



Quality Seed Production of Pumpkin

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Pumpkin is one of the most important crops of family Cucurbitaceae. Pumpkin now occupies a prominent place among vegetables owing to its high productivity, nutritive value, good storability, long period of availability and better transport potentialities. Seed production of pumpkin in India is still dominated by locally available open pollinated cultivars. There is need to scientifically produce quality seeds of Pumpkin.

Introduction

It is estimated that 70% area of different gourds including pumpkin and 60% area of melons is covered by unidentified local varieties, although several improved varieties of pumpkin (Kashi Harit, Pusa Vishwas, Pusa Vikas, CO-1, CO-2 and Ambili) are available. Hence, great scope exists to improve the local cultivars by breeding and replace them with improved varieties and hybrids. The main seed production area of pumpkin in India is West Bengal (West Midanpur and Bankura), Karnataka (Ranebennur and Koppal) and U. P. (Allahabad and Faizabad).

Climatic Requirements and Sowing Time

Pumpkin is a warm season crop that grows best at 21 to 32⁰ C. Freezing kills the plants and cool weather below 16⁰C slows or stops the growth. Pumpkin seeds germinate and emerge within 3-4 days at a soil temperature and from 6 to 12 days at 20⁰C. It has been well documented that short days and low temperature condition favour the expression of female flowers in all the cucurbits. Sowing in June-July and February-March ensured proper maturity of both fruits and seeds. Early sowing is quite conducive for fruit and flower development.

Soil and Field Preparation

Pumpkin grows in a wide range of soil types but do best in well drained soils with good physical characters and rich in organic matter. Careful irrigation management is required when the crop is grown in clay-loam soil to obtain high yielding crops. Most cucurbits including pumpkin are moderately sensitive to soil salinity, displaying a 50% yield reduction in the range of EC 4 to 6 (mmhos/cm at 25⁰C). The land should be free from volunteer plants. Field preparation starts 3-4 weeks before seed sowing. Thorough soil preparation and leveling are essential. Nearly 2-3 ploughing and planking is sufficient to obtain good tilth.

Sowing System and Seed Rate

Seeds of pumpkin should be sown on raised beds or furrow or trenches or pits. It is better to train the plants on a bower system for increased seed yield. Trenches are prepared in well prepared field at the distance of 4m. Generally, depth of trench is kept 20-30 cm with the width of 40-50 cm. Near to these trenches pits of 60 x 60 x 60 cm size are dug and filled with well decomposed FYM (4-5 kg per pit) and top soil. Generally, 3-4 g Furadan is mixed in the soil and filled upto the height of 10 cm above ground. In case of raised bed, two seeds per hill should be sown while; three to four seed should be sown in case of pit method. In case of early sowing, sprouted seeds are sown on the ridges. The optimum plant spacing is 4 m between

rows and 60-80 cm between hills. Five to six kilogram seed is enough for sowing in one hectare area. It is must to treat the seeds by adding 4g 'Thiram' in 1 kg seeds. For summer sowing it is also advisable to soak the seeds in water for 24 hours, wrap the moisten seeds in wet gunny bag and keep for 3-4 days in warm place.

Manure and Fertilizers

Fertilizer requirement depends on the nutritional status of the soil. About 200-250 q/ha of well rotten FYM should be added in the field. It should be mixed with the soil at the time of last ploughing or applied to each pit during pit preparation as the case may be. Pumpkin seed crop typically demonstrates on economical fertilizer response to 100-120 kg N, 80-100 kg P₂O₅ and 60-80 kg K₂O per hectare. Half of N and full dose of P and K should be applied pre-plant in the mound and the remainder 5 to 6 weeks after seedling emergence. Additional N should be placed 20-25 cm from the plant row and about even with the bottom of the furrow as top dressing after 25-30 says after sowing. Care must be taken not cause excessive damage to plant roots. Irrigation water should be supplied shortly after applying the fertilizer to move it towards the plant roots.

Thinning

When the seed is sown on hills, the plants should be thinned so that not more than three plants are left standing on each hill. When sown along the furrows, the plants at each place are thinned to one or two.

Irrigation

Pre sowing irrigation practice if there is insufficient moisture in the soil. It is better to delay further irrigation for some time so that the root system may hardened and develop well. Pumpkin seed field be furrow irrigated instead of flood irrigation, which considerably reduce leaf and fruit wetting and check disease occurrence. Pumpkin has deep root system and therefore requires less frequent irrigations. Irrigation should be stopped at least 15 days before fruit harvest at full ripe stage. Regular irrigation at an interval of 5-7 days should be given. Avoid the moisture stress during vine development, pre-flowering, flowering and fruit development stages. In rainy season crop, irrigation may not necessary at all if rainfall is well distributed between July to September.

Weed Management

The field should be kept free from weeds, especially in the early stages. Later on, rapidly spreading vines suppress the weeds. It is desirable to stake this crop during the rainy season. First weeding should be done at 15-20 days after sowing and second at 30-35 days after sowing at the time of earthing. Frequent hoeing in the early stages is also desirable. The pre-emergence application of Alachlor @ 2.5 kg *a.i.*/ha can be used for weed control.

Pollination

Hence bees are the most reliable and cost effective agent to achieve pollination although 58 bee species belonging to 29 genera and 6 families visit pumpkin crop. Both pollen and nectar are produced in the staminate flowers and nectar in the pistillate flowers. Pumpkin flower open at about 5.0 am and withers by 11-30 am. Bee pollination, therefore is most effective in the early morning hours hence, any spraying should not be scheduled in the morning hours particularly in the flowering span, which may deter the bees. Most authorities favour keeping one or two beehives per acre when 5-10% plants have open flowers. Beehives should be placed in clusters around the periphery of field, with additional hives placed inside the larger fields.

Sex Expression

The sex expression and sex ratio are varietal characters. It is, however, modified by the environment, lower fertility, higher temperature, longer light period all induce maleness. Certain gases and chemicals also affect sex. Both auxins and anti-auxins at proper concentrations modify sex. Gibberillic acid at higher concentrations induces maleness; but at the lower concentration of 10 to 25 ppm increases the number of female flowers. Two sprays at two leaf stages and again at four leaf stage with 25 to 100 ppm maleic acid, 100 ppm of NAA, 3 ppm ethrel, 3 ppm boron or 3 ppm of molybdenum can suppress the number of male flowers and increase the number of female flowers, fruit set and ultimate yield.

Rouging

Rouging of off –types, diseased plants, objectionable weeds, plants of other crops and undesirable plants (wild type) from the seed crop throughout the growing season is a must to maintain the true to type plants. There are four stages of rouging. The first is done before flowering when vegetative characters are checked. The second stage is at early flowering when morphology of the ovary is checked. The third stage is when the developing fruits are checked for trueness to type, and the final rouging is confirming the external morphological characters of the fruits to be harvested. Field inspections for rouging should be based on the stable characters like leaf spot, length of peduncle, shape of peduncle, flaring of the peduncle, ovary shape, matured fruit shape and rind colour of the matured fruit.

Off-type plants are usually detectable fairly early in most of the cucurbits. Bush type plants in a variety, which normally has runners, or vice versa, is easily detected. Likewise, even in varieties with similar vines, the early shape of the fruit and even the shape of the ovary at flowering will sometime reveal on off-type plants. Although some damage may have already resulted from cross pollination, such off-type plants should be considered as a unit. Through some minor injury a fruit may be off-shape, but if the plant, from which it comes, as well as the other fruits borne on it, is all true to type, the seed within the deformed fruit should be no less satisfactory and hence should not be rejected.

Isolation

Maintaining proper isolation distance is a must for obtaining pure seed. The seed production field should be isolated from other varieties/species, which are cross-compatible, the four Cucurbita species namely; moschata, pepo, maxima and mixta are treated as a unit and some intercrossing can occur among these species. Keeping the heavy and sticking nature of the pollen in view, 1000 m and 500 m isolation distance is sufficient for foundation and certified seed production, respectively.

Integrated Pest Management (IPM)

IPM depends on the judicious use of the agrochemicals, management of the pollinators, production technology adjustments and tolerance level of pest management. Red pumpkin beetle attack the plants at an early growth stage of plants. Fruit fly is one of the most serious pests of pumpkin, which cause heavy loss. These insects can be controlled by adopting the following schedule:

1. Expose the dormant pupae of fruit fly by deep summer ploughing.
2. Follow crop rotation incorporating non-cucurbitaceous crops.

3. Maintain sanitation in the field through removal and destination of infested fruits immediately after the initial infestation.
4. Spray Carbaryl 50 WP @ 2 g/lit. of water to control red pumpkin beetle at 2-3 leaf stage
5. Application of 0.1% Carbaryl at tender fruit stage (upto 5 days after fertilization) gives excellent control of fruit fly.
6. Control of aphids in the early stage can effectively check the incidence of some serious diseases like cucumber mosaic, cucurbit aphid borne yellow mosaic, zucchini yellow mosaic, squash mosaic, etc. Cucumber mosaic virus can be controlled by:
7. Use of resistant varieties.
8. Elimination of weed hosts from the field.
9. Elimination of infected plants from the field.
10. Use of barrier crops like sunflower, sorghum and pearl millet.
11. Spraying of plants with Dimethoate (0.05%) or Nuvacron (0.05%) or Metasystox (0.02%) at weekly intervals controls aphid population and the disease spread.

Integrated Disease Management (IDM)

Phytophthora root rot can be a problem early in the season and proper irrigation management can often minimize this. Diseases like anthracnose, downy mildew, powdery mildew and leaf spot attack the pumpkin crop. Adopt the following packages to produce quality seed of pumpkin.

1. Select disease free healthy seeds.
2. Follow crop rotation.
3. Maintain field sanitation.
4. Maintain proper drainage and aeration.
5. Seed production should be carried out in summer to get disease free seed.
6. Treat the seeds with Thiram or Carbendazim @ 2.5g/kg seed.
7. Green manuring followed by soil application of Trichoderma @ 5 kg/ha in soil is highly effective in checking most of the fruit rotting.
8. Apply Trichoderma @ 15 g/pit during sowing.
9. Foliar spray of Carbendazim @ 1 g/lit. or Chlorothalonil @ 2 g/lit. of water.
10. Spray the crop with wettable sulphur @ 2 g/lit. of water to control powdery mildew.
11. Collect affected fruits and burn them to reduce primary inoculum.

Harvesting and Seed Extraction

Pumpkin varieties take about 85 to 120 days (after seed sowing) to reach maturity. Fruits are ready to harvest when fruits redden and seeds inside the shell break readily from the pulp. Immature seeds adhere to pulp. The fruits are cut in half and the seeds scooped out. The seeds are removed from the flesh by rubbing over a sieve, and finally winnowed to remove the light matter. Seeds may be washed, if necessary, and dried in trays to safe moisture content of 6 to 8 percent and stored in a cool, dry place. In pumpkin seeds are embedded in the pulp and the following methods are applied for seed extraction.

1. **Mechanical Method:** In this method machines like *Axial Flow Vegetable Extractor* are used to separate out the pulp from seeds.
2. **Chemical Method:** In this method commercial HCl is used to separate the pulp from seeds within 15-20 minutes. Thereafter the seeds are washed in water and dried to prescribed moisture level.

Conclusion

Considering adequate crop and pollinator management practices, 3-4 q seed can be produced from one hectare area.