HYBRID SEED-PRODUCTION-IN-VEGETABLES
Hybrid seed-production-in-vegetables

Hybrid varieties have been evolved in those high valued vegetable crops that exhibit marked heterosis

- Solanaceous vegetables (tomato, eggplant, sweet pepper)
- Cucurbits (melons, cucumber, pumpkin and gourds)
- Root and bulb crops (onion, radish, carrot)

Techniques of hybrid seed production - SOLANACEOUS CROPS (Tomato)

Hybridization techniques:

- Indeterminate tomato varieties staked and trained with either single stem or double stem, while determinate varieties are trained with 3 stems
- Usually 1st to 4th cluster on each branch selected
- The emasculation involves in holding the corolla at the base and with a single upward pull pick off the corolla along with all the stamens
- Usually the anthers are picked off a day before anthesis with the help of forceps leaving the petals intact
- Fresh pollen collection on the day of anthesis by a vibrator are shed by vibrating the flowers
Physiological Parameters Affecting Tomato Seed Yield and Vigor

- Prolonged high temperature affect pollen fertility and physiology of fertilization leading to poor seed set
- Age of pollen and stigma, abundant or scarce pollination, height of inflorescence and fertilizer application exert an influence on vigor of plant

Seed extraction and Drying

- By fermentation method
- By acid or alkali treatment: 10cc or 36% NaOH added in 4kg tomato pulp for 15 minutes.

Seed Yield

- 1kg tomato produce 3-4g of seed yield. Av. Seed yield: 60-70kg/ha

Techniques of hybrid seed production-Eggplant and Pepper

Manifestation of Heterosis:

- Heterosis in sweet pepper ranged 35-40% and in Eggplant 50-150%
- In eggplant it is manifested by earliness, fruit number per plant & fruit weight
- Sweet pepper: plant height, days to flower, fruit weight, early and total yield
Hybridization techniques:

- Stigma is receptive a day prior to anthesis in eggplant
- Bud pollination possible giving good fruit set and seed yield
- In sweet pepper, emasculation done a day prior to anthesis, whereas, pollination done in the morning on the day of anthesis
- Natural cross pollination ranged from 0.2-46.8% in eggplant flowers
- Pepper flowers are visited by honey bees occasionally. Fresh pollen grains are collected on the day of anthesis by a vibrator and can be stored for a period of 1 to 2 months at O°C using silica gel for proper drying of the

Use of Male Sterility in Hybrid Seed Production in Eggplant and Sweet Pepper

- Male sterile lines available in eggplant (genic male sterility) & sweet pepper (genic and ems) but not successful at commercial seed production
- Seed set on male sterile lines ranged from 46-67% in capsicum
- Cytoplasmic male sterility used now in chilly pepper to produce F1 hybrid commercially by several seed companies
Steps of Hybrid Seed Production in Cucurbitaceous Vegetables

- Production of inbred lines by inbreeding for 3 to 5 generations.
- Selection of inbred parents through combining ability tests and potential hybrid production ability.
- Production of hybrid seeds (preferably single cross hybrids and pistilate parent preparation is relatively easy, and single fruit produces quite a large number of seeds)
- Maintenance of inbred parents

Techniques of hybrid seed production - CUCURBITS CROPS (WATERMELON)

Seed Extraction

- Eggplant harvested 50-55 days after anthesis and stored for 10 days for post harvest ripening
- Sweet pepper: 60-65 days after anthesis
- Ripe fruits crushed and seeds separated by washing. Dry air at 28-30°C

Seed Yield

- Eggplant: 150-200kg/ha
- Peppers: 100-200kg/ha. 1kg yields 5-7g of seed.
Hybrid seeds of watermelon can be produced by two ways:
1. Through artificial pollination.
2. Removal of male flower and use of insect pollination.

**Artificial pollination:**
- Field lay-out
- Selection of female flowers
- Bagging of female & male flowers
- Collection of male flowers
- Period of pollination
- Seed fruit management
- Harvesting
- Extraction, washing and drying of seeds
- Seed yield 150-300kg/ha based on varieties, extent of pollination & field condition

**Removal of male flowers & Use of Insect Pollination:**
- In this technique, male flowers of female plant completely removed before opening
- Fruits from female parent harvested as crossed fruits and other variety as self fruit of male variety
- Used in commercial hybrid seed production
- Also referred as crossing block method
Techniques of hybrid seed production- Pumpkin

Production of Hybrid Seeds
- Planting of female and male inbred parents in 4:1 ratio
- Spray 50-100 ml of ethephon per litre of water on pistilate parent to increase female flowers
- Bagging of flowers before anthesis. Rebag the female flowers after pollination for another two days
- Harvest fruits after 60 days of pollination
- Remove seeds from the fruits, wash and dry for 3-4 days and sun dry for another 3-4 days.
- Preserve the seeds in sealed polyethylene bags at low temperature (4-5°C)

Techniques of hybrid seed production- Bottle gourd

Production of Inbred Lines of Diverse Genetic Background
- Bagging of male & female flowers
- Inbreeding at anthesis through following morning and rebagging of the female flowers for another 2 to 3 days.
- Inbreeding done for 4-5 generations and select better types by discarding the poor performers.
Production of Hybrid Seeds
- Planting of female and pollinator inbred in 4:1 ratio.
- Bagging of female and male flowers before anthesis
- Harvesting of mature fruits after senescence of the plant, remove seeds, wash and dry. Store in sealed polyethylene bags at low temperature
- Maintenance of Inbred Parents
- Inbreeding of parents to produce seeds should be done when the parental stock is depleted. Produce large quantity of seeds to maintain genotypic & phenotypic integrity of the hybrid.

Techniques of hybrid seed production – BULBOUS CROPS (ONION)

Heterosis in Onion: Ranged from 14-67%. It is manifested in uniform bulb size, bulb weight & efficient source sink ratio

Male Sterility in Onion: Controlled by combination of cytoplasmic factor ‘5’ together with recessive nucleus gene in its homozygous form

Hybrid Seed Production Techniques
- For the production of hybrid seed in onion, male and cytoplasmic female lines planted in the ratio of 2:8
- Success of hybrid seed production depends upon the pollen distribution pattern from fertile to sterile plants in the crossing block
Factors Affecting Hybrid Seeds in Onion

- Weak inbred lines
- Abnormal florets where ovary started to develop but failed to produce seed
- Aborted ovule
- Excessive heat damaging the flowers

Seed Yield

Hybrid seed yield in onion ranges from 300-350 kg/ha

Techniques of hybrid seed production - Cole crops

Manifestation of heterosis:

- Heterosis in cabbage: 25-61%
- Cauliflower: 20-60%
- Broccoli: 26-58%
- Manifested by head/curd size, early maturity, head/curd weight and plant weight

Male Sterility and Hybrid Seed Production

- Cytoplasmic male sterile lines and their maintainers have been developed in cauliflower, cabbage and broccoli using radish cytoplasm for male sterility
- Cytosterile plants of broccoli, cabbage and cauliflower are petaloid with large nectarines responsible for bee attraction and good female fertility
- Seed Yield - varies from 500 - 800 kg/ha
THANK YOU