Chapter: Seed, Seed Technology and Seed Production

Seed

- Any plant part used for raising the crop is seed. Seed include true seed seedling cutting, rhizome, grafts, roots etc used for Propagation.
- Botanically seed is matured integument mega sporangium. Seed is also defined as matured ovule consisting or embryonic together with store of food surrounded by protective coat.
- Seed is a mature integumented megasporangium or mature ovule consisting of embryonic plants together whit store food material covered by a protective coat (mega sporangium i.e. female gametophyte –the pistils are the female reproductive organs called megasporophylly in the flowering plants) the ovary of the carpel contains ovules (megasprorangia)
- A ripened ovule or a fertilized matured ovule containing embryo which has developed after fertilisation.
- The dry dispersal unit or matured ovule developed after fertilization
- Any part (or) organ of plant which has the capability to regenerate into a new plant
- A propagule responsible for maintaining the intrinsic (or) genetic qualities of the variety/ hybrid.
- An embryo, a living organism embeded in the supporting (or) the food storage tissue and a protective coat.
- Any propagative material.
- Miniature plant.
- Dormant plant
- Generative part of a plant that develop into a new plant.

As per Seed Act (1966) seed includes:

- Seed of food crops including edible oil seeds and seeds of fruits & vegetables.
- Cotton seeds
- Seeds of cattle fodder
- Jute seeds
- Seedlings, tubers, bulbs, rhizomes, roots, cuttings, all types of grafts and other vegetative propagated material for food crops (or) cattle fodder.

Importance of Seed in Crop Production:

Seed is crucial and basic input to increase crop yields per unit area. The importance of seed in crop production is known to human being since Vedic period. There is clear mention in ancient literature yajarveda "May the seed viable, may the rains plentiful and may the grains ripe days and nights"

History of agriculture progress from early days is also the history of seed of new crops and varieties. The progress was very fast from last three decades. The green revolution was only possible with production of generally pure seeds possessing other qualities namely high generation, high vigours high physical purity and sound health. Hence green revolution is in fact seed revolution. Only seeds of assured quality can be expected to respond to fertilizer and other inputs in expected manner, otherwise see of hope may turn into seed of frustration. Among the inputs used by farmers seed in the cheapest input. It is basic inputs and forms small part of the total cost of cultivation. The good seed also increase the efficiency of the factor of crop production.

Difference between Seed and Grain

The difference between seed and grain is given as below:

S. No	Seed	Grain
1	Any plant part used for propagation is seed. It includes seeds category , rhizome , grafts etc.	It is final produce of grain crops used for consumption.
2	Can be treated with fungicide, pesticide.	Not treated with fungicide and Pesticide.
3	Embryo is important.	Endosperm is important.
4	Viability is important.	Viability never considers.
5	Genetic purity must.	Genetic purity not necessary
5	Genetic purity must.	Genetic purity not necessary
6	Comes under preview of seed acts.	Comes under preview of food acts

Definition of Seed technology:

Cowan (1973): Defined as "That discipline of study having to do with seed production, maintenance, quantity and preservation

Feistritzer (1975): Defined seed technology as the method through which the genetic and physical characteristic of seeds could be improved. It involves such activities as variety development, evaluation and release seed production, seed processing, seed storage, seed testing, seed certification, seed quality control, seed marketing etc.

NATURE: It is a multidisciplinary science encompassing a range of disciplines such as:

1. Development of superior varieties
2. Evaluation
3. Release
4. Production
5. Processing
6. Storage
7. Testing
8. Certification/quality control
9. Storage
10. Marketing and distribution
11. Seed pathology
12. Seed entomology
13. Seed physiology
14. Seed ecology

SCOPE

India is a vast country and bestowed with varied soils and has got different agro climatic zones, enabling year round cultivation of crops. By and large, most seed crops are grown during *Kharif* season. However most of the vegetable crops are produced in *Rabi* season and they posses better quality seeds than the crop grown in kharif. Indian farmers can practice with multiple cropping systems.

The farmers can opt for different crops like cereals, pulses oil seeds, vegetables, fibre crops, etc., in all the three seasons *viz., Kharif, Rabi* and summer.

With the advancement of agriculture, the government of India felt that there is a need to establish Seed Technology department in Agricultural Universities and ICAR institutes in India after the recommendations and suggestions given by National Commission on Agriculture. Accordingly, the Seed technology department was initiated throughout the country with the following main

objectives.

1. To teach seed technology course.
2. Research on seed production/processing/testing.
3. To strengthen the seed technology research.
4. To give training to those who are involved in seed production, processing, testing, etc

Role of Seed Technology:

Feistritzer (1975) outlined the few roles of improved seed.

1. Seed – a carrier of new technologies.
2. Seed – a basic tool for secured food supply.
3. Seed – The principle means to secure crop yields in less favorable production areas.
4. Seed – a medium for rapid rehabilitation of agriculture in case of natural disaster.

1. A carrier of new technologies:

The introduced of quality seed of new verities and combined with other inputs significantly increased yield level e.g. in cereals, yield increased up to 112%, in potato – 24% & sugar beet - 142% in U. S. A. & central Europe. In India the cultivation of high yielding verities have helped to increase food production from 52 million tones (1947) to nearly 200 million tones in 2000-2001

2. **A basic tool for secured food supply**:

The successful implementation of the high yield verities programme in India has led to a remarkable increase the production. As a result, food imports from other countries have been substantially brought down in spite of the rapid population increase.

3. The principle means to secure crop yield in less favorable area of production:

The supply of good quality seed of improved verities, suitable to these areas is one of the crops. Immediate contribution that seed technology can make to secure higher crop yield

Goals of Seed Technology:

The measure role of seed technology is to increase agriculture production through the spread of good quality seed of high yielding verities.

1. **Rapid Multiplication:** Increase in agricultural production through quickest spread of new verities developed (released) by the plant breeders.
2. **Timely supply:** The improve seeds of new verities must be made available well in time, so that farmer is planned planting schedule (or showing time) without disturbed. They are able used good seed for planning (sowing) purpose
3. **Assured high quality of seeds:** Is necessary to obtain the expected dividends from the use of seed of improved verities
4. **Reasonable price:** The cost of high quality seed should be within reach of the average farmer

Seed Production

Availability of quality seeds of improved cultivars is considered crucial for realizing productivity and adoption of cultivars in different agro-climatic conditions. The quality of seed alone is known to account for at least 10-15% increase in the productivity (ICAR 1993). However, lack of quality seed continues to be one of the greatest impediments to bridging the vast yield gap. Therefore, to approach the potentially realizable yield of a cultivar, production and distribution of quality seed is essential. The good quality seed should have the following characters:

- Genetic purity, and uniformity and should conform to the standards of the particular cultivar.
- Disease free, viable seeds.
- Free from admixtures of other crop seeds, weeds and inert matter.
- Acceptable uniformity with respect to size, shape and color.

Seed Production: Systemized crop production is known as seed production. In seed production adequate care is given from the purchase of seeds upto harvest adopting proper seed and crop management techniques. The benefits of seed production are

- Higher income
- Higher quality seed for next sowing

Difference between seed and crop production

Seed production	Crop production
Basic seed should be from an authentic source	Any seed material can be used
Seed plot should be selected carefully for better performance, as per edaphic and environmental requirement	Can be grown in any area
Needs isolation from other varieties	Isolation is not necessary
Needs technical skill for maintenance of quality	Special technical skill is not required
Maintenance of genetic purity is important	Genetic purity is not required
Roguing is compulsorily practiced	Roguing is not practiced
Harvesting should be done at physiological/ harvestable maturity	Harvested at field maturity
Resultant seed should be vigorous and viable	Question of viability does not arise
Importance is given to seed quality rather than the yield	Importance is given more to yield

There are two types (major) of seed production ie. Varietal and hybrid

Seed production based on the type of seed used for multiplication .The difference between varietal and hybrid seed production are as follows

Varietal seed production	Hybrid seed production
It is single parent multiplication	It needs two to many parents
Isolation distance requirement is less	Isolation distance requirement is more
Production is by open pollination	Production is by managed control pollination (Female)
Seed can be used continuously for 3/4/5 generations	Seed has to be changed every time
Production technique is uniform (multiplication)	Technique differ with crop
Production care is less	Production care is more
Yield will be lower	Yield will be higher
Profit is less	Profit is higher

SCOPE AND IMPORTANCE OF SEED PRODUCTION

Indian Agriculture has made enormous progress in the last 50 years. Food grains production has risen from 50 million tons in 1947 to 212 million tons in 2003-04. The country has advanced from a situation of food scarcity and imports to that of food security and exportable surpluses. The Green Revolution of India has been universally acclaimed as a successful enterprise of the farmers, the Scientists and the Government. The land mark achievements in agriculture in the 60s and 70s were the result of a combination of inputs like introduction of high yielding varieties, increased fertilizer use, expansion of irrigation facilities, massive extension efforts, improved farm practices and, above all, ingenuity and industry of the Indian farmers. However, the growth of agriculture sector has not kept pace with the growth of the population and has stagnated. The unsatisfactory growth of agriculture, apart from serious implications for food security of the country, has been adversely impacting the growth rate of country‟s economy. The imperative of National food security, nutritional security and economic development demand a very focused and determined approach to raise productivity and production in agriculture. In view of the fact, that the area under cultivation is unlikely to increase significantly, thrust will have to be on raising productivity per unit of cultivated land.

Substantial increase in yield and quality of crops depends upon a number of factors viz., inputs like fertilizers, irrigation and plant protection measures and suitable agronomic practices.However, the use of high quality seed thus plays a pivotal role in the crop production. The use of poor quality seeds nullifies the utility of all agronomic practices and every other input applied to the crop no matter how lavishly they are applied. Economically, the cost of seed is a very small component of the total cost of production. Sindhur Sen (1974) summarizes the importance of seed quality thus “What are known as the seeds of hope may turn into seeds of frustration” if they are not of high quality. It is therefore, important to use the seed confirming to the prescribed standards in terms of high genetic purity, physical purity, physiological quality and health quality. Since ages, Indian farmers were mostly dependent on traditional varieties; therefore seed requirements were met through farm saved seeds. The use of traditional varieties coupled with farm saved seeds whose quality is not guaranteed, resulted in drastic reduction in production.

Seed is the critical determinant of agricultural production on which depends the performance and efficacy of other inputs. Quality seeds appropriate to different agro-climatic conditions and in

sufficient quantity at affordable prices are required to raise productivity.

Availability and use of quality seeds is not a onetime affair. Sustained increase in agriculture production and productivity necessarily requires continuous development of new and improved varieties of crops and efficient system of production and supply of seeds to farmers. The National Seeds Policy 2002 clearly emphasizes that "It has become evident that in order to achieve the food production targets of the future, a major effort will be required to enhance the seed replacement rates of various crops. This would require a major increase in the production of quality seeds" According to the National seeds Policy 2002, the thrust areas have to be

1. Varietal Development.
2. Seed Production.
3. Seed Replacement Rate Enhancement.
4. Primary responsibility for production of breeder seed to be that of the ICAR/State Agriculture Universities.
5. An effective seed production programme.
6. Popularization of new varieties.
7. Availability of newly developed varieties to farmers with minimum time gap.
8. Provision of incentives to domestic seed industry to enable it to produce seeds of high yielding varieties and hybrid seeds at a faster pace to meet the challenges of domestic requirements.

After the genesis of NSP, NSE & SSC and private seed companies, production of certified and foundation seeds have been undertaken by them.

Popular Varieties in under Production chain

(a) Field crops:

Kharif

Crop	**Varieties**
Soybean	JS-90-41, JS-93-05, JS-95-60, JS-335, JS-97-52, JS 20-29, JS 20-34,JS 20-69, JS 20-116, RVS2001
Maize	A. Tall(F), CM-3, JM-8, JM-12, JM-13, J-POP-1, J Sweet-9, JM 215, JM 218
Black gram	JU-3, PDU-1, LBG-20, TAU-1, PU-19, PU-30, PU-35, JU-86, T-9, TU-98-14
Green gram	JM-721, LGG-460, K-851, TJM-3, HUM-1, Pusa Vishal, PDM-11, PDM-54, PDM-139, Ganga-8, TM-37, SL-668
Kodo	JK-41, JK-48, JK-439, JK-106, JK-155, JK-13, KDPS-439
Kutki	JK-8, JK-36
Rice- **Early**	JR-201, Birsa Dhan 109, Dhanteswari, Sahabhagi, Indira Barani-1
Medium early	Mahamaya, MTU 1010, MTU 1081
Medium	Kranti, IR-36, IR-64, HMT, WG 32100, WGL 3828, M-219, JR-503
Basmati	Pusa Sugandha 1460, Pusa Sugandha 3, Pusa Sugandha 4, PS 5
Sesame	JT-21, JT-22,JT-55,TKG-8, TKG-306, PKDS 11, PKDS 12
Niger	JNC-1,JNC-6, JNC-9, Uttalmand, Birsa Niger 1,2,3,; Pooja, Guj. Niger 1,
Castor	JC 4, JC 24, JC 12, JC 26, Jwala, Jyoti, Kranti, Harita, TMV 6,
Jwar	CSH 1, CSH 2
Bajara	JCB 4, CZP 9802, JB 3, JB 4
Cotton	JK 4, JK 5, Jawahar Tapti
Sugarcane	COC-671, CO-6507, CO-7318, CO-6304, CoJN 86-141, CO-86032, CoJ 64, CoJ 527
Arhar	KMT-7, JA-4, ICPL-87, ICPL-87-119, TJT-501, TT-401, ICPL-88039, MA-2,UPAS 120
Ground Nut	TG-37A , TAG-24, JGN 3, JGN 23, GG 20

Rabi

Barley (JAU)	JB-58, RD-2786, Jawahar Barley-1 , PRITI, DWRB 137
Berseem	JB 5-09, JB 1, Hisar Berseem 2 (HB 2), BL 42, BL-180, Bundel Berseem-3,
Gram	JG 11, JG 12, JG 14, JG 24, JG 36, JGK 1, JGK 2, RVG 201, 202, 203
Lentil (Masur)	JL 1, JL3, IPL 81, RVL-11-6, L-4717, RVL 31, Sekhar Massor-3, IPL-406, Mallika
Lethyrus	Maha Tiwara, Ratan
Linseed (Alsi)	PKDL 165, JLS 95, JLS-79, JLS 66, JLS-73, JLS-67, JLS-27 , PKDL-41,
Lucerne (Alfalfa)	ANAND-3, RL-88, SIRSA TYPE-9, GAU-L-1 (ANAND-2), AL-3
Mustard & Raya	JM 3, RVM 2, Pusa Mustard 25,28, 30, Laxmi, Pusa Bold, Varuna
Oat	Shalimar Fodder Oats1,3, Jawahar Oat 03-93, NDO-1, Phule Harita,
Peas (Field Pea)	Jawahar Matar-6, Prakash, Vikas, Aman, Pusa Mukta, Adarsh, Pant Pea 243
Peas (Veg. Peas)	Azad(P-3), Arkel, Swarna Tripti, Sapna, Punjab-89, HA-4, Pant Pea-13, PSM 3
Rajma	Amber, Arun, Arka Komal
Safflower (Kusum/ Kardi)	JSF 1, JSI 7, JSI 73, NARI – 57, PKV Pink (aks 311), SSF-708, Parbhani Kusum , PBNS-40 (Non-Spiny), AKS-207
Toria	Pant Hill Toria-1, Pant Toria-508, TL-17, Uttara, Anuradha, TS-36, Agrani
Wheat – Rainfed	JW-3288, JW 3211, Harshita (HI 1531), JW-3020, Swapnil (JWS-17), JW 3173, Amrita (HI 1500), JW 3269, HD 4672, HI 8627, HI 153, C 306, Sujata
Wheat - Irrigated late	JW 1203, MP 4010, HD 2864, HI 1454, JW 1202, DL 788-2, HD 2932
Wheat – Irrigated Timely Sown	JW 3465, JW 1323,Pusa Tejas (HI-8759), RAJ-4238, DBW 110, Pusa Anmol (HI 8737), JW 3336, Pusa Mangal (HI 8713), MP 4106, JW 1201, HD 2987, Poshan (HI 8663), Purna (HI 1544), GW 366, GW-322, MP 3382, JW 1215, JW 1203, HD 2932, Snehil JW 1142,RAJ 3777, Malav Shakti (HI-8498), LOK-1, WH-147, GW 273, GW 173,
Wheat Duram	Pusa Mangal (HI 8713), HI 8381 (Malwa shree), Poshan (HI 8663), MPO 1106 (Sudha), JW 1215, HD 4672 (Malwa Ratan), HI 8627 (Malwa Kirti), Malav Shakti (HI-8498),
Yellow Sarson	Pant Pili Sarson-1, Pitambari , NRCYS-05-02, YSH 0401, Jhumka

Hybrids- Field crops

Crop	Hybrids
Paddy	JRH-4, JRH-5, JRH-8, JRH-15, JRH-17, JRH-21, JRH-25
Pigeonpea	ICPH-2671, ICPH-1050
Castor	JCH-1, JCH-2, DCH 519, DCH 177, DCH 32, GCH 4, GCH 5, GCH 6, RCH 1, PCH 1, TMVCH 1
Maize	PJMH 1, JMH-1, JMH-2, HQM-1, HQM-5
Bajara	KVH 108, JVH 905, MPMH 17, 86 M 89, 86 M 86, RHB 173,HHB 223
Cotton	DCH 32, H 8, G Cot Hyb. 10, Banni BT , WHH 09 BT, RCH 2 BT, JKH 1, JKH 3,

Horticultural crops:

Vegetables

Pea	Arkel, AP-3, PSM-3, PSM-4, G-10
Cowpea	CP-4
Brinjal	Pant Samrat, Pant Ritu Raj, JB-4
Sweet Potato	JLB-145, JLB- 114
Okra	Parbhani Kranti, Arka Anamika, VRO-6
Frenchbean	Arka Komal and Contender,
Spinach	All Green, Jobnergreen
Raddish	Japanese White,Pusa Rashmi
Tomato	H-80, SL-190, ACC-99, Pusa ruby,
Dolichus Bean	J. SEM-53, J. SEM-79
Colcocasia	GC-1,
Bottle Gourd	Pusa naveen
Sponge Gourd	Pusa Chikni
Cucumber	Japanee long, Pusa Sanyog
Amaranthus	Kooisur

Hybrids -Battle gourd, Tomato, Brinjal Chillies, Okra

Spices:

Chillies	JM-218, JM-283
Fenugreek	PEB, RMT-1, Plume-55, Kasoori,
Turmeric	Rasmi, Suroma, Roma, Sonali
Ginger	Suprabha,
Coriander	Simpo S-33, JD-1, RCR 41, RCR 437, RG 41, Kumbha Raj,
Onion	AFDR, AFLR
Fennel	Gujrat fennel-1,
Aniseed	JA-1
Garlic	G-282, G-323
Thyme	Gujrat Ajwain 1
Ajwain	AA-1, 2, GA-1
Dill	AD-1 & 2

Fruit plants and sapling:

FRUIT CROPS	
Mango	Amrapalli, Langra, Deshehari, Chausa, Sunderja, Mallika, Bambey Green, Safeda
Guava	L-49, Sardar, Chittidar,
Aonla	Banarasi, NH-7, Chakiya
Citrus	Kagzi
Pomegranate	Ganesh