RAMA UNIVERSITY

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FACULTY OF AGRICULTURAL SCIENCES

AND ALLIED INDUSTRIES

SEEDS ACT AND RULES

The seed is an important agricultural input and it plays vital plays vital role in increasing production and productivity. There is a need to safeguard the farmers with the supply of genetically pure and quality seeds. Any new variety produced by the Scientist has to be multiplied to many times to meet the needs of the farmers. In order to ensure the availability of quality seeds, Government of India have enacted seeds act 1966 and seed rules, 1968. The seed (Control) order 1983 promulgated under essential commodities act, 1955 in order to ensure the production, marketing and equal distribution of the seeds.

Seeds Act 1966.

The object of Seed Act is for regulating the quality of certain notified kind / varieties of sees for sale and for matters connected therewith. The seed act passed by the Indian Parliament in 1966 was designed to create a 'Climate' in which the seeds man could operate effectively and to make good quality seed available to cultivators. Seeds rule under the act were notified in September 1968 and the act was implemented in its entirely in October 1969. This act extent to the whole of India and it has 25 sections.

Seed legislation could broadly be divided into two groups

1. Sanctioning legislation

Sanctioning legislation authorities formation of advisory bodies, Seed Certification Agencies, Seed Testing laboratories, Foundation and Certified Seed Programmes, Recognition of Seed Certification Agencies of Foreign countries appellate authorities.

2. Regulatory legislation

Regulatory Legislation controls the quality of seeds sold in the market including suitable agencies for regulating the seed quality.On quality control basis, the Seeds Act could conveniently be divided into the following:

I. Minimum limit and lablelling of the notified kind / varieties of seed

a. Power to notify the kind / variety
b. Labeling provisions
c. Seed testing
d. Seed analyst

e. Seed inspectors
f. Penalty
g. General provisions

II. Seed Certification

III. Restriction of Import and Export of Seeds

1. Minimum limits and labelling

Quality control as envisaged in the Act is to be achieved through pre and post marketing control, voluntary certification and compulsory labelling of the seeds of noticed notified kind / varieties.

(a) Power to notify the kind / varieties

New varieties evolved by the State Agricultural Universities and ICAR institutes are notified and release /notified respectively under section 5 of the seeds act in consultation with the central seed committee and its sub committees constitute under section 3 and 3(5) of the Seeds Act. As on date more than 2500 varieties and 130 varieties were notified and denotified under this section.

List of varieties notified and denotified from 1969 to 1965 are compiled and made available in the form book called catalogue of varieties notified and denotified under section 5 of the Seeds Act functions of the Central Seed Committee and its sub-committee are defined in Clauses 3 and 4 of part II of seed rule.

(b) Labelling provision

Minimum limits for germination, physical purity and genetic purity of varieties / hybrids for crops have been prescribed and notified for labelling seeds of notified kind / varieties under section 6(a) of the Seeds Act. Size of the label, colour of the label and content of the label were also notified under sub clause (b) of Section 6 of Seeds Act. Colour of the label is opoline green and size of the label is 10 cm x 15 cm or proportionate thereof. Responsibility for making labelling content of mark or label, manner of marking, false / misleading statement on label etc., are defined under clause 7,8,9,10,11 and 12 of part V of seeds rule.

Section 7 of the act regulates the sale of notified kind or varieties. Accordingly no person shall keep for sale, offer to sell, barter or otherwise supply any seed of any notified kind or variety, after the dates recorded on the container mark or label as the date unto which the seed may expected to retain the germination not less than prescribed undr clause (a) of section 6 of the Act.

Seed Testing

There is a provision to set up a central seed laboratory and state sees laboratory to discharge functions under section 4(1) and 4(2) of the Seed Act, In the year 1968 there were 23 state seed testing laboratories in the country. At present there are 86 Seed testing laboratories functioning in the country. During 1995-96 these laboratories tested about 5 lakh samples. Seed Testing laboratories have been assigned certain important functions under part III (5) of Seed Rule.

Seed Analyst

State Government could appoint the Seed Analysts through notification in the Official Gazette under Section 12 of the Seed Act defining his area and his jurisdiction. Seed Analyst should posses certain minimum qualification as prescribed under clause 20 part IX of Seed Rule.

Seed Inspectors

The State Government, under section 13 of the Act may appoint such a person as it thinks fit, having prescribed qualification (Clause 22 part IX of Seed Rule) through notification, as a Seed Inspector and define the areas within which he shall exercise jurisdiction for enforcing the seed law. He will be treated as a public servant with in a meaning of section 21 of the I.P.C. (45 of 1860).

He has power to examine records, register document of the seed dealer. He will also exercise such other powers as may be necessary for carrying out the purposes of this Act or rule made thereunder. Duties of Seed inspectors are defined in clause 23 of part IX of Seed rule.He can issue stop sale order in case the seed in question contravenes the provision of relevant Act and rules for which he can use form No.III. When he seizes any record, register documents or any other material , he should inform a magistrate and take his order for which he can use form No.IV.

Penalty

If any person, contravenes any provision of the Act or Rule, or prevents a seed inspector from taking sample under this Act or prevents a Seed Inspector from exercising any other power conferred on him could be punished under section 19 of the act with a fine of five hundred rupees for the fist offence. In the event of such person having been previously convicted of an offence under this section with imprisonment for a term, which may extend to six months or with fine, which may extent to one thousand rupees of with both.

Seed certification

The object of the Seed Certification is to maintain and make available to the public through certification high quality propagating material of notified kind / varieties so grown and distributed as to ensure genetic identify and genetic purity. The certified standards inforce are Indian Minimum seed certification standards and seed certification procedures form together for the seed certification regulations.

Seed of only Seed if only those varieties which are notified under section under Section 5 of the seeds act shall be eligible for certification.

Seed (Control) order, 1983

Restriction of Export and Import of Seeds

There is a provision to restrict export and import of seeds of notified kinds or varieties. The section 17 define as under

" No person shall for the purpose of sowing or planting by any person (including himself) export or import or cause to be exported or imported any seed of any notified kind or variety unless.

a) It conforms to the minimum limits of germination and purity specified for that seed under clause (a) of Section 6 and
b) Its container bears in the prescribed manner the mark or label with the correct particular thereof specified for that seed under clause (b) of section 6.

Background of the case

The ministry of civil supply through an order dated 24.4.1983 had declared the seed for sowing or planting of food crops, fruits, vegetables, cattle fodder and jute to be essential commodities in exercise of power conferred by Section 2(a) (viii) of Essential Commodities Act, 1955. It was followed by the issue of seed (control) order dated 30th December 1983 by the Ministry of Agriculture, Dept. of Agriculture and Cooperation in exercise of powers contained in section 3 of Essential Commodities Act, which deals with Central Governments power to control, and regulate production, supply and distribution of essential commodities.

The seed (control) order 1983 had been notified as per Gazette notification G.S.R (832(E) dated 30.,12.1983. The notification under reference holds good and remains operative. Joint Secretary (Seeds), Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation has been appointed as Seed Controller for implementation of seed (control) order.

Gist of the seed (Control) order

1983. Issue of licence to dealers

All persons carrying on the business of selling, exporting and importing seeds will be required to carry on the business in accordance with terms and conditions of licence granted to him for which dealer make an application in duplicate in Form 'A' together with a fee of Rs.50/- for licence to licensing authority unless the State Government by notification exempts such class of dealers in such areas and subject to such conditions as may be specified in the notification.

Based on such enquiry as it thinks fit for licensing authority may grant in form 'B' or refuse in provisions of the Order. The refusal to grant licence shall be accompanied by clear recording of reasons for such refusal.

Renewal of licence

A holder of licence shall be eligible for renewal upon and applicable being made in the prescribed form 'C' (in duplicate) together with a feed of rupees twenty before the expiry of licence or at the most within a month of date of expiry of license for which additional fee of rS.25/- is required to be paid.

Appointing of licensing authority

The state government may appoint such number of persons as it thinks necessary to be inspector and define the area of such Inspector jurisdiction through notification in the official gazette.

Time limit for analysis of samples by Seed testing lab

Time limit for analysis of samples by seed testing lab and suspension / cancellation of license may be done by Licensing authority after giving an opportunity of being heard to the holder of license, suspend or cancel the license on grounds of mis-representation of a material particular or contravention in provision of the order.

Suspension / Cancellation of licence

The Licensing authority may after giving an opportunity of being head to the holder of licence, suspend or cancel the licence on grounds of mis-representation of material particular or contravention in provision of the Order.

Appeal

The state government may specify authority for hearing the appeals against suspension / cancellation under this order and the decision of such authority shall be final. Any person aggrieved by an order of refusal to grant or amend or renew the licence for sale, export / import of seed may within 60 days from the date of Order appeal to the designated authority in the manner prescribed in the Order.

Miscellaneous

The licencing authority may on receipt of request in writing together with Rs.10/- from amend the licence of such dealer.

Every seed dealer are expected to maintain such books, accounts and records to this business in order and submit monthly return of his business for the preceding months in Form 'D' to the licencing authority by 5th day of every month

Plant variety protection and the Indian agriculture

The Intellectual Property Rights (IPRs) are generally being applicable to industrial property only. The patent laws of India so not provide for IPRs on living organisms including plant varieties. The question of plant variety protection has been brought in to sharp focus by Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) which is a part of Agreement establishing World Trade Organization (WTO). India is a signatory to TRIPs agreement, which casts an obligation on member countries to provide for a system of plant variety protection either through patents or through a *sui generis* legislation framework or a combination thereof. Under these agreements, a legislative framework for plant variety protection has to be provided by member countries within a specified time period. While this has lent some urgency to the question of plant variety protection, the question of plant variety rights, even independent of the obligations posed by TRIPs agreement, has been under active consideration in view of our strong agricultural research system. The plant breeding programmes have become more

sophisticated and high input based. The extent of investment by the State on public research, in evolving varieties of commercial significance, is coming down with responsibility of evolving new varieties of crops of commercial significance being left to the private sector commercial organisations. There is also a move on the part of the international research institutions, who at one time played a pioneering role in plant breeding and genetic work, to focus on pure or strategic research.

In the wake of the global economic liberalization, it is only expected that agriculture is accorded the status of an industry and given all incentives and impetus, normally required for a fast developing, competitive business. To meet our food demands, as well as to exploit our export potential in agricultural commodities, development and use of new plant varieties having specific agronomic nutritive or market preference characteristics are essential. New varieties may be bred for higher yields, greater resistance to biotic and abiotic stresses, longer shelf life, better consumer preference, higher industrial value, low input requirements and so on. To meet these demands the variety improvement activities based on conventional as well as biotechnological methods requires heavy investments both in scientific man power and economic terms. It is therefore, understandable that the fruits of such intensive efforts will have to be protected from misuse, and also ensuring an appropriate incentive (reward) to the breeder.

The following are the plant variety protection steps;

1. Historical developments of plant variety protection

For over 60 years different forms of protection of new plant varieties through the system of Plant Breeders' Right (PBRs) have been in existence in industralised countries which essentially means that the holder of the PBR can prevent others from producing propagating material of the protected variety and / or marketing the same. In order to coordinate inter country implementation of PBR a " Union Internationale Pour La Protection Des Obtention Vegetables" (UPOV) was established by International Convention for Protection of New Varieties of plants (the UPOV convention), which was signed in Paris in 1961. The convention entered into force in 1968. It was revised in 1972, 1978 and 1991. The 1978 Act entered into force in 1981. The 1991 act has not yet entered into force.

The purpose of UPOV convention is to ensure that the member States of the Union acknowledge the achievements of breeder of new plant varieties by making available to them exclusive property rights, on the basis of a set of uniform and clearly defined principles. To be eligible for protection varieties have to be (I) distinct from existing known varieties (ii) sufficiently homogenous (uniform) (iii) stable and (iv) new in the sense that they must not have commercialised prior to certain dates established by reference to the date of the application for protection.

2. Scope of protection of plant varieties under UPOV convention

Both the 1978 and 1991 conventions set out a minimum scope of protection offer member states the possibility of taking national circumstances into account in their legislation. Under 1978 Act, the minimum scope of the Plant Breeders' right requires that the holders' authorization for the production for purposes of commercial marketing, the offering for sale and marketing of propagating material of protected variety.

The 1991 Act contains more detailed provision defining the acts concerning propagating material in relation to which holders' authorization is required.

Exceptionally, but only where the holder has no reasonable opportunity to exercise his

right in relation to the propagating material, his authorization may be required in relation to any specified acts done with harvested material of the variety.

3. Duration of plant breeder's rights

Like all intellectual property rights, plant breeders rights are granted for a limited period of time (15-20 years) at the end of which varieties protected by them pass into public domain. The rights are also subject to controls, in the public interest, against any possible abuse.

4. Exemptions

It is also important to note that authorization of the holder of plant breeders' rights is not required for the use of his variety for research purpose, including its use in the breeding of further new varieties.

From the inception of UPOV in 1961, farmers have been allowed to use their own harvested material of protected varieties for the next production cycle on their own farms. On farm saving is still a practice in UPOV countries. The 1991 UPOV convention contains an "Optional exception" which provides that it is unto the national government to decide whether to permit farmers to use the seed of a PBR protected variety for propagation purposes on their own holdings or not.

5. Sovereign rights on biological resources

Another major development, which has taken place along with India signing the World Trade Agreement, is global Biodersity Convention. India is a signatory to this convention, which became operational on December 29, 1993. Among offer things it reaffirms that "the states have sovereign rights over their own biological resources" and that states are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner".

6. Suggestions for a SUI system of plant variety protection

The proposal of 1991 UPOV convention which extents plant breeders rights to the harvested material, is not appropriate for our country.

The frame work for plant variety protection has to be evolved in a manner that prevents situations where repeated imports of improved varieties are not required so as to avoid dependence on foreign sources of supply.

While, finalizing a legislation on PVP the government needs to strike a balance between its commitment under WTO, growth of the seed sector and their interests of the farmers, which through a difficult task, is not impossible to achieve.

7. Seed Industry Development

As we are anticipate fairly high investment in seed research from private sector and healthy competition with public sector in crop breeding and seed production and distribution. However, public sector institutions will continue to play major role in developing varieties of wheat rice, chick pea, pigeon pea, mungbeans, urdbeans, groundnut, sugarcane, jute, potato and millets. The continued improvement of these crops is most vital for our food security system. The public sector will have to continue to develop varieties for rainfed, salt affected, hilly and low lying flood prone regions. In export potential of food grains and other agricultural commodities, breeding for quality of produce will have to give priority. We may also tailor varieties suited to the needs of the importing countries. Since there is growing concern about the use of

chemical pesticides in crop production, the present research programme of breeding for resistance against the pests and diseases will have to be strengthened furthers. Strategic research on breeding for research against pests and diseases will be priority areas of research of a public institution. We anticipate that the material generated from these research programmes will be made available to the private sector.

Seed industry both in public and private sector is likely to develop at a fast rate after the legislation on plant variety protection is enacted. The recent experience shows that contribution of both public and private sector in Seed industry development is complimentory. While private sector seed companies are concentrating on hybrids of millets, oil seeds, cotton and vegetables, the public sector seed corporations are engaged in seed production and distribution of self-pollinated crops. It has also been observed that due to competition among the seed companies, the farmers have been benefited not only in respect of stability in prices of hybrid seeds but also better quality of seeds. It is expected that with programmatic policy planning, faster growth of both public and private sector in seed research and development will be ensured so that they can play important role in improving the incomes and standards of living of our farmers.

New seed policy

The Government of India evolved a new seed polity and which is implemented from October 1, 1988.

The policy laid a special emphasis on

- Import of high quality of seeds
- A time bound programme to modernize plant quarantine facilities
- Effective implementation of procedures for quarantine /post entry quarantine and
- Incentives to encourage the domestive industry
- Import of quality seeds.

1. Bulk import of seeds of coarse cereals, pulses and oil seeds may replace (or) displace the local productions.
2. Transfer of technology may not be actual one, because due to bulk import of seeds or import of technology, instead we can import the germplasm of superior variety if any and could be developed locally to meet the demand (i.e.,) incorporate the advantages of exotic variety to the local types(or) even direct multiplication's after adaptive trials.
3. As we have superior varieties of international standard (e.g.) Maize, Sorghum, Bajra, or even in oil seeds like groundnut etc., the bulk import is not necessitated. Instead we need varieties suitable to agroclimatic zones besides higher yields.
4. Import of flower seeds could be encouraged in order to earn foreign exchange through export of flours and it can be imported under (OGL) open general license. But there is a fear of introduction of new pest and diseases as they are coming without post entry quarantine checkup.

Strengthening of quarantine

Since, from 1st October 1988 only bulk import of seeds under taken without any progress either in the strengthening of quarantine facilities.

Threat of pest and disease

Introduction of new pest and disease would pose a new problem due to bulk import due to lack of post entry quarantine. To avoid this threat the imported seeds should be subjected to testing and it should be done by one person from ICAR. Entry of exotic variety without proper field testing may change the disease pattern if that particular strain is becoming susceptible to existing pathogens.
(e.g.) Karnal burnt - which was not noticed in the previous years and because a major disease on wheat after the introduction of Kalyansona.

Genetic erosion

It is another danger, due to introduction of similar strains there is a danger of genetic uniformity and also eliminates local diversified strains which leads to problem of non availability of improved strains if there is any out break of disease.

Incentives to domestic seed industry

Indigenous seed production / seed industry will be affected because of the entry of multi nation diseases. Since the policy is allowing indiscriminate bulk imports through private sectors at the same time the import duty on seeds has been reduced to 15 cent. Import duty on advanced machines and equipment used in seed production or processing has also been reduced and interest on post shiftement credit has also been slashed down to help importers.Income tax rebate and deduction are available to the tax paying units on the revenue expenditure on in house research and development. Incentives area also being provided to seed with located in backward areas and growth centres.

Application of biotechnology in agriculture

The multination would prevent the III world countries in enjoying the full benefit of biotechnology. The bulk import of seed indicates that the accepting the monopoly rights and the limitation of potential bio-technology in agriculture.

Advantages of biotechnology in agriculture

Certain plants fertilize themselves through nitrogen fixation, which is one of the most promising areas of genetic engineering. Bacterium on the roots of plants like groundnut, and soyabean take nitrogen from the air and transform it into nitrates. Scientists are studying the possibility of transforming the genes responsible for nitrogen fixation in wheat, rice, and maize (in which nitrogen fixation doses not occur). They feel new strains can be grown without expensive chemical fertilizers.

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The seeds (control) order , 1963 order

GSR 932 (E) - In exercise of the powers conferred by section 3 of the essential commodities Act, 1955 (10 of 1955), the central government hereby makes the following order namely.

Notification

The following notification of the government of India, Ministry of Civil Supplies, dated 24.2.1983.

S.O. 140 (E) - In exercise of the powers conferred sub clause (XI) of clause (a) of section 2 of the essential commodities act, 1955, (10 of 1955), the central government hereby declares the following seeds used for sowing or planting (including seedings and tubers, bulbs, rhizomes, roots, cuttings and all types of grafts and other vegetatively propagated material of food crops or cattle fodder) to be essential commodities for the purpose of the seed act, namely:-

A. Seeds of food crops and seeds of fruits and vegetables.
B. Seeds of Cattle fodder and
C. Jute seeds

SEED DRYING

The process of elimination of moisture from the seed is called drying.

Stage of moisture elimination

The moisture is elimination in 2 stages

1. Surface moisture of the seed that initially removed by the drying air.
2. The removal of the moisture in the surface cause an imbalance in the moisture potential in the surface of the seed and the inner portion of the seed which leads to the migration of moisture from the inner organ to the surface.

The migration of moisture to the surface is slower than the evaporation and a moisture gradient is developed in the kernal.

Elimination of moisture from the seed depends upon the relative humidity and temperature of the environment surrounding the seed. When RH of the atmosphere is less than the seed, moisture is eliminated from the seed. While drying care should be taken to minimize /prevent oxidation and decomposition and volatilization. In this process there will be loss of dry weight of seed which is widened when the processes take place when high temperature. Hence, high moisture seeds should be dried at low temperature.

Equilibrium moisture content

A seed is in equilibrium with the environment when the rate of moisture loss from the seed to the surrounding atmosphere is equal to the rate of moisture gained by the seed from the atmosphere.

Drying temperature

Greater the seed moisture content lesser should be the drying temperature and vice versa.

10%	MC and below	110 ^{o} F (43.3^{o} C)
10-18 %	MC	100 ^{o} F (42.2 ^{o} C)
18-30 %	MC	90 ^{o} F (32.2 ^{o} F)

The rate of drying depends on

- Initial seed moisture content
- Size of the bin and capacity
- Depth of spread of seed
- The rate of air blow
- Atmosphere air temperature and relative humidity
- Static pressure
- Drying temperature

Different methods of drying

1. Physical drying (or) natural drying (0r) sun drying
2. Mechanical (or) artificial drying

- Drying with forced natural air
- Drying with forced artificially heated air
- Drying with desiccants
- Drying with infrared rays

Different types of dryers

1. Natural dryers
2. Artificial dryers

a) Batch bin dryers (or) Metal bin dryers
i) Rectangular metal bin dryer
ii) Circular metal bin dryer

b) Continuos flow dryer
i) Louisiana dryer
ii) Non mixing column dryer

I. Physical drying / Natural drying / Sun drying

This is the common conventional method in which drying of the harvested crop is carried out in the field or threshing floor by the radient energy of the sun. This does not involve any expenditure. To achieve uniform drying the seed should be spread in thin layer. High MC seed with a moisture content of more than 17% should be dried first under shade / light to reduce the moisture content less than 17% and then dried under

heavy sun i.e. noon drying. Sun dried seeds should not be allowed to remain open in the floor during night. Since seed will absorb moisture from air. 2-4 days are needed to reduce the moisture content to 10-20 days.

Advantages
1. The method is easy and cheap
2. Does not require any expenditure or fuel.

Disadvantages
1. The rate of drying is slow
2. Loss due to attack by insects, birds and animals.
3. Large floor area is required
4. Involves extra labour for collecting and rexposing during the day.
5. Sun drying cause checks or hot spots due to variation in temperature from time to time
6. This checks or spots induce high amount of breakage while processing.
7. Dust, dirt and other foreign materials get admixed
8. High weather risks and damage by heavy wind and rains.

II. Mechanical drying or artificial drying

This involves the use of heated or unheated air or others which are forced through a drier holding the seeds.

1. Forced natural air drying

Generally ordinary seed godowns are provided with two types of ventilators for free movement of air circulation. In modern godowns provisions are to be made for forcible circulation of air with the help of an electronic blower. The outside air which is comparatively dry is circulated into the seed bag in the godown. The seed get dried up in this process. This is possible only in dry months.

2. Forced heated air drying

In this method the outside air is heated with the help of burner heater and circulated into the godown for drying. This principle is employed in several types of the modern dryers.

Dryers

1. Metal bin dryers or batch bin dryers

a) Circulated metal bin dryers

Such dryers usually consist of perforated floor, fan, heater and seed spreader. Here the seeds are spread in a thin layer over a perforated metal sheet while the heated air is blown to pass through the seeds. This heated air removes the moisture from the seed.

b) Rectangular metal bin dryers

Basic principles of operation and construction are essentially the same as for circular metal dryer. The mainly differ in the mode of air circulation and seed movement in or out the bin. Metal screens are with opening not larger than the size of the seed. Their capacity is limited by the strength of the screens used.

II. Continuous flow dryers

a) Louisiana State University dryer (L.S.U. dryers): This is a continuous column heater air drier largely used for paddy. The paddy seeds are fed from the top with the help of gravity force in zig zag manner and heated air is blown from the bottom usually at right angles to the direction of seed motion. This falling at right angles to the direction of seed motion. The falling seeds get dried up by the heated air and this process is repeated till we get a reduction of moisture content to the expected level.

Advantages over bin dryers

1. Short drying period
2. Less damages or spoilage during wet weather
3. Drying is more uniform.

b) Non mixing column dryer

These dryers consist of a tall vertical column through which paddy flows by gravity. No provision is made for agitating the paddy as it flows and hence there is no attempt to drive the paddy from a straight path. Paddy descends gradually between two parallel screens and heated air is forced through the screens.

Advantages of mechanical drying

1. Quick method, timely and uniform drying is possible
2. Makes early harvest possible
3. It reduces the chances of losses due to over ripening and shattering of seed
4. Losses due to rodents and birds are prevented.
5. Less damage during processing operation.
6. Permits long time storage by preventing sun checks and other damages.

Disadvantages

1. Initial cost of drying equipment's is high
2. Fuel is expensive
3. It produces possible fire hazards
4. Considerable supervision is necessary.

Tempering

Seed is usually dried in stages with heated air each stage consisting of a pass through the drier. Between passes the seed is stored in bins for an equilibrium period known as tempering period. This period of tempering shortens the total in drying time. During drying surface moisture is removed and internal moisture moves towards the surface is slower than evaporation, and a moisture gradient develops in the kernel. The outside becomes drier than the inside and evaporation rate decreased. During tempering moisture concentration equalizes in the kernel and then evaporation of surface moisture is nearly as rapid as at the start of drying.

SEED PROCESSING

Seed processing is to narrow down the level of heterogeneity of the lot by using suitable processing methods.

The seed lot is heterogeneous due to the following reasons

1. The soil is heterogeneous and there is a lot of variability in the fertility status of soil due to availability of nutrients, physical, chemical and biological properties.
2. Variability is introduced due to position of seed set on the plant / fruit , time of pollination and fertilization over a period of time
3. Variability is created by biotic factors like pest and variability infestation.
4. Variability is also due to the management practices like water, land preparation, leveling, staggered sowing, uneven distribution of fertilizer and irrigation water, uneven plant protection sprays and uneven maturity at harvest.

This heterogeneity can be narrowed down in the processing of seeds by eliminating the undersized, shrivelled, immature, ill filled seeds using appropriate sieve size.The germinability and vigour of the seed lot can be upgraded by grading the seeds according to size, specific gravity, length and density of the seeds. The inherent qualities such as germinability and vigour are exemplified by certain physical characteristics of the seed is large size, a denser seed, optimum length etc., So if grading is done to obtain a particular range of size, shape, length and density of the seeds the quality of the lot is upgraded.

Requirements in seed processing

1. There should be complete separation
2. Minimum seed loss
3. Upgrading should be possible for any particular quality shape
4. Efficiency
5. It should have only minimum requirement

Physical characteristics used to separate seeds are

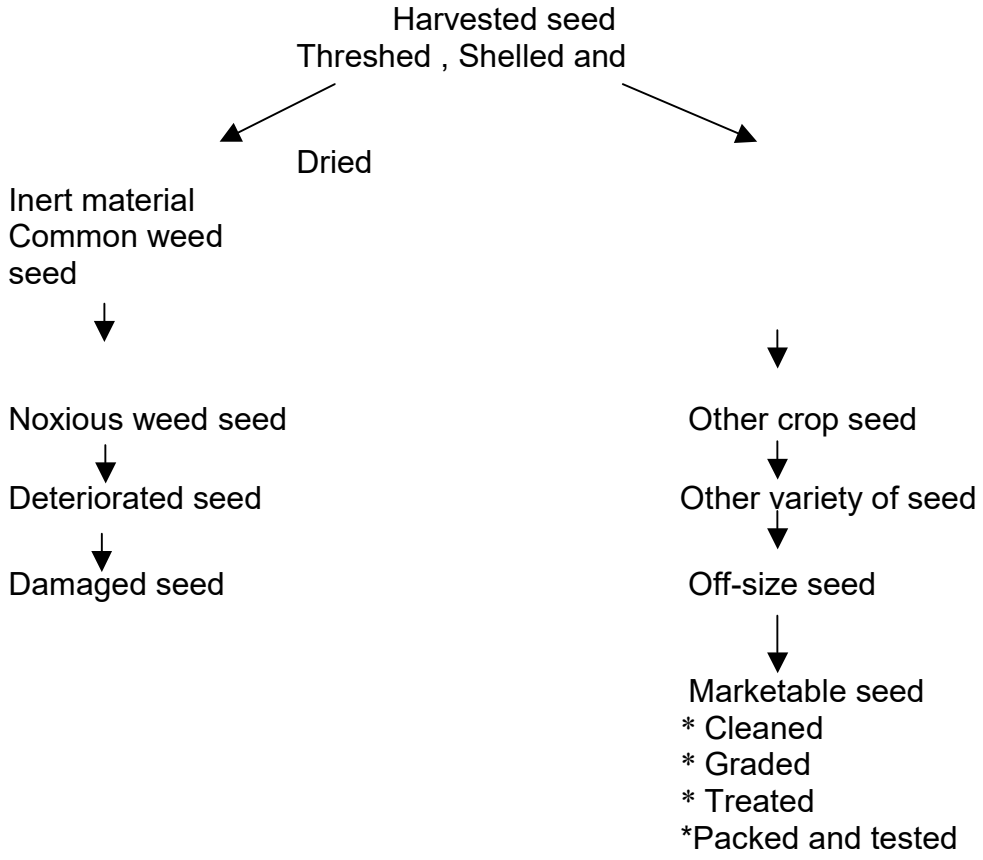
1. Size : Based on size it can be separated with air screen cleaner cum grader
2. Length : Disc or indented cylinder separator
3. Weight : Specific gravity separator
4. Shape : Spiral separator or draper separator for round and flat seeds
5. Surface texture : Rough from smooth surface seed- dodder mill
6. Colour : Electronic colour separator
7. Electrical conductivity

Seed differing in their ability to conduct electrical charge can be separated with electronic separator.

8. Affinity to liquid

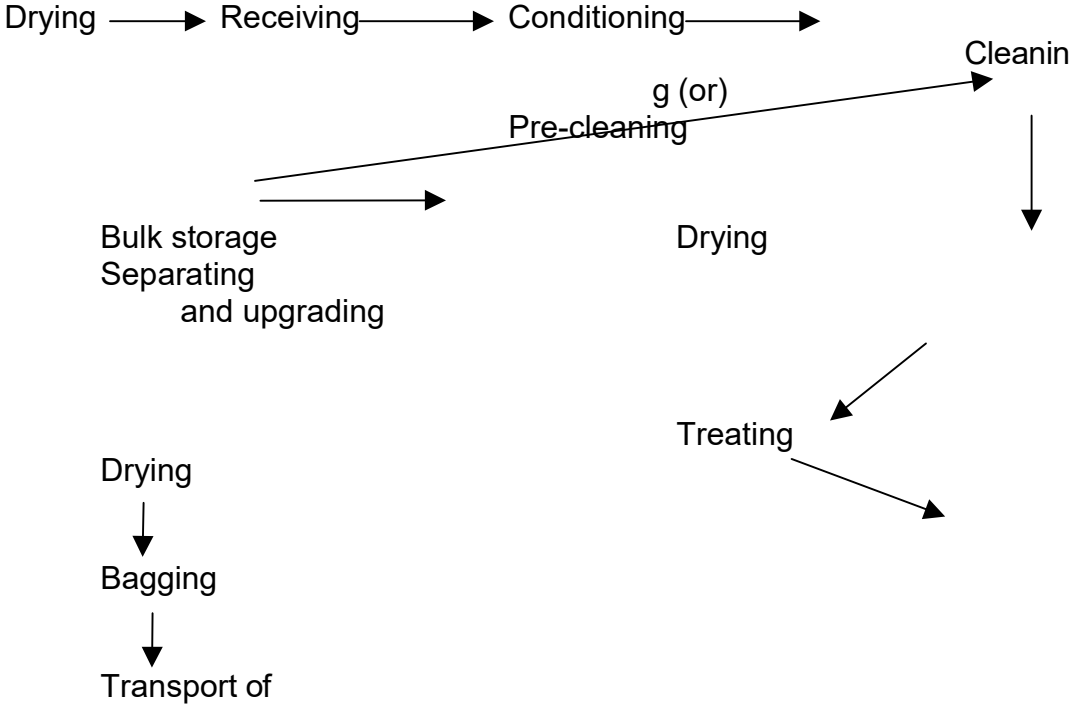
The seed coat of seed will absorb water, oils etc., which provides a means of separating seed on the magnetic separator.

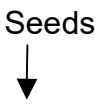
The flow charts illustrating the types materials required from seeds during processing.



Receiving: The fields run produce after threshing is received in the processing plant. Cleaning cum grading: The dried seeds should be cleaned and graded with the help of a cleaner cum grader machine.

Seed movement /basic steps in seed processing plant

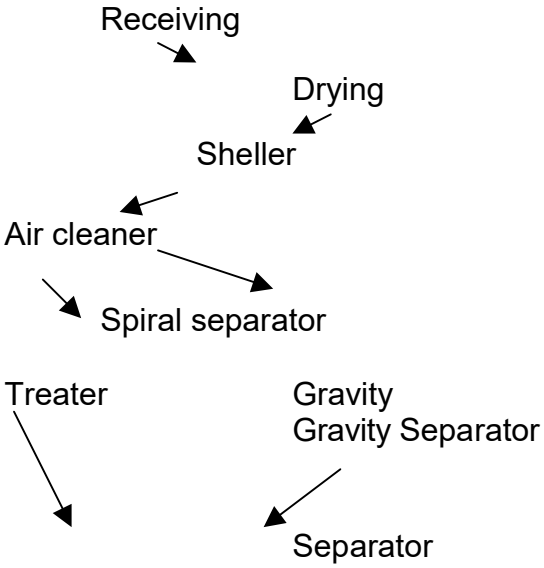



Seeds

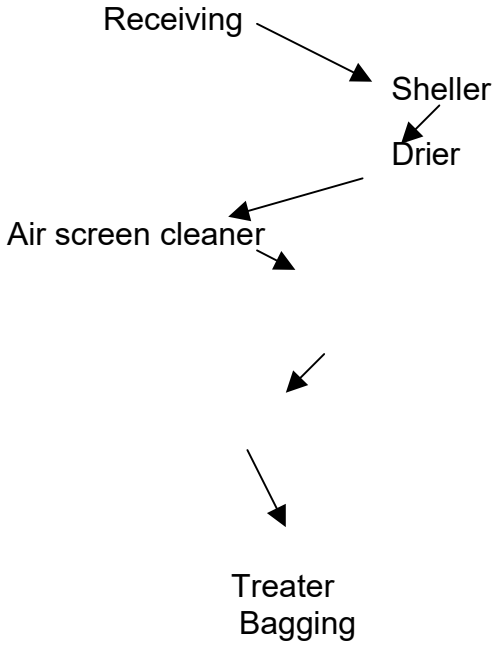
Storage

Processing sequences of different crops

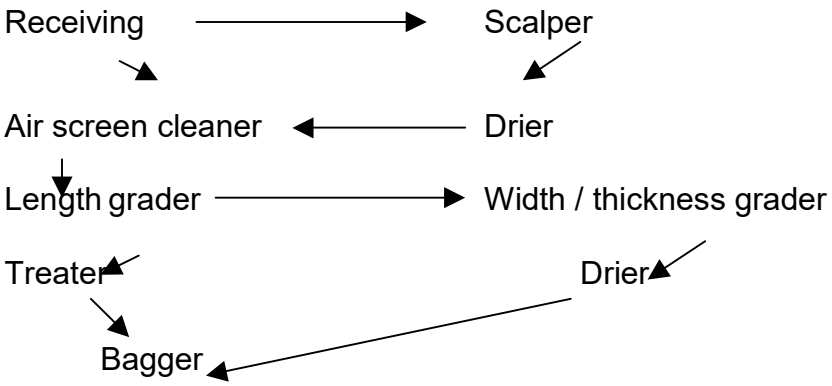
BHENDI



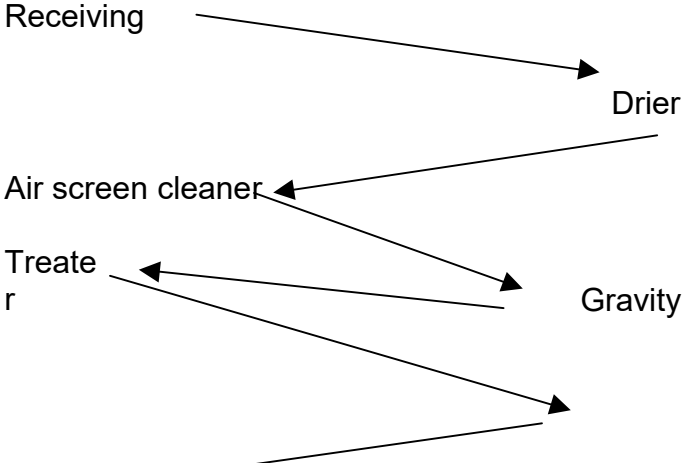
COWPEA AND PEAS



PADDY



SORGHUM



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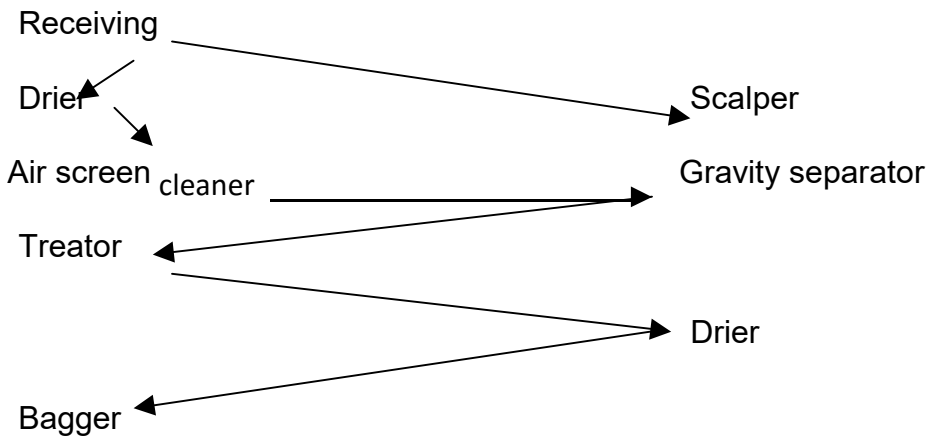
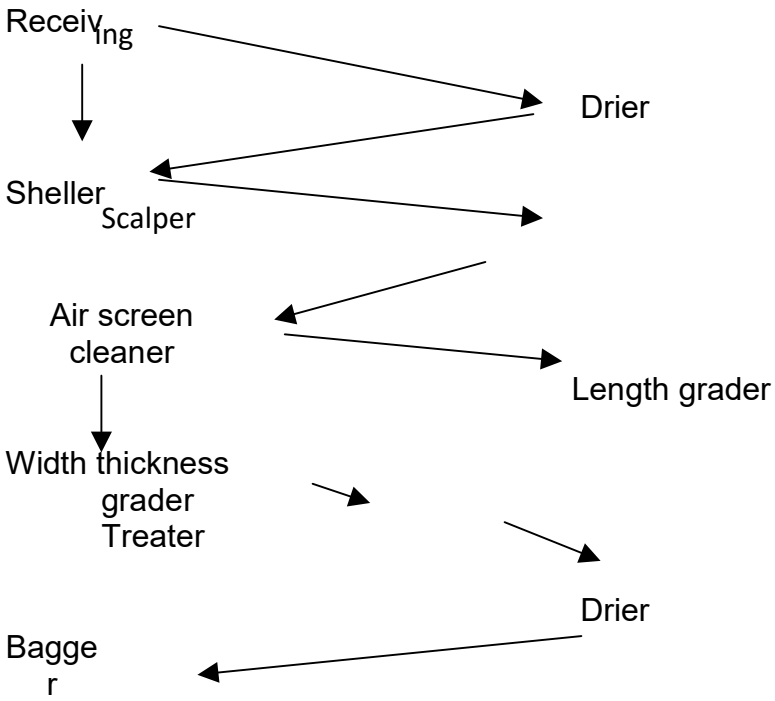
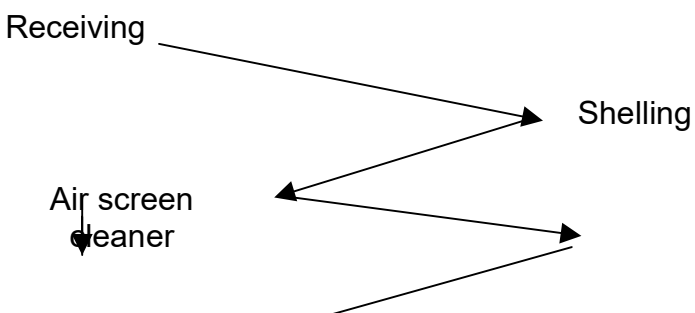
BAJRA



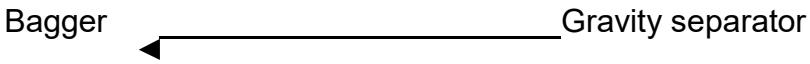
MAIZE



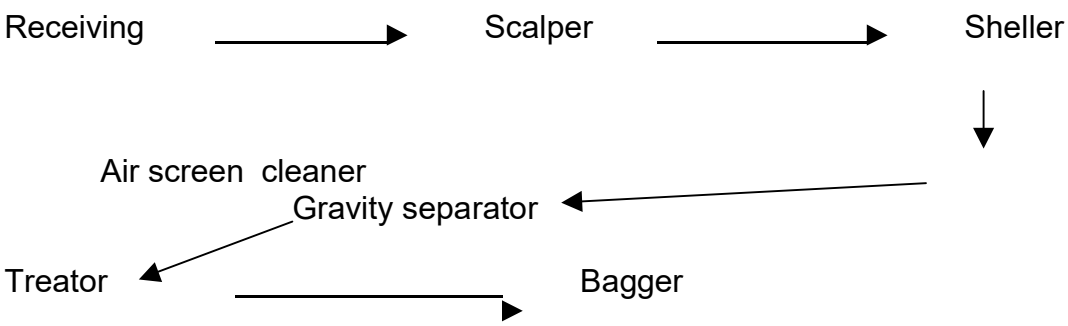
SOYBEAN



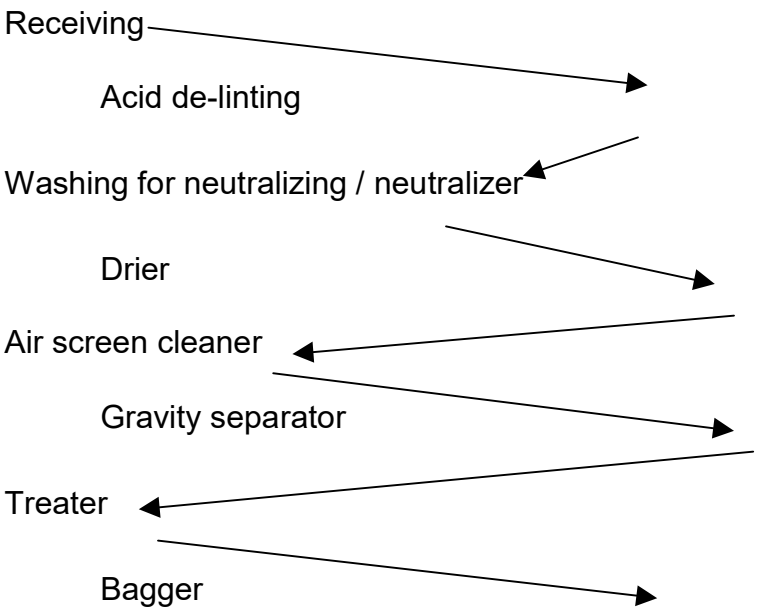

Spiral separator
Treater



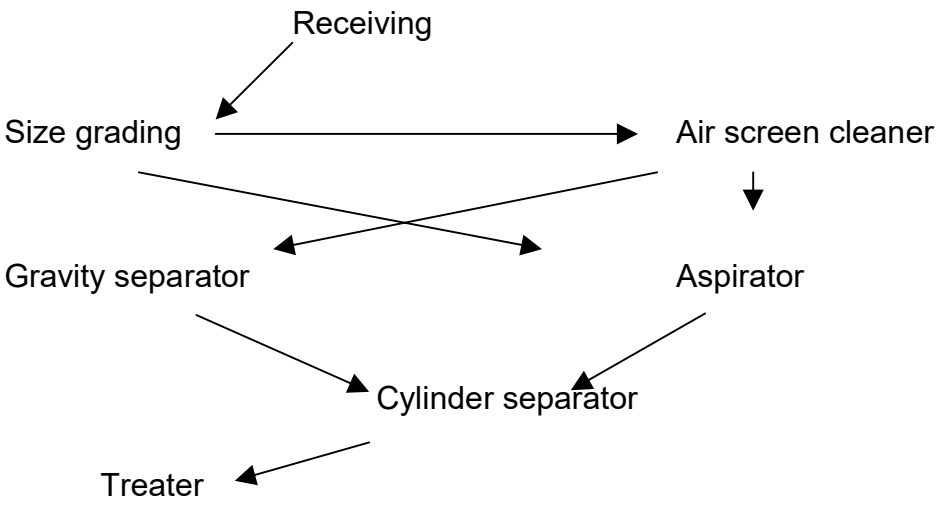
GROUNDNUT

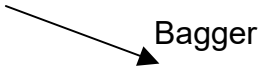


COTTON



Tomato, Chilies, Radish, Turnip, Cabbage and Cauliflower




Bagger

Seed processing equipments

I. Cleaner cum grader

The dried seeds should be cleaned and graded with help of a cleaner cum grader. For large scale cleaning and grading the commonly available machine is the "Crippen model seed cleaner cum grader.

It consists of the following parts

1. A hopper in the top for seed filling
2. A flutted roller below the hopper to regulate the seed flow to the screen.
3. Screen (or) sieves

Perforated metal sheet with specific size of perforation in which there are two types.

i) Rectangular perforations for paddy and

ii) Round perforations for seed other than paddy

4. Screen shaking unit : for oscillating the sieves to move the seeds on the screens
5. Screen brushes to remove the blocked seeds
6. Air blower with adjustments for air outlet
7. Collecting outlet
8. Air duct for directing the blown up light particles to outside
9. Collecting bins.

Working principle

When seeds are fed into the hopper and they are guided to fall on the first sieve. The first sieve is a scalping screen which scalps all the foreign materials larger and heavier than seed and the entire quantity of seed passed through the first sieve.The second sieve is a cleaning sieve which removes all the unwanted particles larger in size than the seed.The third sieve is actually the grading sieve which size grade the seed lot and bring into a uniform size and which also screens the undersized, shriveled , immature seed, dust and dirt. The seeds are then rolled and passed through air column, where they are relived of the light chaffy and other materials by the blowing air.

Adjustment
s Flutted
roller

The speed of this roller can be adjusted so as to increase (or) decrease the flow of seeds the hopper to the sieves.

Slope (or) inclination of the screen

The angle of inclination of the screens can be adjusted according to nature of seeds.

Rate of vibration of sieve

This can be adjusted either to increase or to decrease the speed of the rolling seeds on the screen.

Volume of air flow

By increasing (or) decreasing the air inlet.

Choice of screens

According to variety we have to change the screen

Screen dams

Small check dams, which can be provided here and there on the screens so that the seeds can be stopped a while and takes the charge either to pass or to roll.

Types of seed cleaner cum grader

I) Crippen model cleaner cum grader
ii) Clipper model cleaner cum grader
iii) Petkas cleaner cum grader

II. Disc separator

It consists of a series of discs, which revolve together on a horizontal shaft inside the cylindrical body. Each disc contains many under cut pockets. The seed enter the intake end of the separator and move through the open centers of the discs towards the discharge end of machine. As the discs revolve through the seed mass the pockets lift out short seed but rejects longer seed. Longer seeds are conveyed by flights on the disc spokes towards the discharge end of the machine where they go out through the tailings gate. The rate of seed travel through the open disc centers is controlled by conveyor or blades attached to the spokes of the discs. The discs separator makes a very precise separation. No factor other than seed length and shape affects its separation. Flexibility is obtained by varying the size of the pockets.

III. Indented cylinder separator

The indented cylinder separator is a rotating, almost horizontal cylinder with a movable, horizontal separating adjustments which are mounted inside it. Indents line are there inside the surface of the cylinder. The indented cylinder revolves ,turning the seed mass to give each seed a chance to fit into indent. Short seeds are lifted out of the seed mass and are dropped into the lifting through long seeds remain in the cylinder and are discharged out via., a separate spout at the end of the cylinder.

As the cylinder revolves, it creates centrifugal force which helps to hold the seed in the indent. Short seeds are held in the indent until the cylinder turns to the point where the indent is inverted enough for gravity to cause the seed to fall

out of the indent. The

length, surface texture and size of seeds all determine how they fit into the indent, so that it can be lifted out of the seed mass. The speed of the cylinder creates centrifugal force which holds the seeds in the indent as it is lifted upward. Thus the shape and size of the seed to cause some seeds to fall out after being lifted only a short distance, while other seeds are lifted closer to the top of the cylinder before they fall out.

As the seeds enter the cylinder, the small, short, easy to separate seeds are quickly removed. The center cylinder section removes the intermediate sizes of seeds still in the cylinder. All indents in a cylinder are the same size, only the progressively declining amount of material to be lifted causes this difference in separating action.

Adjustments

1. Cylinder speed 2) Size of the indent 3) Through setting 4) Tilt of the cylinder

5) Adjustable retarder.

IV. Specific gravity separator

Seeds of the same size and general shape can often be separated because they differ in specific gravity or relative weight. This difference is very useful in removing light, immature seeds or heavy sand and rocks to improve the purity and germination of crop seeds.

If seeds which differ in specific gravity (relative weight / unit of volume) are placed on substrate of intermediate density, seeds of higher specific gravity will fall down through the substrata, while seeds of lower specific gravity will be buoyed up the substrata. Here air is used as a separation substrata.

As seeds flow on the deck of the gravity separator, they enter a column of air coming up through the porous surface of the deck. The pressure of terminal velocity of the air rising through the deck can be controlled very closely to separate two kinds of seeds differing in specific gravity, the air is adjusted so that only the lighter seeds are lifted up off the deck surface. These lighter seeds are held up by air pressure and tend to float on the deck surface.

The heavier seed possess a velocity greater than that of the air column's so they are not lifted and so will lie on the deck surface. The air column thus stratifies the seed mixture into vertical zones of relative weight with the heavier seed lying on the deck and the lighter seeds lifted up to the top of the seed mass.

Adjustments

1. Feed rate 2) Air flow 3) End slope 4) Side slope 5) Deck oscillation speed

6) Deck speed.

V. Roll mill or dodder mill or velvet roll mill

It is used to separate the seeds based on surface texture and shape. This separator should be used only after the seed has been carefully cleaned and separated from the chaff and fresh. These are effective in separating seeds with a rough seed coat or shape angles from smooth seeds.

The roll mill consists basically of two roller, covered with flannel or velvet, placed side by side, so that they touch each other down their entire length. The rollers are mounted on an incline and they turn in opposite directions. A curved

adjustable shield is mounted above the rollers.

Separating action

The mixture of smooth and rough seeds is fed into the place, where the rollers touch each other, at the high end of the machine. As the rollers turn up and out, seeds that are rough or have sharp or broken edges are caught by the nap of the fabric covering the rollers. These seeds are thrown up against the curved shield. They strike the shield at an angle, bounce back down to the roller and are again thrown up against the shield. Smooth seeds bounce down the inclined position forward between the rollers, and discharge at the lower end of machine. They are not affected by the fabric roller covering, and are not pitches over the side of the rollers.

Adjustments : 1. Rate of feed 2) Speed 3) Clearance between shield and rolls 4) The angle of inclination of rolls.

VI Magnetic separator

The separation is mainly based on the affinity for liquids which is used for separation. Since seeds contains no free iron and are not attracted by a magnet they must be selectively pretreated with a magnetic material such as finely ground iron powder. Rough seed coats, cracked or broken seed coats , dirt lumps, chaff or seed with a sticky residue on the surface will hold the liquid and become sticky, so that iron powder will adhere to them. Smooth coated seeds will not absorb liquid. So no iron powder will adhere to them.

The seed are then discharged from mixing chamber and brought into contact with a powerful magnet, which removes the iron coated seeds. Most magnetic cleavers pass the seeds over a revolving drum which has a high intensity magnetic field. Seeds with an affinity for liquids which are now coated with iron powder are attracted by the magnet and adhere to the drum until they are removed by a brush or scraper. Seeds which are relatively free of iron powder are not attracted by the magnet and will fall into a separate discharge spout.

The first requisite of magnetic seed separation is that the seed to be separated must possess different seed coat characters. Crop seeds should have a smooth surface, while the seeds to be removed should have a rough surface which will retain liquid and can accept the iron powder. Success in separating the components depends upon the magnitude of seed coat differences and thoroughness with which the moistened seeds and the iron powder are blended.

VII Colour separator

Many large crop seeds such as peas and beans differ in colour between varieties. Colour variation may also occur due to immaturity or disease. Electronic colour sorting machines can separate such seeds by difference in colour and also remove mud balls and discoloured seeds in the same operation.

The electronic colour sorter views each seed individually with photo electric cells. The seed is compared with a selected back ground or colour range and is discharged from the machine according to its colour. If it is the great desired colour, the seed is discharged out the good seed spout. If it's colour or shade falls within the reject range, a blast of compressed air deflects the seed and sends it in to the reject discharge spout. These

are highly sensitive. Since the machine views each seed individually, capacity is low, but the initial cost is high and operating cost is less. The usefulness of machine is greater with large seeded crops.