic. Genetic similarity coefficients obtained using 23 SSR markers, grouped the studied 20 genotypes into four clusters. The PIC values ranged between 0.163 (Satt201) to 0.553 (Satt573) with an average of 0.329. SSR marker, Satt423 was found to discriminate two groups' *i.e.*, good and poor storer distinctly.

Black, smaller seed with grey hilum attributed to better seed quality and vigour. Based on correlation coefficient values, any of these SVI ( $r=0.98$ ), SV II ( $r=0.97$ ), and/or EC ( $r= -0.93$ ) either individually or in combination may be used as better indices of seed vigour. MDA content and efficiency of antioxidant system, like SOD, CAT and GR were also good indices of seed vigour or quality. Satt423 proved to be a candidate marker linked with seed storability, illustrating its usefulness in

marker assisted selection of genotype for breeding cultivars with better seed longevity. Based on the detailed physical, physiological and biochemical parameters, three genotypes, namely AMSS 34, G-265 I and G-2253 were identified as better storer and may be exploited in soybean crop improvement programme.

*Name of the student: Sooganna*  
*Chairman : Dr SK Jain*

## Hybrid Seed Production of Maize

The present study was undertaken in maize [*Zea mays* L] to assess the performance of parental lines under different sowing dates and the feasibility of hybrid seed production under climatic change regime. Parental lines of single cross hybrids namely, BML6, BML7, VQL1, VQL2, HKI193-1, HKI163, CM150, CM151 were sown on six planting dates in *kharif*, *rabi* and spring-summer seasons. Hybrid seed production potential was compared with two parental lines namely, CM150 and CM151 in *kharif* and spring-summer seasons. The temperature and RH had significant influence on field emergence, vegetative growth, flowering behaviour (days to flowering, flowering, duration, anthesis, silking interval), seed setting and seed yield of the parental lines. Among parental lines: CM150 and CM151 were least; VQL-1 and 2, HKI193-1, HKI163 were moderate and BML6 and BML7 were most affected by weather conditions (different planting dates). The results showed that *kharif* season was ideal for *parental* line multiplication followed by spring-summer season under Delhi conditions. Non-synchronization of flowering in parental lines was less during *kharif* (1.81 days) than spring-summer (4.21 days) season. Thus, among parental lines, hybrid seed production was feasible of single cross hybrid: PEHM-5 in *kharif* and spring-summer season. For higher seed yield and quality, sowing should be undertaken during second fortnight of July and first fortnight of March for *kharif* and spring-summer seasons, respectively. Seed quality parameters *viz.*, seed germination, vigour indices and incidence of mycoflora were found significantly higher in seeds harvested from *kharif* season. Seeds produced in all the seasons could safely be stored for 12 months from harvest under ambient conditions. Among fungal pathogens, *Aspergillus flavus* infection recorded was maximum, whereas *Fusarium moniliforme* was minimum.

*Name of the student: RezaZodukai*  
*Chairman : Dr (Ms) Sudipta Basu*

## Image Analysis for Establishing Distinctiveness in Phenotypically Similar Rice Varieties

The present research was conducted on similar rice [*Oryza sativa* (L.) varieties with the following objectives: i) Validation of essential and grouping characters of rice varieties; ii) Development of digital image library (stem, leaves, panicle and seeds) for the selected varieties; iii) Extraction of size, shape and textural features from the images; and iv) Grouping of varieties based on features (image features as well as morphological DUS parameters) and ranking of image features based on their importance to distinguish among varieties. The field experiment was conducted during *kharif* season of 2014-15 at the experimental field of Division of Seed Science & Technology and Division of Genetics, ICAR-Indian Agricultural Research Institute, New Delhi. The image analysis work was done as per the designed protocol in laboratory of Division of Seed Science and Technology, IARI, New Delhi and at Agro-Produce Processing Division, Central Institute of Agricultural Engineering, Bhopal. To resolve differentiation using image analysis, the selection criteria for forming closely related groups included those plant parts which were used for imaging *viz.*, seed (length and width), flag leaf (length and width), stem (length), panicle (length) in addition to time of heading; since this trait. The study grouped the 28 varieties into five different clusters based on these DUS parameters. An exhaustive image library for various plant parts *viz.*, seed, leaf, stem and panicle was also developed for the material studied. Thus, a complete digital database comprising of 84 images each for seed, stem and panicle; and 448 leaf images was generated. Two different types of softwares were used for extraction of features from the images *viz.*, Grain Analysis Software (for size and shape features) and MATLAB software (for textural features). The varieties were grouped on the basis of these features generated from seed and leaf images. The size and shape features extracted by the Grain Analysis Software as well as derived shape factors clearly distinguished the varieties. The additional textural features extracted from seed images (about 27 textural features) further aided in the differentiation of varieties. Thus, seed imaging features differentiated the varieties into six clusters. Similarly,

image features was extracted from the leaf images. The MATLAB software extracted 27 textural features from both flag leaf and penultimate leaf with both ventral as well as dorsal side. Seven clusters were thus formed on the basis of leaf imaging features. The images were of immense help to distinguish the varieties on the basis of visual differences.

Finally, to establish distinctiveness among phenotypically similar rice varieties, the experimental material was divided into various groups using image features in combination with the DUS parameters. The study had shown that varieties were better differentiated from each other by using image analysis in combination with DUS parameters, since the number of clusters formed were more than those to clustering done on the basis of DUS alone. Based on the comparative clustering patterns on four different kinds of features *viz.*, DUS parameters, seed imaging, leaf imaging and DUS in combination with imaging; the study depicted that image features extracted from seed was more helpful for distinguishing the varieties. Thus, the overall ranking of image features for the material of the present study registered was Seed > Leaf > stem/panicle.

Name of student: Sunny Kumar mundotiya  
Name of chairperson: Dr (Ms) Monika A Joshi

## Imbibition Behaviour and Germination Response in Conventional and Quality Indian Mustard

The present study was conducted for comparative analysis of conventional and quality type of Indian mustard [*Brassica juncea* (L.) Czern & Coss] genotypes, differing in seed coat colour, based upon the imbibitional behaviour, enzymatic and non-enzymatic antioxidants and bio-molecules affecting seed germination and vigour. The material consisted of eight varieties of Indian mustard, in which four genotypes were from each of conventional and quality types. The seed of these genotypes varied for seed coat colour *i.e.*, four black and yellow. Thus, the experimental material had two genotypes each with black and yellow seed coat from conventional as well quality groups. The results showed significant differences for imbibition and electrical conductivity (EC) amongst the black and yellow seeded genotypes. The results indicated that

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imbibitional behaviour was significantly correlated with seed coat colour, melanin and phenol content. Yellow seeded genotypes imbibed faster than those to black seeded genotypes. Quality type genotypes showed higher percent of imbibition (119.08%) than those to conventional type genotypes (81.20%) during 24 hr of water imbibition. Yellow seeded genotypes which had low melanin and phenol content, with weak seed coat, imbibed faster as well had higher leakage. Significant differences between yellow and black seeded genotypes were noticed for EC, melanin, phenol, ascorbic acid, tocopherol content and antioxidant enzymes. The amount of melanin (58.80 U) and phenol content (11.11 mg GAE g<sup>-1</sup>) in black seeded genotypes was significantly higher than those to yellow seeded genotypes (29.25 U and 6.86 mg GAE g<sup>-1</sup>), respectively. The mean value for ascorbic acid and tocopherol content were higher in black seeded genotypes (28.42 mg/100 g and 50.26 µg/g of seeds) than those to yellow seeded genotypes (23.11 mg/100g and 43.37 µg/g of seeds), respectively. The superoxide dismutase (SOD) and peroxidase (POD) activity was more efficient in black over yellow seeded genotypes as well in conventional over quality types of genotypes. Increase in mean germination time (MGT) on CD was higher in yellow seeded genotypes. Vigour index I (SV I) and Vigour index II (SV II) resulted in significantly higher values in black seeded as well conventional type of genotypes than those to yellow seeded genotypes. It was concluded that the yellow seeded genotypes were found to have less phenol and melanin contents, resulted in weak seed coat, thereby faster imbibition, higher leakage, longer MGT, reduced and non-uniform germination, increased in abnormal seedling and ultimately the low seed vigour. Less efficient antioxidants were the major cause of differences in seed quality in conventional and quality type of genotypes with different seed coat colour of Indian mustard.

**Name of student: Sunil Swami Ramling (20468)**

**Name of chairperson: Dr (Ms) Sangita Yadav**

**\*All existing members are kindly requested to update their membership details at (ISST1971@gmail.com) to ensure correct and timely delivery of all correspondence from ISST.**

## INTERNATIONAL CERTIFICATE COURSE FOR NIGERIAN NATIONALS

Directorate of Seed Research, MAU



International certificate course on “Requisites of Seed Production, Processing, Testing and Quality Assurance” was organized for eight participants from Nigeria under the auspices of ICAR-Directorate of Seed Research (DSR), Mau. The training programme was commenced at ICAR-DSR, Regional Station, Bengaluru. The international certificate course was divided into three distinct phases: first phase began at ICAR-DSR, Regional Station, GKVK Campus, UAS Bengaluru; second phase was on exposure visits to various institutions and private seed enterprises at Hyderabad and Delhi; and third phase was at ICAR-DSR, Mau.

The training programme focused on expert talks and practical sessions on varied aspects of seed science and technology *viz.*, seed production technology in field and horticultural crops; seed processing; seed testing and certification; seed storage and handling; seed quality enhancement; seed health management and seed economics, marketing and management.

Trainees were also exposed to methodology of seed production through hands-on training in seed production technology, wherein trainees were engaged in seed production of OPV/Hybrids of varied crops. As a part of project appraisal, four project proposals were brought up by trainees targeting seed entrepreneurship for the holistic upliftment of seed sector in major crops of Nigeria. *In toto*, during six months international certificate course 462 expert talks, 128 practical sessions, 68 field visits and 52 exposure visits covering five states were organized.

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