RAMA UNIVERSITY

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FACULTY OF AGRICULTURAL SCIENCES

AND ALLIED INDUSTRIES

SEED PRODUCTION IN PULSES

REDGRAM

Floral biology

Axillary or terminal raceme borne on long peduncle, The flowers are yellow or purple. Based on the back of the standard petal colour, the variety is identified. Flowers are papilonaceous, bracteolate, ,bracteolate, clayx five, gamosepalous, and corolla with keel petals free, stamens (9+1) diadeplhous and didynamous, ovary superior with a few ovules. Fruit is a pod.

Anthesis usually occuars, between 8 a.m. to 5.00 p.m. Flowers may remain open from 6 to 68 hours. Fertilization occurs five hours after pollination. Red gram is an example for often cross pollinated crop. The cross pollination occurs mainly due to bees and thrips. Pigeon pea is an often cross pollinated crop where natural out crossing is recorded upto 40-70%.

Method of Seed production

Varieties : Under isolation, the crop is raised and by open pollination seeds are allowed to set. The nucleus seed production is by ear to row method.

Hybrids : The tool employed for production of hybrid seed is by genetic male sterility system (GMS) where male sterility is maintained in heterozygous stage following the test cross principle, there would be fertile and sterile plants in the ratio of 1:1 in the male sterile population (female plant).

Land requirement

The land selected should not have been grown with pigeon crop in the previous season. It should be fertile with good irrigation facilities.

Isolation	**FS**	**CS**
Varieties	200	100
Hybrids	200	100

The parental lines either for foundation or certified seed production should be bought from an authenticated source with tag and purchase bill.

	Seed rate	**Spacing**
Varieties:	25 kg ha-1 Short duration	45 x 30 cm
	10 kgha-1 Long duration	90 x 30 cm
Hybrid :	Male : 5 kg/ha Female: 30 kg/ha	45 x 20 cm 45 x 10 cm
	Male : 5 kg/ha Female: 40 kg/ha	45 x 20 cm

Seed treatment

Treat the seeds with carbendazim orThiram @ 2 g/kg of seed 24 hours before sowing (or) with talc formulation of Trichorderma virdie @ 4 g/kg of seed (or) Psedomonos fluorescens @ 10 g/kg of seed. Bio control agents are compatible with biofertilizers. First treat the seeds with bio control agents and then with Rhizobium. Fungicides and bio control agents are incompatible.

Fungicide treated seeds should be again treated with a bacterial culture. Treat with Rhizobial culture CC 1. There should be an interval of at least 24 hours after fungicidal treatment for giving the bacterial culture treatment. For red lateritic soil rhizobial culture VPR 1 is effective.

Planting ratio

The male and female seeds are sown in 1:4 ratio or 2:8. Sow 2 rows of male line all around the field as border row.

Synchronisation treatment

1. Example: The pollen parent ICPL 87109 should be sown one week after sowing the female parent (MST 21).
2. The field should be bordered with sunflower to increase the seed yield.
3.

Roguing

In male sterile line or female parent

1. Remove the off type plants
2. Remove the male fertile plant by examining the colour of the anthers (yellow) at the time of 1st flower formation, one-day before flowering.
3. Rogue out at 7-10 days interval till completion of flowering.
4. Remove the late flowering and early flowering plants.

In Male fertile line or pollen parent

1. Rogue out off types
2. Remove the immature pods set in the plants from time to time to induce continuous flowering and to ensure pollen availability for longer period.

Pollination

1. To supplement pollination 5-8 beehives may be arranged per ha
2. To have the availability of pollen from the male parent for a prolonged period, clip off pods from the male parent. This will induce more flowering.

Harvesting

The crop attained physiological maturity 32 and 38 days after anthesis in winter and summer respectively. To avoid field exposure, matured pods should be harvested in 2- 3 pickings. In hybrids male line should be harvested first and female line should be harvested later on.

Seed standards

Characters	**FS**	**CS**
1. Physical purity % (max)	98	98
2. Inert matter % (max)	2	2
3. Other crop seed	5/kg	10/kg
4. Weed seeds	5/kg	10/kg
5. Other distinguishable varieties	10/kg	20/kg
6. Germination (%) (min)	75	75
7. Seed moisture content (%) (max)		

a. Pervious container	9.0	9.0	
b. Vapour proof container		8.0	8.0

B.COWPEA AND SOYBEAN

Floral biology

Soybean : Flowers - small born on short auxillary condensed raceme bearing 3-25 flowers. Flower white or violet purple with a papilionaceous corolla. Stamens 10, moadelphaous, ovary many ovules, short style, incurved, congigate stigma. The stamens develop a tube around the pistil and pollen from the anther is shed directly on the stigma. So soybean is self-pollinated crop.

Flower opens early in the morning. The pollen is shed normally shortly before or after the flower opens. But pollen shedding may occur sometimes within the bud itself. Normally cross-pollination does not exceed 1 per cent.Soybean is a highly self pollinated crop but Cowpea though it is a self pollinated the extend of cross pollination is upto 15- 20%. On insect activity the extend of insect pollination will be higher. Both crop belongs to the family leguminoceae.

Cow pea:auxillary raceme that may be branched with clusters of 5-6 flowers on a short but later elongates peduncle. Flowers small, yellow and clustered at the top of the peduncle. Flowers bracteate, bracteolate, pedicellate, bisexuall, hypogynous, zygomorphic, complete, pentamerous, gamosepalous, imbricate, coroola papilionaceious, Keel petal spirally coiled, stamen 10 (9+1) diadelphous, didynamous, ovary superior unilocualr with few ovules.

A high rate of flower occurs in this crop. Normally a cowpea plant produces 100- 500 flowers of which 70 to 80% shed before anthesis in the remaining about half of them abort prematurely. Under Coimbatore conditions flowers open between 7.00 a.m. to 9.00
a.m. The time of dehiscence of anthers is from 10.00 a.m to 12.45 p.m. The dehiscence taken place before flower opening.

Method of Seed Production

The varieties are raised under isolation and by thorough roguing genetically pure seeds are produced.

Seeds Multiplication stages

Breeder seed --> Foundation seed --> Certified seed

Land requirement

The land should be fertile and should not have been grown with the same crop in the previous season. If grown, it should be the same variety which was

certified for the said class of seed.

	Foundation	Certified
Isolation(m) Cowpea	10	5
Soybean	3	3

Seeds and Sowing

Seed should be obtained from authenticated source with tag and bill. The seeds are to be treated with fungicides (capton 2gm Kg-1) for better germination and establishment. Before sowing seeds are to be treated with Rhizobium culture.

		Seed rate	Spacing
Cowpea	:	20Kg ha-1	45x20 cm
Soybean	:	80Kg ha-1	30x10 cm

Roguing

The off types and volunteer plants are to be removed as and when they occur from vegetative to harvesting stage based on leaf colour, stem colour, growth status, flower colour, pod colour, seed colour etc.

Field standards	FS	CS
Offtypes (%)	0.10	0.50

Irrigation

Irrigation is given immediately after sowing. Life irrigation is given on 3rd day after sowing. Subsequently the field is irrigated once in 7-10 days. Critical stages are flowering and pod filling stage.

Important Operations

In Cowpea the tendril are to be clipped off (pinching) for good seed setting. Spraying of NAA 40 PPM at flower initiation and at peak flowering stage will promote pod and seed setting.

Pre-harvest Sanitation Spray

Two weeks before harvest endosulfan0.07% should be sprayed twice at weekly interval to control pod borer and primary infestation of Bruchids.

Harvesting at physiological maturity

Threshing

The pods of (Cowpea) and whole plants of Soybean are dried in the threshing floor and beaten with pliable bamboo sticks for removal of seeds. The extracted seeds are winnowed to get the seeds. The seeds should be dried to 10-12% moisture content under sun for good seed storage.

Grading

The bulk seeds are graded using 14/64" and 10/64" round perforated metal sieve for soybean and cowpea, respectively for homogenising the seed based on size. In cowpea for C02 alone 12/64" round perforated sieve is to be selected.

Seed standards

The graded seed should possess the following characters for certification and sale as certified/ truthfully labeled seed

Parameter	Cowpea		Soybean	
	FS	CS	FS	CS
Physical purity (min) %	98	98	98	98
Inert matter (max) %	2	2	2	2
Other crop seed (max)	None	10/kg	None	10/kg
Weed Seed (max)	None	10/kg	5/kg	10/kg
Other distinguishable variety seed (max)	5/kg	10/kg	5/kg	10/kg
Germination (max) (including hard seed)	75	75	70	70

Moisture content (max)				
(a) Open storage	9	9	12	12
(b) Moisture vapour proof storage	8	8	7	7

Seed treatment and Storage

The seeds should be treated with Captan+ Sevin @ 2g+200mg Kg-1 of seed for safe storage. The treated seed can be stored upto one year in open storage and upto 2years in moisture vapour proof containers, provided the seeds are devoid of bruchid infestation both primarily and secondarily.

SEED PRODUCTION IN GROUNDNUT

A. Floral biology

Flowers are borne in axillary condensed cymes. Flowers are with long, tubular calyx. Corolla five, free with standard, wing and keel petals. Androecium 8+2, four with linear anthers and four with globose anthers and two staminoides, monodelphous. Gynoecium with long style passing through calyx tube ending in hairy and club shaped stimga. Ovary superior, monocarpellary with one to four ovules.

Anthesis takes place between 4-6 a.m. Anthesis dehisces two hours before opening up of the flower. Receptivity of the stigma is between 4 to 8 a.m.Seeds are produced by self pollination and fertilization. Stigma remains enclosed in the keel petal even in fully opened flowers. Hence self pollination is the rule. The cross pollination occurs to an extend of 0-5%.

Method of seed production

Varieties : The crop is raised under isolation and seeds are allowed to set by self pollination.

Hybrids : Emasculation and dusting procedure is under research for release of hybrids.

Stages of Seed production

Since it is highly self pollinated, and the multiplication ratio is very low (1:5-13), 5 stages are allowed at foundation seed stage in the seed certification programme of groundnut.

Breeder seed ---> Foundation seed I, II, III, IV, V ---> Certified seed

Land requirement

The land should be fertile and porous. Previous crop should not be groundnut of other varieties.

Harvesting and maturation time should not coincide with rainy season since it may lead to insitu germination.

Important varieties

1. Spreading type :TMV1, TMV3, TMV4
2. Semi-spreading type :TMV6, TMV8, TMV10
3. Bunch type :TMV2, 7, 9, 11, 12, ALR2,VRI1, VRI2, VRI3, JL24, CO1, CO2
4. Dormant varieties :TMV7 - 10 days, CO1 - 10-15 days,VRI2 - One week
5. Seed colour variation in groundnut varieties

   Light rose - TMV2,7, JL24, VRI 1, 2,3
   Rose - CO1, CO2
   Red - ALR1
   Red mottled with white - TMV 10

Isolation distance in FS and CS is 3m

Seeds and sowing

Kernals are used for sowing, broken, decoated, tip broken, yellow coloured (***Aspergillus*** sp), black coloured (diseased) and insect damaged seeds should be removed. The unsized and oversized kernals are also removed and uniformly graded seeds should be used for sowing. Pods should be obtained from authenticated source.The seeds are sown either behind the country plough or in ridges and furrows and gap filling should be done within 10 days after sowing.

Pre-sowing seed treatment

The seeds should be treated with1.Trichoderma @ 4g/kg. It is compatible with biofertilizers.2.The seeds are treated with thiram @ 4g/kg of seed or Carbendazin @ 2g/kg of seed. But this is not compatible with trichoderma. These seed treatment will protect the young seedling from root rot and collar rot infection.3.Treat the seed with 600g/ha of rhizobial culture using rice Kanji as adhesive.4.If seed treatment is not carried out apply 10 packets per hectare with 2 kg of FYM and 25 kg of soil before sowing.

Presowing seed hardening

The seeds are soaked in 0.5% $CaCl_2$ solution (1/2 the volume of seed) for 6 hrs. After 6 hrs seeds are spread over moist gunny bags and covered with another moist gunny bag for 24 hrs. After 24 hrs the seeds with sprouted radical should be separated at every 2 hours and dried under shade and used for immediate sowing. The remaining non-viable dead seeds are rejected. The viable seeds can be dried to original moisture content and stored for 7-10 days. The rejects may be dried and used for commercial purpose.In dormant varieties the dormancy can be broken by seed treatment with 200 ppm ethrel.

		Seed rate	**Spacing**
1.	Bunch type :	100-120 kg ha-1	25 x 15 cm
2.	spreading type :	80-100 kg ha-1	60 x 15 cm
3.	Semi-spreading type:	80-100 kg ha-1	45 x 15 cm

Manure's and fertilizers

1. Compost :12.5 tons/ha
2. Basal :40:40:60 NPK kg/ha
3. Boron (Basal) :10 kg/ha
4. Micronutrient mixture:12 $kgha^{-1}$ (at the surface of the soil)

After sowing

1. Gypsum: On the 45^{th} day after sowing Gypsum @ 400 kg ha^{-1} is applied to the plants on 40-45^{th} days after sowing for irrigated crop and on 40-70^{th} day for rainfed crop depending on the soil moisture. This will increase the easy penetration of pegs as well as pod formation and filling up of pods.

2. DAP: Foliar spray with DAP 0.5% at flowering stage for proper seed setting.

Deficiency Symptoms

Calcium deficiency :Leads to early abortion of seed, although normal pod matures, it contain either nil seed or minute shriveled seed. Another disorder known as "Dark plumule" results in poor seed viability, where as normal kernal plumule is light cream in colour.

Boron deficiency :Increases single seeded pod and "hallow heart" seeds. Hallow is observed in between the Kernels and sometimes darkened or off coloured. It leads to invasion of seed borne pathogens results in poor seed quality. Apply borax 10 kg + Gypsum 200 kg/ha at 45th day after sowing for boron deficient soils.

Zinc deficiency : Light yellow stripes along with veins of leaf blade acute condition-vein chlorosis and cessation of growth of terminal bud. Apply 25 kg $ZnSO_4$ /ha basely for zinc deficient soils. If soil analysis shows less than 1.3 ppm of zinc, soil application of 25 kg $ZnSO_4$ is recommended. For the standing crop, less than 39.4 ppm of zinc in leaves, foliar spray of 0.5% $ZnSO_4$ is recommended.

Iron deficiency : Interveinal chlorosis - Depression on growth of aerial parts and roots. Stunted growth. For correction of iron deficiency spray 1% $FeSO_4$ on 30,40 and 50 days after sowing.

Sulphur deficiency: Stunted growth, uniformly chlorotic plants, thin stemmed and spindle appearance.

Weed management

i) Pre-sowing : Fluchloralin at 2.0 l/ha may be applied and incorporated.

ii) Re-emergence: Fluchloralin 2.0 l/ha applied through flat fan nozzle with 900 l of water/ha followed by irrigation. After 35-40 days one hand weeding may be given.

Pre emergence application of metachlor (1.0 kg ai/ha plus one hand weeding on 30 days after sowing in more profitable. In case of herbicide spray is applied two hand hoeings and weedings are given 20 and 40 th day after sowing.

Field standards

	Maximum permitted (%) FS	CS
1. Off types	0.10	0.20 (at final inspection)

Roguing

Removal of offtypes based on foliage colour, spreading habit, flowering and volunteer plants should be done from vegetative phase upto harvest.

Irrigation

It should be given once in 10-15 days and it is must during flowering, pod formation stage and seed filling stage.

Pest and Disease management should be done on time.

Harvesting

Drying and falling of older leaves and yellowing of the tip leaves indicate maturity. The colour of the inner side of pod turns black. The seeds will move freely inside the pod (crackling sound). On irrigation, the whole plants are uprooted at harvest. The moisture content of seed at harvest will be around 35-40%.

Stripping

It is the process by which pods are removed from plants either mechanically or manually. The machine used for stripping is groundnut-stripper.

Pod verification/Pod sorting

The stripped pods are verified based on pod shape, size, veination and waist characters. This is important for maintenance of genetic purity.

Drying

The pods are dried to 10-12% moisture content.

Pod /Kernel Processing

Groundnut is stored as pod till sowing. Hence the basic processing is done with pod. Using groundnut pod grader, the groundnut pods are graded based on size. The sieve size used for grading is 22/64" to 24/64" round perforated metal sieves depending on varieties. Seeds are graded using 18/64" to 20/64" round perforated metal sieve

Decordicator

The seeds are removed from pod using groundnut decordicator. The moisture content at that time should be 16-18%.

Seed drying and seed storage

Graded seeds should be dried to 7 - 8% moisture content. The seeds are treated with thiram @ 2g kg^{-1} of seed. Under ambient conditions kernels can be stored for 6 months while in pods upto 18 months.

Seed standards

Standards for each class Factor	FS	CS
1. Pure seed (min) %	96	96
2. Inert matter (max)	4	4
3. Other crop seed (max)	None	None
4. Weed seed (max)	None	None
5. Germination (kernels) (%) (min)	70	70 (Hand shelled)
6. Moisture content (kernels)		
a. Pervious container	9	9 (Hand shelled)
b. Vapour proof container	5	5 (Hand shelled)

The pods can also be treated with thiram @ 3g/kg Pods can also be stored in gunny bags along with $CaCl_2$ @ 250 g/30 kg of pod, placed in a plastic container.