Entrepreneurship Development Through Seed Production

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Forward

Agricultural productivity has increased in our country due to technology based innovations but more production is required to feed ever increasing population of India. Availability of healthy and quality seed is very crucial to increase the production. It is essential to maintain the quality of seed in agriculture sector and availability of good quality seed is the basis for improved agriculture and successful entrepreneurship. Quality seed has high germination capability and high genetic purity which is responsible for increase in the production. The quality seeds are disease–free and therefore next crop also remains healthy. Expenditure on agriculture inputs e.g. fertilizers, irrigations and agrochemicals are all in vain without the use of quality seed. Use of high yielding improved crop varieties and proper use of agri- inputs is beneficial for successful seed production. Indian agriculture is all set for another green revolution but to achieve a second green revolution dependence on availability of good quality seed is must. In our country almost 80% farmers still use 'farmers produced seed'. Use of quality seed can increase our production by 15 – 20%. In the present scenario, seed production should not be limited to the fields only, but farmers should undergo trainings to acquire technological skills to become self-reliant and develop into successful seed entrepreneur.

Indian Agricultural Research Institute, Regional Station, Karnal is regularly organizing various farmers trainings on different aspects of Seed Technology under the Seed Production Scheme in agriculture crops of Indian Council of Agriculture Research, New Delhi. A three days farmers' training programme on "Entrepreneurship development through seed production" from Feb. 20–22, 2013 is an effort in this direction. This training is an initiative to motivate farmers to be seed entrepreneurs. During this training, available information and practical experiences on seed production technology of food grains, oilseeds, pulses and vegetables along with pest management (diseases, insects and weeds) in seed crop will be imparted to the trainee farmers. The lectures to be delivered during training will be compiled as technical bulletin in very simplified language and will be given to the farmers. This technical bulletin will be a useful literature especially for extension workers, agriculture students and farmers. The aim of this humble effort of the editors is to develop farmers based robust seed industry in India.

Saroj Jaipal

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Successful Entrepreneurship through Seed Production

S. S. Atwal

Indian Agricultural Research Institute, Regional Station, Karnal

Seed is the basic and most effective agricultural input. By being often the central input in the production input package, quality seeds of improved varieties play an important role in modern agriculture. It has been observed that use of quality seed alone can enhance productivity by 15 to 20 percent. For the last several years we have been talking about the need for a 2nd Green Revolution to ensure National Food Security. In addition to other factors, Seed Revolution will have a major role to play in ushering in the 2nd Green Revolution. If we are able to increase Seed Replacement Rate (SRR) along with Variety Replacement, it will go a long way in increasing agricultural productivity and overall production.

Recent Govt. policy initiatives in seed sector have shown improvement in SRR in major crops like wheat and paddy especially in northern states of the country. However, at national level and across the crops the use of Farmer saved seed is still more than 80 percent. As per National Seed Plan (2005) the desirable SRR's are 25 % for self-pollinated crops, 35 % for cross-pollinated crops and 100 % for hybrids. Thus, there is a lot of scope for promotion of entrepreneurship development in seed sector. However, there should not be any compromise with seed quality. This will require extensive training of prospective entrepreneurs on various aspects of quality seed production including awareness about the various provisions of The Seeds Act (1966) and its Amendments, Seed Control Order (1983), various Govt. initiatives in the seed sector, breeder seed indenting system, seed certification system etc. Prospective entrepreneur has to register the seed agency with State Department of Agriculture / State Seed Certification Agency. Desirably the seed agency should have its own seed processing and storage facility to have better control on seed quality. Maintenance of proper temperature and humidity in the seed godowns is very essential for preserving high seed quality during storage. He should have marketing intelligence regarding choice of variety for seed production and arrangement for its sale in attractive packaging with all the required details printed on the seed packet itself.

The primary mandate of IARI, Regional Station, Karnal is quality seed production and distribution of field and vegetable crop varieties and it is playing an important role in promoting quality seed production through trainings on various aspects of quality seed production, demonstration of seed production technology at the station and at farmer's field through supply of best quality of breeder seed.

As a result of Farmers Participatory Seed Production Programme and Seed Village programme of DAC, availability of quality seed has increased many-fold. Increased efforts to impart on-farm training on different aspects of quality seed production in newer areas resulted in creating awareness amongst the farming community towards importance of quality seed and adoption of new agricultural technologies. It has also improved the socio-economic status of the farming community. Trainings on various aspects of quality seed production to farmers, seed growers and producers helped in better dissemination and interaction of seed production technologies with the end-users.

Quality Seed Production in Rice

Rakesh Seth

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Quality seed are of high species and cultivar purity (genetic purity); analytical (physical) purity; high germination capacity and vigor; uniform in size; free from weed seed; free from seed borne diseases; and with low moisture content. Seed quality as an explicit paradigm is a recent phenomenon, and is co-terminous to development of seed technology as an independent interdisciplinary science.

Pusa Basmati 1:
An outstanding example of varietal maintenance

The crux of transformation from traditional to modern agriculture was the proper understanding of the concept of "Seed Quality" & the critical distinction between "grain" and "seed". The quality seed or improved seed has two distinct sources of improvement (i) genetic information contained in seed (*i.e.* improved variety) (ii) physical and physiological attributes of seed lot (i.e. purity and germination). The genetic quality is the ultimate determinant of performance, but if physical and physiological quality is poor, the benefits of genetic potential can not be realized.

Seed Production Technology : Seed production is different from crop production. Quality seed production of rice should be planned systematically so as to minimize the chances of genetic contamination as well as mechanical admixtures. The important protocols of rice seed production based on IMSCS (Indian Minimum Seed Certification Standards, 1988) are described below.

(i) Application and amplification of general seed certification standards: It is important for seed producers/farmers to be aware of the prescribed seed certification standards (general and specific) of the specific crop for which they are undertaking seed production programme (e.g. here in this case Rice).

(ii) Land requirement: Land to be used for seed production programme should be free from volunteer plants (self sown seeds). If land requirement is not checked then the resultant seed crop may have problems of ODVs (Other distinguishable varieties) and/or physical admixture because of volunteer plants (Table 1). The quantification of ODVs is must and not voluntary for certified seed (where standards are available). Labeled seed is not tested for this seed quality attribute.

(iii) Field inspections: Field inspections are made in the field on the standing crop and are meant to verify those factors which can cause irreversible damage to the genetic purity or seed health. Field inspections also check that the seed being produced is of the designated variety and has not been contaminated genetically or physically beyond certain specified limits.

Minimum two field inspections are undertaken in rice, first during flowering and second before harvesting.

(iv) Field standards: Field standards have two components (i) general requirements dealing with isolation (ii) specific requirements indicating maximum permitted off types. Field standards have critical impact on the genetic purity of the seed crop (Table 2).

Pusa Sugandh 5: Seed Production Plot

Table 1 : Seed Standards

Factor	FS	CS
Pure seed (%), ↓	98.0	98.0
Inert matter (%), ↑	2.0	2.0
Huskless seeds (%), ↑	2.0	2.0
Other crop seeds, ↑	10 / kg	20 / kg
Other distinguishable varieties ↑	10 / kg	20 / kg
Total weed seeds, ↑	10 / kg	20 / kg
* Objectionable weed seed (no.), ↑	2 / kg	5 / kg
Seeds infected by paddy bunt (no.), ↑	0.10	0.50
Germination (%), ↓	80	80
Moisture (%), ↑	13.0	13.0
Vapour proof containers (%), ↑	8.0	8.0

↓: minimum ; ↑maximum ; * Wild rice

Table 2: Field Standards

(A) General Requirements : Isolation distance	Minimum distance (m)	
	FS	CS
Fields of other varieties	3	3
Fields of other varieties not conforming to varietal purity requirements for certification	3	3
(B) Specific requirements	**Maximum permitted (%)**	
	FS	CS
Off types	0.05	0.20
* Objectionable weed plants	0.01	0.02

Pusa 44: A popular variety of rice


Roguing: Removal of offtypes and unwanted plants

The quality of seed crop is hampered by (i) Off types (ii) Inseparable other crop plants (iii) Objectionable weed plants (iv) Diseased plants. The removal of these unwanted plants is called roguing. Roguing is a critical component of management of genetic purity of a crop.

(v) Seed standards:

After the seed crop is harvested, the seed lots are checked against prescribed standards, thereby ensuring seed quality to the end-user (Table 2).

Seed Production Plot

If the aforesaid points are taken into consideration, then the farmers can themselves produce their own genetically pure high quality seed of rice varieties.

Quality Seed Production of Wheat

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Wheat is one of the most important food crops of the world. In India, it is grown mainly in the northern and central part. Variety development programme is very strong in the country and new varieties are developed every year. Quality seed is very important along with agronomic practices to realize worth of an improved variety. Availability of quality seed in sufficient quantity year after year is a must for enhancing agricultural production. Quality seed may be defined as seed of an improved variety

Seed Production Plot HD-2967

which is high in genetic and physical purity, has high germination and vigour; is free from weed seeds and seed borne diseases, and has low moisture content. There are three classes of seed in India, namely breeder seed, foundation seed and certified seed. Breeder seed is produced by the breeder or the breeding Institute; and is used to raise foundation seed crop. Certified seed is produced mainly from foundation seed and is grown for commercial cultivation. Seed production differs from crop production in several aspects. In seed production of wheat following points should be taken care of.

Selection of land: The plot selected for seed production should be fertile, well drained and free from volunteer (self sown) plants.

Isolation: Wheat is a self pollinated crop. So isolation requirement is merely 3 meters for foundation as well as certified seed. The isolation is mainly to avoid admixture from adjoining plots. The isolation requirement is 150 meters from loose smut infected plots of wheat, triticale and rye (Table-1).

Seed source and method of sowing: The seed, to be used for sowing of seed crop, should be of appropriate class and be procured from a reliable source. The crop should be sown in rows (instead of broadcasting) to facilitate roguing, field inspection and other agronomic operations.

Agronomic practices: Cultural practices for the seed production are usually the same as recommended for crop production. All recommended agronomic practices should be followed for optimum growth and proper expression of plant type. Presence of *Phalaris* plants in the wheat seed crop becomes hindrance in rouging. Recommended doses of Phosphorus and Potassium should be applied; however, nitrogen may be slightly reduced to avoid lodging. Rouging and inspection are very difficult in a badly lodged crop and hence the crop may not be approved.

Mechanical admixture through seed drill

Rouging : Rouging is the removal of off-type plants and is a very important operation in seed production for maintenance of genetic purity. Off-type plants are those plants which do not conform to the diagnostic characteristics of the variety. The entire plant should be uprooted without leaving behind any tiller. The uprooted plants should not be left in the plot otherwise they are very likely to get mixed with the seed crop during harvesting and threshing.

Field inspection: Foundation and certified seed production is supervised and approved by the State Seed Certification Agency. The seed plots are inspected by the SSCA officials for field standards (Tables-1 & 2). A minimum of two field inspections are required for the wheat seed crop. Breeder seed production has been kept out of purview of SSCA, rather it is monitored by a joint inspection team of plant breeders and officials of SSCA and National Seeds Corporation.

Rouging in Wheat

Table-1: Field Standards: Isolation requirement.

Contaminants	Minimum distance (m)	
	Foundation	Certified
Field of other variety/same variety not conforming to varietal purity requirements for certification	3	3
Fields of wheat, triticale and rye with infection of loose smut in excess of 0.10% and 0.50% for foundation and certified seed respectively.	150	150

Table-2: Field Standards: Specific requirements (varieties).

Factor	Maximum permitted (%)*	
	Foundation	Certified
Off-types	0.05	0.20
Inseparable other crop plants	0.01	0.05
Plants affected by seed borne diseases	0.10	0.50

N.B. A minimum of two inspections from time the crop approaches flowering until it is ready for harvesting.

* Standards for off-types and objectionable weeds shall be met at the final inspection.

Table-3: Seed Standards

Factor	Standards	
	Foundation	Certified
Pure seed (Minimum)	98.0%	98.0%
Inert matter (Maximum)	2.0%	2.0%
Other crop seeds (Maximum) No.	10/kg	20/kg
Total weed seeds (Maximum) No.	10/kg	20/kg
Objectionable weed seeds (Maximum) No.	2/kg	5/kg
Seeds infested by Ear-cockle & Tundu (Maximum)	None	None
Seeds infested by karnal bunt (Maximum)	0.05% (by number)	0.25% (by number)
Germination (Minimum)	85%	85%
Moisture (Maximum)	12%	12%
Moisture for vapour proof containers (Maximum)	8%	8%

Harvesting, threshing and processing of seed: The crop should be harvested after maturity at a proper moisture content to minimize damage to the seed. The outer 3-4 rows should be left as grain and harvested at the end as they may have some out crossed plants. The combine harvester should be thoroughly cleaned otherwise it may become the major source of contamination and will nullify all care and efforts made in the field. Proper care should also be taken to avoid admixing during seed processing.

Seed testing, labeling and storage: A representative sample of the processed seed is sent to the notified seed testing laboratory for analysis. Seed testing is done as per the ISTA rules. If the seed lot meets the prescribed seed standards (Table-3), the lot is approved and labels and certificates are issued (by the SSCA) to the seed producer. Foundation seed tag is of white color while blue colored tags are issued for the certified seed.

The seed is a living entity and is sensitive to weather conditions viz. temperature and relative humidity (RH). High temperature and RH deteriorate the seed quality and shorten its life (viability and vigour). So the seed should be stored at low temperature and relative humidity conditions; and be protected from storage pests, mainly insects.

Seed Production Technology of Kharif Pulse Crops

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Pulse crops occupy special place in agriculture as they are major source of protein in vegetarian diet. They have nodules in their roots which fix the atmospheric nitrogen and thus help to sustain soil fertility. Pulse crops have comparatively less requirements of fertilizers and water and hence can be successfully grown in poor soils. Pulses have ability to survive in adverse conditions particularly in low rainfall regions and so are important for different crop rotations in the rain fed area. Farmers can get good profit through seed production due to recent hike in prices and deficient supply of pulses. Moong, urd, pigeonpea and cowpea are important Kharif pulse crops of North Western India. Among them moong and pigeonpea are suitable for cultivation in greater part of country. Important varieties and points to be taken care for their seed production are briefly described below.

Pigeonpea

1) Pusa 992: The variety was released for entire North West India. It is a medium height variety takes 140-150 days to maturity. Average yield is 7-8q per acre. Its grain is bold. Average weight of 100 grains is 8.8-9.0g.

2) Pusa 2001: This variety matures in 140-150days and has good branching. It was developed by IARI, New Delhi. Its grain is quite bold. Average weight of 100 grains is 8.2 g. Average yield is 7-8q per acre.

Moong

1) **Pusa Vishal :** This is a short duration variety. It was recommended for cultivation in the North Western India during summer season. It has bold grains. In the summer it matures in 60-65 days. Best sowing time for the variety is first fortnight of March. It gives an average yield of 4-5q per acre.

2) **Pusa 9531:** It is also a very good variety recommended for summer cultivation in North West India. It also takes 60-65 days to maturity. It has comparatively small but shining grain. Both Pusa Vishal and Pusa 9531 are suitable for one time harvesting and thus pod picking may be avoided.

3) **Pusa Ratna:** The variety was developed at IARI New Delhi for cultivation in Kharif season in Delhi state. It is tolerant to Yellow Vein Mosaic Virus disease.

Field Selection: Pigeon pea and moong both have problem of hard seeds like other pulses. The shattered seeds remain in the soil and grow as volunteer plants in the coming seasons. The volunteer plants may cause admixture or genetic contamination by natural out crossing, if not removed timely. So the field selected for seed production should be free from volunteer plants. To achieve this, it should be ensured that there was no same crop in the field for the last two years, or it was the same variety that too conformed to the seed certification standards.

Isolation distance: The seed plot should be isolated from other varieties or cross compatible crops to avoid genetic as well as physical contamination. This separation of the seed plots is called isolation distance. Depending upon the pollination behavior different isolation distances are prescribed for various field crops in the Indian Minimum Seed Certification Standards. Moong, urd and cowpea are self pollinated and isolation of 10m and 5m is sufficient for foundation and certified seeds, respectively. Pigeonpea is an often cross pollinated crop and isolation distance of 200m and 100m is required for foundation and certified seeds, respectively.

Class of seed: Seed used for growing the seed crop is one of the most important factors in quality seed production. So generation system should be followed i.e. breeder seed — foundation seed—certified seed. Seed production by use of genetically pure seed will be easy and cost effective as less roguing will be required.

Seed rate and spacing: Sowing of pigeonpea should be done in rows spaced at 60cm apart. Five kg seed will be sufficient for sowing in one acre. In case of moong line to line spacing should be kept 20-25 cm in summer sowing and 30 cm in kharif sowing. Seed rate of 10-12 kg per acre in summer and 8-10 kg per acre in kharif will provide a good plant stand. If seed size is very bold the seed rate must be increased accordingly.

Sowing time: Optimum sowing time of pigeon pea in North Western Plains of India is first fortnight of June. Moong crop can be sown at three times as given below.

Summer crop	First fortnight of March
Kharif crop	First fortnight of July
Late *Kharif* crop	Up to 20th of August

Fertilizer and irrigation: Application of 35-40 kg/ acre DAP as basal dose at the time of sowing will be sufficient for both the crops. Two irrigations are essential for summer crop of moong. During *kharif* season both moong and pigeon pea crops should be irrigated as per need.

Certification standards: Different standards for field and seed have been prescribed for certified as well as foundation seed production for various crops. Isolation requirements of both crops have been given above. Almost all the *kharif* pulse crops have similar specific field requirements. Maximum offtypes 0.10% in foundation seed and 0.20% in certified crops are permitted

Roguing: Removal of offtype plants is rouging. Timing of rouging is very important. Rogues must be removed before flowering particularly in cross pollinated (CP) and often CP crops. Otherwise off types should be removed as and when detected for purity of seed. The uprooted plants should be thrown out of the seed plot otherwise they might be threshed along with the seed crop and may cause contamination. Plants of other varieties, different type and colour of flower and pod, arrangement of pods, plant type and diseased plants are major off types which occur in moong and pigeon pea.

Harvesting, threshing and storage: The seed crop should be harvested at proper maturity. In over mature crops, shattering of pods may take place. Special care should be taken during transportation of harvested crop from field to threshing floor and during threshing to avoid any admixture. The trolley used for this purpose should be thoroughly cleaned. Threshing should be done after thorough drying and with proper speed of thresher. Pulses because of being dicotyledonous, are very sensitive to splitting of seed if not handled carefully. Seed bags/ seed bins to be used for storage should be thoroughly cleaned. Infestation of storage insects generally starts in the field itself. So the seed should be fumigated before processing and/or storage.

Farmers can produce good quality seed and earn good profit by taking care of these points.

Offtype in Moong

Offtype In Pigeon Pea

Quality Seed Production of Rabi Pulses

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India produces a wide range of pulses, the major ones being chickpea, pigeon pea, urd bean, mungbean, lentil and field pea. Lentil is the second most important rabi pulse, after gram.

Seed production is different from crop production. Seed production is a systematic and organized activity that follows certain procedures. Rabi pulses (Lentil & Field pea) seed production should be undertaken in such a way that the chances of genetic contamination as well as mechanical admixture are minimized. From a seed technological perspective, high quality seeds are of high species and cultivar purity; analytical (physical) purity; free from weed seeds; with high germination capacity and vigour, uniform in size; free from seed borne diseases; and have low moisture content.

Management of genetic purity: Backbone of a quality seed production system

The important protocols based on IMSCS (Indian Minimum Seed Certification Standards) of quality seed production of lentil and field pea are described below.

(i) Application and amplification of general seed certification standards:
It is important for a seed producer to be aware of the prescribed seed certification standards (general and specific) of the specific crop for which the seed production programme is being undertaken (e.g. here in this case Lentil and field peas).

(ii) Land requirement:
Land to be used for seed production programme should be free from Volunteer plants (self sown seeds). If land requirement is not checked then the resultant seed crop may have problems of ODVs (Other distinguishable varieties) and or physical admixture because of volunteer plants (Table 1). ODVs are based on readily apparent differences in stable and well known morphological characters of seed. The quantification of ODVs is must and not voluntary for certified seed (where standards are available). Labeled seed is not tested for this seed quality attribute.

Volunteer plants of Lentil (L 4076)

Table 1 : Seed standards for Lentil and Field pea

Factor	Lentil		Field pea	
	F.S.	C.S.	F.S.	C.S.
Pure seed (%) ↓	98.0	98.0	98.0	98.0
Inert matter (%) ↑	2.0	2.0	2.0	2.0
Other crop seeds ↑	5 / kg	10 / kg	None	5 / kg
Weed seeds ↑	10 / kg	20 / kg	None	None
Other distinguishable varieties ↑	10 / kg	20 / kg	5 / kg	10 / kg
Germination including hard seeds (%) ↓	75	75	75	75
Moisture (%) ↑	9.0	9.0	9.0	9.0
Moisture (Vapour proof containers) ↑	8.0	8.0	8.0	8.0

F.S. Foundation Seed; **C.S.** : Certified Seed; ↓ minimum; ↑ maximum

(iii) Field inspections:

Field inspections are made in the field on the standing crop and are meant to verify those factors which can cause irreversible damage to the genetic purity or seed health. Field inspections also check that the seed being produced is of the designated variety and has not been contaminated genetically or physically beyond certain specified limits (Table 2).

Table 2 : Field inspection numbers and stage

Seed Crop	Field inspections (No.) (↓)	Field Inspection Stage
Lentil	two	(i) before flowering (ii) at flowering
Field Pea	three	(i) before flowering (ii) at flowering (iii) at pod stage

(iv) Field standards:

Field standards have two components (A) general requirements dealing with isolation and (B) specific requirements indicating maximum permitted off types. Field standards have critical impact on the genetic purity of the seed crop. The prescribed minimum Field standards for Lentil and Field pea are given in Table 3.

Table 3 : Field standards for Lentil and Field pea

(A) Contaminant	Isolation distance (m) ↓	
	Foundation	Certified
Fields of other varieties	10	5
Fields of same variety not conforming to varietal purity requirements for certification	10	5
(B) Factor	**Foundation**	**Certified**
Off types* (↑)	0.1	0.2

(v) Seed standards:

After the seed crop is harvested the seed lots are checked against prescribed seed standards, thereby ensuring seed quality to the end-user. The prescribed seed standards for Lentil and Field pea are given in Table 3 and for genetic purity are given in Table 4.

Table 4: Seed Standards for Genetic Purity

Class	Minimum Genetic Purity (%)
Foundation	99.00
Certified Seed	98.00

GOT: Testing of genetic purity of seed lots

Seed Production Technique of Forage Sorghum

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Sorghum is 5th staple food for 50 crore people of 30 countries. Sorghum production in 98 countries (Africa, Asia & America) on 42 m ha. 55% grain used for roti & dalia, straw for animal feed. In America, 33% grain is for animal feed. In India 20% of total land area comes under sorghum (8.7m ha) which is 5.9% of the total cultivable land.

The production was 9 mt in 1970 and 12 mt in 1980, which was same during 2006, while the area got reduced. The credit goes to improved technologies. Yet there is a shortage of 80 mt of green fodders and 660 mt of dry fodder in India every year.

Sorghum have important place in fodder crops because of its:

- Wide adaptation
- Rapid growth
- High green and dry fodder
- Ratoonability
- Drought tolerance

Reasons of short fall of Sorghum Seed

- Lack of awareness of developed techniques
- Non availability of quality seed
- Farmers – don't save their own seed
- Crop sown in less fertile land

Seed Production Techniques of Forage Sorghum

- **Selection of land**
- **Selection of variety:** As per recommendation,
- **Use of quality seed**
- **Seed treatment**
- **Time of sowing:** 4th week June-Ist week july
- **Depth of sowing:** 3-4 cm
- **Seed rate:** 12-15 Kg/ha
- **Fertilizers:**
  - **Nitrogen :** 75-80 kg/ha (1/2 at sowing & rest half as top dressing after 1st irrigation)
  - **Phosphorus :** 30-40 kg/ha at the time of sowing,
  - **Potash:** 25-30 kg/ha at the time of sowing

Irrigation : Ist irrigation after 20-25days after germination & 2nd at inflorescence
Isolation : 400m for Breeder/Foundation and 200m for certified seed production
Weeding : ●Pre sowing) - Atrazine 0.5kg/ha ●nterculture ●Control
Diseases and their control

- **Sugary disease**: Ziram @0.2%at boot leaf stage, Repeat at 15 days interval, rogue out all diseased plants.
- **Ear mould**: Captan @ 0.2% at the time of grain setting stage(Mould attacks after rains)
- **Leaf spot**: Dithane Z-78 @0.2% twice after 45 days of sowing.
- **Smut**: Treat the seed with vitavax@2g/kg seed.

Major insects and their control

- **Stem borer**: Rogue out the affected plant, endosulphan / carbaryl @ 4% 2-3 times at 10 days interval, 20 days after seedling emergence.
- **Shoot fly**: Treat the seed with 5% carbofuran, Phorate granules @1.5gm in 1m length.
- **Ear head bug**: Treat ear head with carbaryl dust (1.3%) 20kg/ha.
- **Termite**: 25kg sulphur/ha if field was rainfed for a long.
- **Aphid**: Spray 50ml malathion in 50 litre of water.
- **Rodents**: At the time of flowering poison bating with zinc phosphide.

Roguing

- Rogue out the off type plants and volunteers before they begin to shed Pollen.
- They are distinguished on basis of characteristics.
- Diseased plants should also be rogued out.

Harvesting and Threshing :

- Ensure that Crop is fully ripened.
- Diseased/undesirable heads-sorted out.
- Dried on floor for a wee k.
- Threshing by thresher.
- Seed should be dried to 10% before storage.

Seed Yield : 18-20 q/ha.
Varieties:

- Pusa Chari-6: Single cut
- Pusa Chari-9: Two cut (May be)
- Pusa Chari-23: Multicut
- Pusa Chari-615: Multicut
- Pusa Chari-1003: Single cut

Ear head

Seed Production Technique of Bajra

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Bajra is cross pollinated crop. India is the largest producer of bajra. Bajra production mostly takes place on hot, dry conditions on infertile soils. Total area under bajra production is 9.3 m ha and total production is 8.3 m ton. From 1980, area has declined but production increased by 28% (64% increase in productivity, 870kg/ha from 450kg/ha). Hybrid bajra production is in 3.0 m ha out of 9.3 m ha total area (cover 30% area). 95% of bajra is used as food for poor & forage for animals in Asia & Africa, but only forage & feed crop for animals in America. Hybrid seed production technology is important for achieving quarter jump in productivity.

The crop residue (stover) after grain harvest is valuable source of fodder for livestock because of its:

- Wide adaptation.
- High tillering and Rapid growth
- High green and dry fodder.
- Ratoonability.
- Drought tolerance.

Reasons of short fall of Bajra Seed

- Lack of awareness of developed techniques.
- Non availability of quality seed.
- Farmers – don't save their own seed.
- Crop sown in less fertile land



Seed Production Technology of Bajra

♦ **Selection of land** ♦ **Selection of variety:** As per recommendation

♦ **Quality of seed** ♦ **Seed treatment** ♦ **Time of sowing:** 2nd fortnight of July

♦ **Depth:** 3-4cm ♦ **Seed rate:** Direct seeded: Line A = 1.50 Kg/ha
Line B = 0.75 Kg/ha
Transplanting: Line A= 400- 600g/ha
Line B=200- 300g/ha

♦ Method of sowing: Continuous sowing Transplanting

♦ Planting Ratio: 2:4 ♦ Spacing: PxP=15cm, LxL=60cm ♦ Nursery: on raised beds

Hybrid Seed Production Technology

In Hybrid seed production two lines of males and four lines of females are to be planted. To maintain regular supply of pollen four lines of males should be planted around the field for bumper hybrid seed production. For example for hybrid seed production of variety Pusa-23, first we have to produce 841- A (Female parent-Male sterile) than cross it with male parent of D-23.

Fertilizer:

- **Nitrogen :** 100kg/ha (1/2 at sowing & rest half as top dressing after 1st irrigation/
- **Phosphorus:** 60kg/ha at the time of sowing.
- **Potash:** 40 kg/ha at the time of sowing.

Irrigation: Need base (Ist after 20-25 days after germination & 2nd at inflorescence)

Isolation: ●1000m for Breeder/Foundation. ●400m for certified seed production

Weeding: ●(Pre sowing) – Atrazine 0.5kg/ha ●nterculture ●Control

Diseases and their Management

Rust: Observed at flowering in Sept. in North India when temperature is moderate.

Control : ●Weed control ●Rust resistant cultivars

Rust

Smut

Ergot

Ergot: Grain is contaminated by fungal bodies (Sclerotia) as high as 58 to 70%.

Cultural practices: ●Deep ploughing ●Separate infested seed from normal seed by soaking in 10% salt solution light weight infested seeds float and can be separated.

●Two perennial grass weeds *Cenchrus ciliaris* & *Panicum antidotale* were found to harbor the ergot fungus.

Chemical Control: ●A practical and economical fungicide spray. ●Use of resistant cultivars is the most cost-effective method.

Downy Mildew: Symptoms: Chlorosis at the base, white asexual sporulation. Plants are generally stunted and do not produce panicles, which transform into leafy structures.

Insect and pest & their control

●**Termite**: 25kg sulphur/ha if field was rainfed for a long.

●**Aphid**: Spray50ml malathion in 50 litre of water.

●**Rodents**: At the time of flowering poison bating with zinc phosphide.

●**Roguing**: Rogue out the off type plants and volunteers before they begin to shethe Pollen. They are distinguished on basis of characteristics.

●Diseased plants should also be rogued out.

Harvesting and Threshing: Ensure that crop is fully ripened. Diseased/undesirable heads should be sorted out and dried on floor for a week.
Threshing by thresher. Seed should be dried to 10% moisture before storage.

●**Seed Yield** : 20 q/ha

Seed Production Technique of Mustard

Raj Kumar

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In India total area under mustard is 7.2 mha. and production is 8.1t, 1st in the area wise in world (19.2% of total oilseed crops) and productivity is 3rd after Canada & China. (1/2 t less than world Av.yield). Mustard producing states in India are Rajasthan (Ist), Uttar Pradesh (IInd), Madhya Pradesh, Haryana (IIIrd), Gujarat & West Bengal.

Seed Production Technology of Mustard

Following Seed Production technique should be adopted for quality seed production.

1. Selection of land: Other varieties should not be planted in same field in previous year to avoid voluntary plants. If same variety planted in previous 3-4 years in the same field, change the field to raise healthy crop.

2. Isolation: To avoid pollination from different varieties an isolation of 400 meter for Breeder/foundation seed and 200 meter for certified seed production is required.

3. Preparation of land: Irrigate the field so that weeds may germinate before final preparation. Harrow the field 3-4 times upto 3 inch deep before sowing. Ensure the proper moisture.

4. Time of Sowing: Rainfed condition:15 Sept. – 15 Oct. Irrigated condition: Before 30 Oct. Time is important for production & diseases development

5. Seed Rate: 5 Kg. seed is sufficient in one ha.

6. Seed Treatment: 2gm.carbandazim to treat 1 kg of seed as a preventive measure for many diseases

7. Fertilizer: DAP- 90Kg.+ Urea -140Kg per ha. or SSP- 250Kg + Urea -175Kg per ha. Sulphur: 40 Kg per ha. enhance disease resistance & oil content. If nitrogen & phosphorus is given in the form of ammonium nitrate then sulphur should not be given separately.

8. Sowing: Sowing should be done in lines. Rainfed Condition: North to South (Plant x Plant =10cm., Row x Row =30cm.) Irrigated Condition: Plant x Plant =15cm.Row x Row =30cm.)

9. Irrigation: First Irrigation: 30-35 days after germination, 2nd Irrigation: No time limit, if needed then irrigation should be given. Deep irrigation: More than 3 inch should be avoided as it promote *Sclerotinia* disease.

10. Weeding: Inter culture after 20-30 days after sowing,

Chemical control of weeds: Pre sowing: Spray Fluchlorolyn 45EC1litre/800 litre water/per ha. After sowing: Spray Pendamethalon/1litre/800 litre water/ha. within 2 days of sowing.

11. Frost: 0.1% sulphuric acid is very effective to control the damage from frost. Smoke is also effective to minimise the effect of frost.

12. Roguing: Off type should be removed when ever needed.

- At flowering stage
- After flowering
- At maturity
- Diseased plants
- Weed plants
- Other varieties plants


White Rust


Sclerotinia Stem Rot


Alternaria Blight


Aphid

Diseases: *Alternaria* blight, White Rust & *Sclerotinia* stem rot: 1.5-2kg. mancozab/ha.
Intensity of diseases low if the crop is sown timely.
Alternaria on the pods appear after rainfall in Feb.
Downy mildew and *Sclerotinia* stem rot occurs more in irrigated conditions.
Powdery mildew occurs on late sown crops.

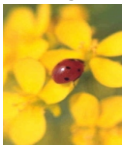
Painted bug: Spray Endosulphan 4% after 10 days of germination, In severe condition: spray Endosulphan- 625ml/500litre water/ha.

Aphid of mustard

Significant appearance of aphid – 5th to 8th week after germination, Peak at 7th standard week.

Integrated Disease Management : Garlic bulb extract / *Trichoderma harzianum* as seed treatment alone or in combination with foliar spray by garlic extract were at par with chemical fungicides. Highest (Rs.664) incremental benefit recorded with garlic bulb extract (seed treatment).

Integrated Pest Management: Bio-agents and insecticide, Plant extracts against mustard aphid, Neem oil 2% and NSKE 5% were found effective.



Bio Control of Mustard Aphid

Lady bird beetle *(Coccinella septempunctata)*
@ 5,000 beetles/ha effective with highest yield.

Chemical control of aphid

Metasystox or Rogor or Endosulphan or Monochrotophos: 600-800 ml/600 litre water/ha.

Harvesting &Threshing:

Harvest the crop when plants look light green & pods light golden.Leave the crop in small heaps in the field for 2-3 days. Then dry on floor for 2-3 days before threshing. Threshing by beating/tractor as per convenience. Store properly after drying up to optimum moisture.

Yield Potential: 20-25 quintal per ha.

Varieties developed by IARI for different Regions:

1. Punjab, Haryana, Delhi & N.Rajasthan for rainfed & early sown-P. agrani, for timely sown–P.bold, for irrigated early sown-P.agrani & P.mahak and for timely sown–P.bold & P.jagannath.
2. U.P., N.E.Rajasthan & N. Madhya Pradesh for irrigated & timely sown–P. jagannath.
3. Gujrat, S.W.Rajasthan & Maharastra for irrigated & early sown P.agrani & for timely sown-P.jaikisan.
4. Orissa, Bihar, Jharkhand, MadhyaPradesh, Chattisgarh, W.Bengal, Assam & N.E.States–for rainfed & timely sown P.bold & P.bahar, for irrigated & early sown-P. agrani, for timely sown-P.jaikisan, for late sown–P. bold
5. Karnataka & Tamilnadu for late sown–P.bold.

Basic Concepts of vegetable Seed Production

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Seed is the basic starting point of most of our vegetable crops although some are propagated vegetatively from cuttings of tubers. The vegetable seed is, therefore, basic for all inputs such as fertilizers, crop protection, irrigation, harvesting and marketing. It is therefore essential that seed of highest possible quality may be made available to the farmers. Quality of seed includes:

Genetic purity | Physical purity | Germination potential | Freedom from pests

To produce seed with all these quality attributes, a systematic seed production is must. During the seed multiplication process, the following points are to be kept in mind for obtaining high yields of quality seed with low cost of production.

Land Requirements : The field selected for raising a vegetable seed crop should be free from 'volunteer' plants. Volunteers mean the plants originating from the seed/plant material of the previous crop. In vegetables volunteer plants are seen in palak, tomato etc.

Isolation Requirements : Vegetable crops like tomato, garden pea, fenugreek, cowpea are self pollinated and majority of other vegetable crops like okra, chillies, cucurbits, brassicas are cross pollinated. Satisfactory isolation of seed crop helps to maintain purity in three ways:

a) Cross-pollination does not occur between cross compatible crops.
b) During harvesting seeds of different varieties of same crop are not mixed.
c) The transmission of pest and diseases from alternative host crop are minimized.

Proper isolation is thus essential to maintain genetic purity and health of a variety. Isolation between cross compatible varieties is achieved in different ways.

- Isolation by time will allow seed of different varieties of the same crop to be produced at the same station each year. If the season is too long enough to allow two production cycles of the cross compatible crops then they too are isolated by time. For example, early and mid maturity group of cauliflower grown for seed production can be isolated by time.
- The mode of pollination is related to the degree of isolation necessary. In case of self-pollinated varieties the isolation distance is relatively short but, in case of cross-pollinated varieties the distance from other variety should be relatively wide. The isolation distance also depends on the direction of insect flight (in case of insect pollinated varieties) or the direction of winds (in case of wind-pollinated varieties).

Roguing : The vegetable varieties, which are produced for seed show genetic change over several generations. It is, therefore, necessary to exert control and keep the natural variation within the acceptable limits. This is achieved by inspecting the crops at various growth stages and removing individual plant which do not confirm to the defined limits of that variety. Thus roguing is a technique that is used in seed production to maintain genetic purity of the variety. Rogues or off-types may occur in a crop due to any of the following reasons.

The diversity of the morphological types within a crop may be wide. This tendency is greater in predominantly cross-pollinated (e.g. cauliflower, cabbage, cucurbits and onion) than self-pollinated (e.g. peas, tomato, fenugreek) crops. This is why varieties of self-pollinated crops are generally more uniform and stable than varieties of cross-pollinated crops.

The seeds that result from cross-pollination between the crop for seed production and other compatible varieties or wild plants. These are not always identified in the first generation and show up in the second. Some plants may

display deviation from the normal type due to mutation. Seeds of other varieties may have been accidentally mixed in the seed stock during its production, processing or admixture via seed drill. Volunteer plants may arise from vegetative pieces or dormant seed of the previous crop grown in the same field.

It is always easier to conduct intensive roguing in breeder seed plots than in large commercial seed production plots. To obtain maximum benefits from roguing operation, we should follow the below mentioned practical points.

- The crop should be grown in such a way that plants can be seen individually.
- Paired row system of planting may be followed so that it is easy to walk between rows. This shall facilitate detection of dwarf undesirable plants.
- Walk systematically through the crop so that each plant is seen. Remove the whole off-type.
- Do not simply remove the fruits showing undesirable character because the remaining flowers on the off-type plant will still contribute to the material in the next generation.
- Inspect the crop with the sun behind you as it is difficult to examine plants with the sun on your eyes.
- Do not delay field inspection. The undesirable plants should be removed before flowering as far as is possible. Remove cross-compatible weeds and wild relatives.
- Remove all diseased plants and related infected weeds also.

Variety description based on morphological characters like leaf shape, flower colour, fruit shape and colour generally form a good basis of roguing but some characters like leaf colour, plant height, earliness of flower are affected by environment.

Harvesting, threshing and seed extraction : The best time of harvesting vegetable seed crops is at a stage when the highest yield of best quality seed will be obtained. Seed has to be extracted from dry seed heads, or from dry fruits or from fruits in which the seeds are wet at the time of extraction. Threshing can be done by hand, animal or machines. Care should be taken while transportation of material from the field to threshing floor. Both the trolley and the threshing floor should be clean from the seed/ plant parts of the other varieties of the same crop or weeds to avoid admixture at this stage. Threshing machines must be used with care in case of vegetables. They should be run at a reduced speed to avoid mechanical damage to the seed. Threshing machines should be properly cleaned to avoid admixture.

Seed drying : At the time of harvest, the seed frequently contains higher moisture content which should be reduced to optimum level before storage. For ambient storage seed moisture should be kept under 9-12% and for sealed storage it should be 6-8%. Natural and artificial methods are used in vegetable seed drying.

Seed Processing: Seed processing operation removes plant debris like chaff, straw, flower heads, stones, soil clods etc and other crop and weed seeds. In vegetable seed processing air screen machines are generally used. Air screen machines have at least two vibrating screens, the upper screen removes impurities larger than the seed while the lower screen separates out any seed or other impurities smaller than the optimum seed size of the crop. Further upgradation of seed quality can be achieved by processing seed on a gravity separator.



Agronomic Principles for Seed Production

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Seed is the basic unit in the agronomy of any crop .Without good seed investment on fertilizer and water will not pay dividends which ought to be obtained. Agronomy of crop will decide the potential yield and Quality of seed which is further improved by processing.

Agronomic Principles : The agronomic principles like agro climatic requirements, sowing time and methods, plant spacing, fertilizer management, irrigation management, harvesting management and prevention of mechanical mixture affect the seed yield and quality of different crops.

Selection of a Agro-climatic region:

- A crop variety to be grown for seed production in an area must be adapted to the photoperiod and temperature conditions prevailing in that area.
- Regions of moderate rainfall and humidity are more suited to seed production than regions of high rainfall and humidity.
  Regions of moderate rainfall and humidity are more suited to seed production than regions of high rainfall and humidity.
- Excessive dew and rains hindrance in normal pollination causes lower seed set.
- Most crops require dry sunny weather and moderate temperature during flowering.
- Too high temperature causes pollen desiccation and lower seed set.
- Hot dry weather prevailing during flowering in vegetables, legumes and fruit trees fails to set seed.
- In wind pollinated crops bright sunny weather with gentle winds are helpful because an even flow of pollen over the crop is conducive for best pollination and seed set.
- Very cold temperatures may also damage the seed quality during early maturation stages.
- Apart from affecting pollination excessive rainfall leads to higher incidence of diseases and insects and makes seed harvesting difficult. It may also result in delayed maturity and pregermination in standing crops.

Selection of seed plot

- The plot selected for seed crop must be free from volunteer plants, weed plants and have good soil texture and fertility and leveled.
- Volunteer plants are one of the important sources of deterioration of variety.

Isolation of Seed crops

- The seed crop must be isolated from other nearby fields of the same crops and the other contaminating crops as per requirement of the certification standards.
- The isolation of seed crop is done by providing a safe distance between seed and contaminating crop. Sometimes distance isolation is not feasible then time isolation can be given.
- After harvesting, isolation of seed crop of different varieties is required to avoid mechanical mixture.

Preparation of Land

- Good land preparation helps in improved germination, good stand establishment and destruction of potential weeds. It also aids in water management and good uniform irrigation.

Seed and Sowing

- Breeder seed will be required for the production of foundation seed and foundation seed will be required for production of certified seed.
- The time of sowing/transplanting enormously influences the growth and yield of crop. Seed crops should invariably be sown at their normal planting time.

- The most efficient and ideal method of sowing is by mechanical drilling which deposits the seed in the desired amount and at a uniform depth.
- Sowing in lines enables to remove any volunteer plant of previous variety which improves the seed purity and quality
- It is of utmost importance that seed drills/planters are thoroughly cleaned before use i.e. free from left over seeds of other crop/varieties.
- Small seeds should usually be planted shallow, but large seeds could be planted a little deeper.

Roguing

- Rogues should be removed as early as possible before the flowering.
- It is always advisable to remove the whole plant than the flower bud/tiller.
- Roguing at vegetative/pre flowering in cross pollinated crops is extremely important to avoid genetic contamination.
- Roguing at flowering is important and the rogues not distinguishable earlier should be removed soon after emergence of ear head in order to avoid genetic contamination.
- The rouging at maturity requires removing off textured / off colored ear heads, diseased/malformed ear heads.
- Provision of honey bees in hives in close proximity to the seed fields of crops largely cross pollinated by the insects, ensure good seed set thereby greatly increase seed yields.

Nutrition

- Adequate supply of nitrogen is important for good health of crop and increases yield.
- Excessive quantity of nitrogen may delay maturity, increase succulence, increased risk of disease and insect and lodging which is not desirable seed point of view.
- There should not be too much nitrogen during early stages otherwise vegetative growth will increase, fruiting will be reduced and lodging may take place in seed crops.
- To guard this, split application should be made. The second application of nitrogen often leads to increase in seed yield and quality without lodging.
- A good supply of Phosphorus helps in good root growth, fruiting and seed development.
- Phosphorus may hasten maturity and increase disease resistance.

Irrigation

- Excess moisture or prolonged drought adversely affects germination and frequently results in poor crop stands.
- Crops must be irrigated at their critical stages, lower moisture contents affects the yield and quality

Harvesting of Seed Crops

- For minimizing the mechanical losses harvesting must be limited to moisture contents below 20 percent. Hand harvesting at the appropriate time and subsequent drying results in good quality seeds.
- In order to preserve seed viability and vigour it is necessary to dry seeds to safe moisture content levels. Drying of seeds to safe moisture levels should be done quickly.

Disease Management in Seed Crops for Successful Entrepreneurship

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Availability of good quality of seeds in sufficient amount at the right time and at affordable price is basis for successful agriculture based entrepreneurship. But the attack of various disease pests in different crops is a serious problem and is a main constraint in the financial upliftment of the farmers. Disease infestations affect crop productivity and seed quality of the seed crops adversely. Therefore, it is essential to control the diseases timely.

Causes of plant diseases: Disease in plants does not occur due to a single change but it occurs due to step by step changes in succession. Disease is caused by biotic factors (bacteria, fungi virus, nematodes, insect vectors, some flowering plants e.g. broomrape, dodder, witch weed) or by abiotic factors (deficiencies or excess of nutrients or adverse environment) known as pathogen which spread disease as individual or in group.



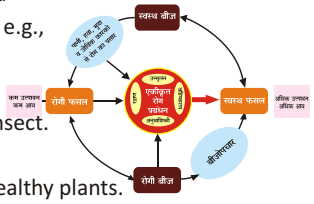


Plant Disease Management: Several methods are adopted for the control of disease e.g. culture control, biological control, chemical control or use of disease resistant varieties. In case single method fails to control the disease, integration of two or more than two methods is used for control the diseases.

What is Integrated Pest Management:

Use of various crop protection measures in integrated manner keeping environmental pollution at low level e.g.,

- Proper agricultural practices.
- Judicious use of agrochemicals in the crop.
- Biological methods using useful bacteria, fungi or insect.



Selection of seeds:

- Use of disease free, healthy seeds obtained from healthy plants.
- Seeds to be obtained from reliable source.
- Use seeds after treatment.

Seed Treatment:

Seed should be treated with 10% salt solution. Floating seeds should be discarded and the remaining settled heavy seeds must be washed 3-4 times with plain water before sowing.

- Seed should be sown at recommended rate.
- Seed should be dried properly before storing in clean room.
- Seeds should not be kept directly on the floor or in direct contact with the walls.
- Seeds should be monitored at timely intervals and fumigated as and when required.

Diseases in Nursery :

- After germination, rotting starts at the base of seedlings, due to which seedlings die.
- The disease becomes visible after 10-15 days of germination when the seedlings emerge from the soil surface.

Different agricultural practices for management of diseases:

- Irrigation should be restricted and drainage should be proper
- In Kharif season, seed bed should be raised 15 cm above the surface to prevent water stagnation. Preferably, sandy loam soils should be used for making seed beds in nursery.

- Staking of plants should be done with sticks to support them.
- Injuries to the plants must be prevented during inter cultural o
- Appropriate management practice must be selected after disease in consultation with agricultural scientists.
- Disease should be managed timely.
- Clean cultivation should be promoted.

- Diseased plants in the nursery must be uprooted and burnt after the appearance of disease symptoms.
- Farmers should not smoke during field operations.
- Hands must be washed with soap solution after touching diseased plants.
- Deep ploughing is recommended during summers.

- Crop rotations should be followed
- Crop debris should be destroyed.
- Neither take two crops of rice in the same field in one season for some extra profit nor allow others to do the same.
- Sowing of rice should be done timely e.g., in rainy season to avoid water problems.

- Use balanced amount of fertilizers and chemicals.
- Non-judicious use of pesticides should be avoided.

Biological control of plant diseases: Biological control of diseases is an alternative method of crop protection in which beneficial micro-organisms are used to control the diseases. Several biological products and formulations prepared from fungi e.g. *Trichoderma harzianum, T. viride, Aspergillus niger* etc. were found very effective against soil and seed-borne diseases of field and horticultural crops.

Plant diseases can be managed by treating seeds and soils with Kalisena S.D. and Kalisena L.L., respectively, which are valuable fungicide and biofertilizer used to enhance crop production. These are important organic manure and organic fungicide which helps to control many diseases of agricultural crops.

Insect Pest Management for Successful Entrepreneurship in Seed Production

P. B. Singh

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India has limited arable land for producing desired quantity of food grains to meet our future demands. The situation appears grim considering lack of purchasing power among farmers. There seems to be one solution for these and that is through large scale adoption of quality seed production programmes by our farmers. Quality seed production and its marketing can not be achieved without proper insect pest management. Insect pests inflict about 10 to 30% crop losses thereby need required attention. In the foregoing text, management of insect pests is being discussed so as farmers or seed growers may resort to such control measures as and when required.

1. Soil insect pests

Important soil insects which damage our seed crops include termites *Odontotermes, Microtermes* species, white grubs *Holotrichia* sp. and cutworms. Such insect may be managed by applying chlorpyriphos 1.0 to 1.5L, bifenthrin or imidacloprid @ 400ml/acre with irrigation water or mix the above insecticides in 15-20kg of sand, broadcast it and irrigate the field. Alternatively, fipronil 0.3GR@ 7.0 to 10kg/acre may be applied. For cutworms, additionally, malathion or fenvalerate dusts may be applied on the crop @ 8 to 10kg/acre when morning dew is present.

2. Sucking insect pests

Sucking insects suck cell sap from leaves, seeds and stem. This includes aphids, jassids, whiteflies and mealy bugs. For aphids and jassids, spray dimethoate or oxydemeton methyl @ 400ml/acre or imidacloprid/ thiamethoxam @40 to 60ml or g /acre. For whiteflies, apply acetamiprid @ 60g/acre and for mealy bugs apply profenofos @600ml/acre. For brown plant hopper (BPH), buprofezin @ 330ml/acre may be sprayed with hand or tractor mount sprayer, when BPH incidence is severe, it would be better to use deltamethrin 200ml or imidacloprid or thiamethoxam @ 50 to 80ml or g/acre, mixed the usual dose of buprofezin.

3. External feeders of foliage, flower & pods

These insects are leaf, flower and pod feeders which cut and chew plant parts. Such insects include larvae of many lepidopterans (gram pod borer, diamond back moth etc.), coleopterans and few hymenopterans (mustard saw fly). Many adult coleopterans (red pumpkin beetle, gujhia weevil, *Epilachna* beetle etc.) are such feeders. For management, spray carbaryl 500g, malathion 500ml, phosalone 400ml, deltamethrin 200ml, fenvalerate 200ml or flubendiamide 50ml/acre.

4. Internal feeders or tissue borers

These insects feed inside stems, leaves and fruits and include leaf miners, stem borers fruit borers and root borers. Commonly known insects which come under this group are sugarcane borers at shoot as well as cane stage, pink and spotted bollworms of cotton, yellow stem borer of paddy, brinjal and okra fruit and shoot borers and many more. Management of these insects is relatively difficult. However, if recommended insecticides are applied at appropriate time with proper dosage and appliances they can be managed effectively. For management, spray monocrotophos @ 400ml, indoxacarb 200ml, spinosad 60ml, rynaxypyr 60ml, triazophos 300g or profenophos 500-600ml/acre. For less toxicity in produce, use spinosad or rynaxypyr. In case of sugarcane borers dose of rynaxypyr should be 150ml/acre.

Termite

White grub

Aphid

Gundhi bug

Gram pod borer

General instructions

- Prepare insecticidal spray solution in utensil specially meant for the purpose and do not use any kitchen utensil.
- Protect your body from insecticide contact and if it happens, immediately wash the affected area with soap and fresh water.
- While spraying move in upwind direction in such a way that spray droplets do not fall on you.
- Read company instructions carefully before spraying.
- Wear protective clothing, goggles, gloves, gumboots etc. while spraying.
- Fill spray tanks only 80% to avoid spray fluid spill over on you.
- Do not eat or chew anything while spraying.
- Store insecticides in original packing, away from children reach and keep under lock and key.
- In case of poisoning, consult any nearest authorized doctor along with the packing and company instruction slip.

Weed Mangement in Seed Crops

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Weeds cause two types of losses. The most important is the direct yield loss resulting from competition, followed by indirect damage by reducing the crop quality due to competition.

A. Preventive Weed Management

To obtain weed free crop seeds following cultural and mechanical measures are to be adopted:

- In India most of the peasants use their own saved seeds, which are full of weed seeds, so peasant should procure the seeds from certified sources.
- Separating crop seeds from ad mixture of weed and crop seeds on the basis of physical difference like seed size, weight, shape and colour.
- Do not use manure unless the viability of weed seeds have been destroyed through fermentation.
- Preventive measures like cleaning irrigation channel before irrigation should be adopted to prevent carrying of weed seeds, rhizomes and other propagating materials to the crop by irrigation water.
- Agricultural equipment and combine harvester should be cleaned before using them.

B. Weed management through agronomic practices

- Crop rotation plays an important role in management of weeds in general and also for the problematic weeds which develop resistance to herbicidal control. In mono cropping the weed species persists and expands rapidly but crop rotation helps in interrupting the normal life cycle of weeds to become dominant.
- It was observed that with increased use of isoproturon for controlling grass weeds the population of *Convolvulus arvensis* has increased in wheat. The weed twins around stem and completes its life cycle and form seeds; however the population is considerably reduced when wheat was rotated by garden pea.
- Crop rotations also assist in rotating herbicides.
- Stale bed technique also helps in weed management. In this technique 1-2 flushes of weeds are destroyed before planting of any crop. Most weeds germinate from top 4 to 5 cm of surface layers of soil. When final preparation of seed bed is with held, a flush of young weed seedlings will appear on it with in a week's time. After 7 to 10 days of good growing conditions there is flush of the weed seedlings which can be killed with herbicides e.g. glyphosate or by shallow non-inverting type of tillage implement.
- Irrigation has direct or indirect effect on weed intensity. Pre sowing irrigation is always better over dry sowing immediately followed by irrigation because pre-sowing irrigation encourages the weed seeds to emerge, which latter are destroyed by repeated ploughing during field preparations.
- Transplanted rice in puddle conditions and maintaining appropriate plant population gives crop seedlings 14 to 21 days advantage over weeds and covers the ground fast thereby smothering the weed growth.

C. Chemical approach

Herbicides can kill many weeds that survive by mimicry e.g. *Echinochloa* spp in paddy, *Avena* spp. in oats and wheat, *Phalaris minor* in wheat

- Pre-emergence treatments with herbicides provide early season weed control.
- Cost of weed management through herbicides is less than the manual weeding.
- Herbicide rotation involves either- (i) change of herbicide in the same crop, or (ii) change of the crop in the same field so that a different herbicide could be used. In Punjab and Haryana clodinafop (Topic 15WP) is a boon to farmers in controlling isoproturon resistant biotypes of *P. minor*, but broad leaf weeds were not suppressed by clodinafop.
- Metsulfuron (Algrip@4ga.i. /ha) can give good control of Rumex spp. in zero tillage system.
- Fenoxya prop-p-ethyl has also been found to control resistant biotypes of *P.minor*, however, showed its showed inefficiency towards the broad leaf weeds. Hence Metsulfuron and carfentrazone @20g a.i./ha in mixture can control complex mixed flora of weeds.
- Sulfosulfuron controls *Phalaris minor* besides broadleaf weeds except *Rumex* species.

Some of the herbicide mixtures recommended for different crops:

Crop	Efficient herbicide mixturewq	Dose (g/ha)
Wheat	Fenoxaprop+carfentrazone	90+20
	Triasulfuron +Clodinafop	20+40
	Clodinafop+ Sulfosulfuron	60+20
Rice	Butachlor+Almix	1000+4
	Pretilachlor + 2,4-D	300+300
	Anilophos+ Ethoxysulfuron	400+15
	Clomazone + 2,4-DEE	175+270
Maize	Atrazine + Pendimethalin	500+250
Pea	Alachlor+ Pendimehalin	1000+900
Black gram	Pendimethalin + Fluazifop	1250+375

Modern Seed Processing and Storage

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Seed is first and important input of agricultural production system. In India, post production losses in food grains are estimated about 10 per cent. Post production losses are not only quantitative but also qualitative. The genetic purity, physical purity, uniformity in seed size and viability are important to determine the quality of seed. The harvested seed lot contains impurities, improper moisture content, immature and damaged seeds. These components of seed lot invite insects and microorganisms during its storage. In light of above facts, it is essential to know the proper seed processing and storage requirements, for each lot.

Drying & Moisture : At high moisture contents there is natural higher respiration rate in the grain that causes deterioration in seed. High moisture also promotes the development of insects. For proper storage of the seed, the moisture content should be 8-16% in various crops. There are different drying methods *viz.*, field drying or stacking, sun drying, air drying method, fixed-bed batch dryers, re-circulating batch dryers, continuous flow dryer and vacuum drying, adopted for proper seed drying.

Seed Processing: After achieving accurate seed moisture content, the seed lot is forwarded for processing. After every variety and crop, machines should be cleaned. There is a series of machines which are used for processing to get good quality of seed *viz.*, air screen cleaner and grader, length separator, specific gravity separator and seed treaters.

Seed Pre-cleaner : Bulk of trash is to be removed to facilitate the product flow through the processing machines and elevators. It prevents the clogging of feed hoppers on the processing machines, allows more accurate processing, increases the capacity of the cleaning machines and thereby speeds up the processing operations. The performance of machine is a function of pitch of screens, vibration rate of screens, air blast volume, feed rate and cleaning arrangement of screens.

Air screen cleaner and grader: The air screen cleaner is the basic machine in the seed processing plant. The air screen cleaner and grader removes MOS from the seed mass on the basis of differences in thickness and aerodynamic behavior of good seed and MOS. Two air screen machines are required for effective cleaning and grading. It has three processing operations: Aspiration; by removing light impurity as well as light seed component, Scalping; by removing coarse impurity and grading; by removing under sized seed component. The machine consists of set of screens. An aspiration system is also installed in the machine providing air steams at two places. In this machine, the screen selection is very important. Round (scalping) and oblong shape of screen should be selected for paddy. The size of scalping screen should be larger enough to allow all the seed component to pass through and scalp off the coarse impurities, while the size of grading screen should be just smaller than the optimum thickness of good seed so as to pass other than good seed and ride over all the good seeds.

Specific Gravity Separator: Specific gravity separator removes low density seeds, such as, badly damaged, diseased seeds, immature seeds and insect damaged seeds. The seeds are vertically stratified in layers on the gravity deck according to density. The oscillating movement of the gravity table makes the heavy seeds walk uphill the deck. The air flows the light seed down the slope. The seeds traveling to the edge of the table range from light at the lower end, to heavy at the upper end. The discharge is divided into three density grades: heavy (product), middling and light (rejections). The middlings are reprocessed and the light rejections are discarded.

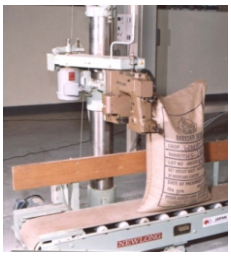
Mist-O-Matic Seed Treator: Seed and treatment material dumps are metered separately. The treatment material flows to a rapidly spinning disc mounted under the seed separating cone. The disc atomizes treatment liquid drops into fine mist and sprays this outward to coat seed falling over the cone through the treating chamber. Later on the seed flows through the mixing chamber housing by an auger conveyor. The coating efficiency can be attained to 85-95%, which is significantly higher than slurry type treaters (75-80%).

Seed Packaging: Seed packaging comprises of seed weighing, bag filling, labeling and sewing of the bag. Automatic weigher baggers are utilized in bulk seed processing plant. Seed flows from the product tank and is received in the seed hopper mounted over weighing scale. The weighing scale is attached to the bottom of the hopper. The feed gate opens and closes automatically, as the set weight is attained. After filling, the seed bag is placed on the conveyorised bag closer. The level is sewn to the bag by the sewing head of conveyorised bag closer.

Seed Storage: Normally seeds are stored in jute or canvas bags or low-density polythene sheet or in metal, wood or mud containers. Old or used bags should be properly cleaned and treated with suitable insecticide. Old bags of a crop variety must not be used for the same crop in the subsequent season to avoid mixing of varieties.

Thorough cleaning of seed processing plant and storage premises should be done religiously and regularly followed by dis-infestation with residual sprays of insecticides at least four weeks in advance. The storage facility should be white-washed once in year. Spilled seed should immediately be removed because it attracts wandering insects that may infest and lay their eggs. It can also become the cause of mechanical mixing.

The filled seed bags should always be stacked on wooden pallet. This prevents seed from picking up moisture from the floor, facilities proper cleaning and circulation of fumigant or fresh air. Alley space should be left between seed-stacks and walls for inspection or sampling. It has been observed that seeds of pulses, cereals and vegetables as well as old or new stocks should be stored separately. The timely fumigation is very important for healthy seed storage


Safe Seed Storage – An essential component of successful seed enterprenuership

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Healthy seed is the base for good crop yield. Food supply depends on the quality of seeds. Quality seed should have some important characteristics viz., good germination, high genetic and physical purity, free from diseases and insect pests and low moisture content. Seed can be stored for longer period by lowering down its respiration rate during its storage.

Safe seed storage can be grouped into two stages-

(A) Pre-harvesting Stage: This stage deals with the steps from seed selection to harvesting of the crop –

- Certified, disease free, healthy seeds should be selected for sowing.
- All the standard procedures should be followed for seed multiplication.
- Seed should be treated with suitable fungicide before sowing. For example, rice seed should be treated with 20 g Bavistin+1g Streptocycline solution in 10 litres of water for 12–14 hours for 8–10 kg of seed to protect the crop from Bakanae and Bacterial Blight diseases.
- Crops should be monitored regularly. Off types and diseased or infected plants should be uprooted and brunt.
- As soon as disease symptoms appear suitable chemical should be sprayed in proper amount.
- The crop should be sprayed with Propiconazole (Tilt) @ 200ml/acre to protect the seed from discolouration (brown and black). Second spray of Bavistin @ 500g/ acre should be given at 15–20 days interval during the ear head formation.
- Summer deep ploughing is recommended to reduce population of soil inhabiting insects and soil-borne inoculum of phytopathogens.
- Crop rotations should be adopted to reduce diseases and insect pest incidence.

(B) Post–harvesting stages: This stage deals with seed processing and storage related steps–

- Seed should be harvested from disease free area. It should be taken from healthy plants. Seed should be fully mature. Decision for harvesting should be taken after testing the moisture content.
- Seed should have 8–10 % moisture. Seed containing excess moisture should be dried up on cemented floor by rotating it from time to time.
- Seed with excess moisture are quite prone to storage fungi viz., *Rhizopus* spp, *Aspergillus niger, Alternaria alternata, Fusarium* spp, *Penicillium* spp etc. These storage fungi reduce the seed germination and viability. The storage gets contaminated due to these fungi.

Rhizopus species | *Aspergillus niger* | *Alternaria alternata* | *Fusarium* species | *Penicillium* species

Fig. 1: Major damaging fungi during storage Source: Google Images

- Seed processing unit should be cleaned well. There should be no old seed and other variety's seed.
- Machines should be cleaned. There should be no seed infected with disease or insects.
- There should be no soil in or on the seed. There is more population of pests in soil.
- Seed should be free from insects and ants. These reduce germination and lower the product value.

- Seed should be kept in store only after its processing.
- Old bags may be infested with diseases and insect pest and there are chances of mixture with old seed. Therefore seed should be kept in new bags.
- Seed should be stored in cool and dry places. Storage at favourable temperature increases the number of fungi/insects in seeds.
- Seed should be stored by keeping gunny bags on wooden crates. Proper aeration should be ensured in storage.
- Seed should be tested for fungal and insect incidence prior to storage.
- Seed should be treated with suitable fungicide prior to storage e.g. for vegetables Captan @ 2g/kg of seed, for wheat, Vitavax or Bavistin @ 2 g/kg of seed .
- Treated seed should be stored for a limited period only. It is always better to distribute seed after its treatment.
- Prior to sale or distribution the seed should be tested for fungal incidence and per cent germination.
- Small lots can be treated in dry dressing drum by mixing fungicide powder. Slurry treatment or mist-o-matic treatment should be done for big lots. Uniform application of fungicide is very essential for good results.
- Seed storage room should be established at proper place. It should be clean and hygienic with better sunlight and aeration. Don't smoke in it.
- Major Insect pests of Storage: About 50 insect species are known to cause damage to the stored seeds however seeds are mainly damaged by lesser grain borer *Rhyzopertha dominica,* snout weevil *(Sitophilus oryzae)*, khapra beetle *(Trogoderma granarium)*, red rust beetle *(Tribolium castaneum)* and pulse beetle *(Callosobruchus* spp).

Rhyzopertha dominica *Sitophilus oryzae* *Trogoderma granarium* *Tribolium castaneum* *Callosobruchus* spp.

Fig. 2: Major Insects pest of Storage

- Holes and cracks in the store house should be filled with clay soil or cement.
- Important management practices for storage insects: Generally the attack of storage insect pest on seeds starts from field level. The seed should be avoided from getting wet because such moisture containing seeds are infested more severely with insect pests.
- Disinfest the godown by spraying malathion 50 EC or primiphos methyl 50 EC or DDVP @ 20-30ml/L water or deltamethrin 2.5WP @ 40g/L (deltamethrin 2.8EC@ 36ml/L) of water.
- On harvest, check seeds if insect infestation is detected, seeds should be fumigated with aluminium phosphide @ 2–3 tablets/tonne, as early as possible.
- Proper sanitation of the seed store should be carried out at every 3 to 7 day interval.
- The seeds which are to be sown in next crop season should be treated with malathian 6–8 ml or deltamethrin 4–5 ml in 500ml of water per quintal of seeds. The treated seed should be dried in shade and kept in the container/bags. This treatment is effective for 6 months.
- The seed storage should be sprayed or fumigated time to time with effective chemicals.
- The protection of seed from moisture, rain, insects and heat is prime aim of the storage.

  If seed growers keep these important points in their consideration, they will be surely able to solve or get rid of the diseases and pest problems during storage. The seed will be free of insects and pests and its quality will restored for a long time. The availability of good quality seed will ensure more food production and solve the problem of hunger and malnutrition.

Requirements & Process of Seed Certification

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1-Seed Certification.

Today seed variety is developed somewhere, seed is grown somewhere and seed is marketed somewhere, so on the seed bag for the confirmation about genetic and physical purity of seed, the information of variety, producer and status of seed is need for confidence within the mint when seed is purchased. So by the Government of India, under seed act the seed production procedure and seed certification procedure is designed and created as act.

By looking of tag on bag, the complete knowledge and confirmation about progeny, producer, processing and standard is collected within mint.

As when you purchase the bulb of any company but it can be set in any holder and get light. Just like in agriculture, when you will purchase certified seed from anywhere then you will find the good standard seed of desired variety.

2-Mentality and key points for seed certification.

- Common crop growing and seed crop growing has some little difference.
- Keeping of seed with isolation and with identity.
- Record keeping of all steps.

3-Work of Seed Certification Office.

1. As alarm, awaken yourself as per time , just like certification keep alert as per time step for quality.
2. As your record copy is also with certification, then nobody can send yourself on bad and wrong way.
3. As you are registered unit with certification then it will give quality symbol to you.

Steps for certification –

Unit registration-

A-Selection of unit name and brand photo.

B-Collection of seed sale licence from Agriculture Department.

C-Registration in Certification Office.

Alertness for seed production

1-Purchasing of mother seed and keeping of record of all documents.

2-Handing over seed to seed grower and in keeping all detail.

3-Inspection of farm and map of the field.

4-Collection of raw seed as per yield estimation of certification report and stocking with identity mark class and variety wise.

5-Submission of list of raw seed to certification office for physical verification.

6-Processing of seed .

7-All record of processing and certificate collection.

8-Baging and tag detail recording.

9-Sale of seed with bill and detail recording

Class	Quantity	Area	Qtl Pass	Qtl After Fail	Cost if pass	Cost if fail
B-f	2 qtl	5 ac	100 qtl	60 qtl	All exp/100	Total exp /60
F-c	100 qtl	250 ac	5000 qtl	4500 qtl	All exp /5000	Total exp/ 4500

Total expenditure-

Cost of mother seed, administration expenditure, fees and charges of certification, processing expenditure.

Cause of poor income—Crop rejection in the field, Poor processing, un- sold seed.

(Cost of un-sold seed if seed is not packed well before Sowing time for marketing)

1-Right time letters for mother seed.

2-Right time mother seed distribution to seed grower.

3-Seed production guide line to seed grower.

4-Submission of seed grower list at right time to certification.

5-Yield knowledge by inspection.

6-Collection of raw seed with full care.

7-Listing of raw seed with full care.

8-Proper processing timely.

9-Collection of certificate and bagging.

10-Marketing of seed well before sowing.

11-Inspection of sold seed crop.

12-Putting of seed use care leaflet in the seed bag.

13-Information of seed plant machinery on bag.

14-Issue of seed dealer certificate to seed dealer.

15-Leaflet of own working pattern for farmers satisfaction that we followed the care point for processing, new harvest, billed quantity, new packed seed, identity, stack gap, use of covers

Seed grower respecting and gifting programme to-

1-Grower Supplier of good more raw harvest producer.

2-Grower of lot which has highest germination .

3- Grower of lot which has good uniform crop(as P.S.O) .

Protection of Plant Varieties and Farmers' Rights Act

The Govt. of India enacted "The Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001" adopting sui generis system. Indian legislation is not only in conformity with International Union for the Protection of New Varieties of Plants (UPOV) 1978, but also have sufficient provisions to protect the interests of public/ private sector, breeding institutions and the farmers. The legislation recognizes the contributions of both commercial plant breeders and farmers in plant breeding activity and also provides to implement TRIPs in a way that supports the specific socio-economic interests of all the stakeholders including private, public sectors and research institutions, as well as resource-constrained farmers.

Objectives of the PPV & FR Act, 2001

1. To establish an effective system for the protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants.
2. To recognize and protect the rights of farmers in respect of their contributions made at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties.
3. To accelerate agricultural development in the country, protect plant breeders' rights; stimulate investment for research and development both in public & private sector for the development of new plant varieties.
4. Facilitate the growth of seed industry in the country which will ensure the availability of high quality seeds and planting material to the farmers.

General Functions of the Authority

- Registration of new plant varieties, essentially derived varieties (EDV) and extant varieties
- Developing DUS (Distinctiveness, Uniformity and Stability) test guidelines for new plant species
- Developing characterization and documentation of registered varieties
- Compulsory cataloging facilities for all variety of plants
- Documentation, indexing and cataloguing of farmers' varieties
- Recognizing and rewarding farmers, community of farmers, particularly tribal and rural community engaged in conservation, improvement, preservation of plant genetic resources of economic plants and their wild relatives
- Maintenance of the National Register of Plant Varieties and
- Maintenance of National Gene Bank

Rights under the Act

Breeders' Rights

Breeders will have exclusive rights to produce, sell, market, distribute, import or export the protected variety. Breeder can appoint agent/ licensee and may exercise for civil remedy in case of infringement of rights.

Researchers' Rights

Researcher can use any of the registered variety under the Act for conducting experiment or research. This includes the use of a variety as an initial source of variety for the purpose of developing another variety but repeated use needs prior permission of the registered breeder.

Farmers' Rights

- A farmer who has evolved or developed a new variety is entitled for registration and protection in like manner as a breeder of a variety;
- Farmers variety can also be registered as an extant variety;
- A farmer can save, use, sow, re-sow, exchange, share or sell his farm produce including seed of a variety protected under the PPV&FR Act, 2001 in the same manner as he was entitled before the coming into force of this Act provided farmer shall not be entitled to sell branded seed of a variety protected under the PPV&FR Act, 2001
- Farmers are eligible for recognition and rewards for the conservation of Plan Genetic Resources of land races and wild relatives of economic plants;
- There is also a provision for compensation to the farmers for non-performanceof variety under Section 39 (2) of the Act, 2001; and er shall not be liable to pay any fee in any proceeding before the Authority or Registrar or Tribunal or the high Court under the Act

Registration

A variety is eligible for registration under the Act if it essentially fulfills the criteria of Distinctiveness, Uniformity and Stability (DUS). The Central Government issues notification in official Gazettes specifying the genera and species for the purpose of registration of varieties. So far, the Central Government has notified 54 crop species for the purpose of registration.

Fees for registration

Type of variety	Registration
Extant variety notified under section 5 of Seed Act, 1966	Rs. 1000/-
New variety/Essentially derived variety (EDV)	Individual Educational Commercial Rs. 5000/- Rs. 7000/- Rs.10000/-
Extant variety about which there is common knowledge (VCK)	Rs. 2000/- Rs. 3000/- Rs.5000/-

The Registration of a variety is renewable subject to payment of annual and renewal fees.

DUS Test Centers

Authority has 52 DUS test Centers for different crops with a mandate for maintaining and multiplication of reference collection, example varieties and generation of database for DUS descriptors as per DUS guidelines of respective crops. The list of DUS test Centres is available on the official website of the Authority.

Plant Variety Journal of India

Authority publishes its official journal “Plant Varieties Journal of India” (PVJI) as a monthly bilingual (Hindi & English) publication and it is made available to public on the first working day of each month on its official website. This journal has the equivalent status of a gazette under the Regulations, 2006. The contents of Journal includes official and public notices, passport data of plant varieties, DUS test guidelines of crop species, details of certificate of registration and other related matters.

Certificate of Registration

Applications which have fulfilled all requirements and have been finally accepted by the Registrar for registration were issued Certificates of Registration. 305 Certificates have been issued, out of which 10 have been issued for new varieties, 292 for extant varieties notified under the Seeds Act, 1966 and 3 for farmers' varieties. The certificate of registration issued will be valid for nine years (maximum 18 years) in case of trees and vines and six years (maximum 15 years) in case of other crops.

National Register of Plant Varieties

National Register of Plant Varieties has been kept at the head office of the authority, containing the names of all the registered plant varieties with the names and addresses of their respective breeders, the rights of such breeders in respect of the registered varieties, the particulars of the denomination of each registered variety, its seed or other propagating material along with specification of salient features thereof and such other matters as may be prescribed.

National Gene Bank

Authority has established National Gene Bank to store the seed material including parental lines submitted by the breeders of the registered varieties. The seed lot is stored under low temperature conditions at 5^{0}C for the entire registration period, and if necessary after few years of storage in the National Gene Bank, the seed lot will be rejuvenated and replenished at the cost of the applicant.

National Gene Fund

A National Gene Fund has been established by the Authority to receive the contributions from:

- the benefit sharing received in the prescribed manner from the breeder of a variety or an essentially derived variety registered under the Act, or the propagating material of such variety or essentially derived variety, as the case may be
- the annual fee payable to the Authority by way of royalty
- the compensation deposited by breeders
- the contribution from any National and International organizations and other sources.

The Gene Fund shall be utilized for

- any amount to be paid by way of benefit sharing,
- the compensation payable to the farmer/community of farmers'
- the expenditure for supporting the conservation and sustainable use of genetic resources including *in-situ* and *ex-situ* collections and for strengthening the capability of the panchayat in carrying out such conservation and sustainable use
- the expenditure of the schemes relating to benefit sharing

Plant Varieties Protection Appellate Tribunal (PVPAT)

All orders or decisions of the Registrar of Authority relating to registration of variety and orders or decisions of the Registrar relating to registration as agent or licensee can be appealed in the Tribunal. Further, all orders or decisions of Authority relating to benefit sharing, revocation of compulsory license and payment of compensation can also be appealed in the Tribunal. There is transitory provision by which it is provided that till the PVPAT is established the Intellectual Property Appellate Board (IPAB) will exercise the jurisdiction of PVPAT. The decisions of the PVPAT can be challenged in High Court. The Tribunal shall dispose of the appeal within one year.

Address for communication:
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New Delhi-110 012
Tel: 011-25843315, 25840777, 25843808 Fax: 011-25840478
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