

Eggplant Seed Production

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Introduction

The eggplant originates from India and is now generally grown as a vegetable throughout the tropical, sub-tropical and warm temperate areas of the world. It is an important vegetable in India, China and Japan. In recent years, it has increased in importance as a protected crop in Northern Europe.

The varieties of *Solanum melongena* L. display a wide range of fruit shapes and colors, ranging from oval or egg-shaped to long club-shaped; and from white, yellow, green through degrees of purple pigmentation to almost black. Most of the commercially important varieties have been selected from the long established types of the tropical India and China. In the past, farmers maintained and supplied seeds of eggplant with special type of varieties adapted in the region. Now there are an increasing number of F_1 hybrid varieties bred by seed companies and the seed production of eggplant is shifting from farmer's hands to seed companies.

Environment

Environmental factors are important in the production of eggplant seed. The same climatic factors that influence the cultivation of eggplant as a market vegetable also act on seed production. Eggplant is a warm season crop. It requires a long and warm growing season for successful production. It is more susceptible to lower temperatures than tomato and pepper. A day temperature of 25–32 °C and a night temperature of 21–27 °C are ideal for

plant growth and fruit development. Comparatively a hardy crop, it can tolerate drought and heavy rainfall. However, it is advisable to select a dry climate or at least a season with a low air humidity, which discourages fruit rot and other diseases. Furthermore, good soil and adequate fertilization are essential. Eggplant can be grown on different kinds of soil but does best on well-drained silt loams or clay loams with a pH of 5.5–6.5.

Flowering habit

The eggplant does not have a specific daylength requirement for flower initiation. The flowers are borne solitarily or in clusters of two or more. In the solitary flowering type, flower drop is very low, whereas in the clustered flowering type, flower drop may be as high as 80%. The flower is normally perfect, having functional male (anthers) and female (pistil) parts (Fig. 1). It has been reported that long-



Fig. 1. Eggplant flower.

styled flowers (defined as the stigma is either above or on the same level as the stamen) are always more appreciable in number than short-styled flowers (defined as the stigma is below the stamen). Fruit set rates are higher for long-styled flowers compared with short-styled flowers.

In most eggplant-growing areas, anthesis and pollen dehiscence in eggplant flowers occur between 6:00 and 11:00 in the morning. However, anthesis and dehiscence are mainly influenced by the daylight, temperature and humidity, therefore, the exact timing for every areas should be determined by observation and experience.

Pollen variability is retained for 8–10 days at a temperature of 20–22 °C and with a relative humidity of 50–55%. Best results are attained when pollen is used within four days.

Eggplant is a normally highly self-pollinated crop. The cone-like formation of anthers favors self-pollination; but since the stigma ultimately projects beyond the anthers, there is an ample opportunity for cross-pollination. The rates of natural cross-pollination may vary depending on genotype, location, and insect activity. It has been reported that the extent of natural outcrossing was from 2 to 48% in eggplant varieties in India and from 3 to 7% in China. At AVRDC, from 0 to 8.2% of natural outcrossing rates (with a mean of 2.7%) have been observed.

Crop management

Cultural practices and crop management for seed production are almost same as for market fruit production except that fruits are harvested when they are ripe and the skins become yellow. Furthermore, seed crops require special attention in terms of isolation, roguing, harvesting, and seed extraction.

In general, higher levels of P and K fertilizers result in greater seed yield and better quality. The importance of nitrogen on accelerating flower formation in eggplant has been reported and practiced in Japan. In Japan, special techniques are also used to train and support the plants.

Eggplants are susceptible to many of the soil-borne pests and diseases associated with other members of Solanaceae. Rotation of seed crops with non-solanaceous crops must be taken into account.

Isolation

Appropriate isolation of the seed-producing field from other varieties of the same crop is generally required. Since there is considerable amount of natural cross-pollination in eggplant, isolation is essential to seed production. An isolation distance of 200 m and 100 m for foundation and certified seed production, respectively, is recommended.

Roguing

Seed growers should be well acquainted with the characteristics of the varieties so that they may effectively rogue out the off-types and undesirable plants at different stages of crop growth. Leaf and stem characters can easily be identified even at the seedling stage. Roguing can also be performed based on fruit size, shape and color, and other plant characters. All the plants infected with virus diseases of other seed-borne diseases should be rogued out. A minimum of three roguings should be made: before flowering, at flowering, and at fruiting stages. In case of F_1 hybrid seed production, both parental stocks need final checks for trueness-to-type before hybridization starts; any off-type should be eliminated.

Production of F_1 hybrid seed

The use of hybrid varieties is rising dramatically. The major role played by the private seed sector in developing and distributing improved eggplant varieties has encouraged the trend toward increasing the use of hybrids. It is true that F_1 hybrids exhibit favorable traits such as uniformity, high yield, and, to some extent, better resistance to diseases, but their advantages over the standard varieties have not been as great as in cross-pollinating species. The popularization of F_1 hybrids among self-pollinated species is due to that it gives better protection of variety right to the developer.

In general, F_1 hybrid seed production is manually done in eggplant. Hand pollination is relatively easy due to its large-sized flowers. It is also more economical because each fruit contains a good quantity of seed as compared to other vegetables. High daytime temperature but a wide difference between day and night temperatures, especially during the fruit developing stage, and less rain during flowering and pollination periods, are con-

sidered suitable for hybrid seed production. Selection of a fertile, well-drained, and disease-free field is important for successful hybrid seed production. It is also important that crops grown for seed production are given the optimum conditions for growth and reproduction to insure that good seed quality and high overall seed yield will be attained.

The process of hybrid seed production take invariably many hours of skilled work. Attention to detail is essential and some details may require modification under local conditions.

Preparation for hybridization

The male parent should be planted 7–10 days before the female parent so that an adequate source of pollen is available at pollination time. It is important that sufficient male plants producing good flowers at the right time be assured. A ratio of five or six female to one male plant is adequate for commercial hybrid seed production. However, this ratio may be adjusted according to the flowering behavior of the parents.

The operations of emasculation and hand-pollination are usually done considering to coincide with better cycle of fruit setting. To obtain a period of concentrated flowering for efficient emasculation and pollination, fertilizer application and other crop management practices are planned in such a way that plant growth is most vigorous during the mid-stage of flowering. Before starting emasculation, all opened flowers and developing fruits are removed completely along with any undesirable flower buds.

Emasculation

Flower buds about one to two days away from opening should be chosen for emasculation. At this stage, the petals are still white. Emasculating very young flower buds could lead to injury to the style and ovary. On the other hand, emasculating large flower buds which petals have turned violet color are not recommended since the likelihood of self-pollination is high.

To emasculate, use sharp-pointed forceps to open the unopened bud, and then carefully remove all the anthers inside leaving only the petals, ovary, and style (Fig. 2). The emasculated flower buds

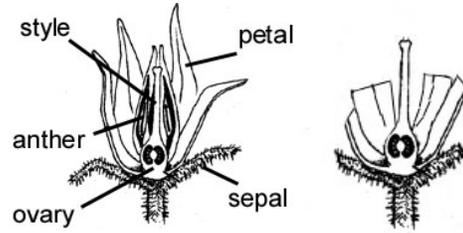


Fig. 2. Solanaceous flower before and after emasculation. The anthers are removed to prevent self-pollination. The petals and sepals are cut to identify the flower for future pollination.

are covered with bags or left uncovered depending on the field isolation condition and insect activity.

Pollen collection

Pollen flowers are collected from the male plants in the early morning hours before the anthers dehisce. After most of the anthers have dehisced in the container, the pollen is gathered in convenient small-sized vessels by vibrating the flowers. An alternative pollen collection method uses a specially made vibrator and adopts the same principle of shaking the dehiscent flowers to force the pollen to shed.

Pollination

The flowers emasculated one or two days earlier should have completely blossomed and are ready for cross-pollination. Using a small pair of scissors, cut two calyxes of the emasculated flower buds to mark the hybridized buds. Then, the stigma is dipped into pollen mass kept in a suitable pollen container. Pollination can also be done by dipping the tip of the little finger into a pool or pollen, then touching the stigma with the pollen-covered finger. Mark the pollinated flowers with either small rubber bands or strings or tin ties on the peduncles of the hybridized flowers.

Any unhybridized old flowers of the female plants should be removed to eliminate the chance of contamination from selfed seeds. The pollination period for a seed crop varies with a 25–35 day range.

The number of hybrid fruits to be produced per plant depends on the average fruit size and seeds per fruit of the maternal parent. The average number of seed fruits per plant is 4–6 for the large-fruited types, 6–10 for the medium-fruited, and 12–15 for small-fruited types.

Plant protection

Timely protection of crops is essential. In the tropics, eggplant is attacked by several pests, including epilachna beetle, fruit and shoot borer, jassids, aphids, and mites. Chemical sprays are usually used to control these pests.

The important diseases of eggplant have been previously mentioned. Effective control measures such as seed treatment, crop rotation, and soil fumigation can be taken before sowing the seed crop to prevent seed- and soil-borne diseases. Chemical sprays are often used for controlling *Cercospora* leaf spot, powdery mildew and *Phomopsis* fruit rot.

Harvesting

For seed production, fruits are allowed to ripen fully to ensure complete seed development and maturity. In general, the color of fully mature fruit fades and turns normal color to yellow. For open-pollinated varieties, only the ripe yellow fruits are harvested. In case of hybrid seed production, the seed fruit fully matures about 50–55 days after pollination depending on the maternal parents. Only the marked pollinated fruits are harvested.

Seed extraction and drying

The harvested fruits are stored for three to four days until they become soft. This allows the seed to mature fully. The top one-third of the fruit is removed since it contains almost no seed.

In most cases, seeds are extracted by cutting, crushing or macerating with a mechanical extractor. After extraction, seeds are washed and cleaned with extra water in a container. Some seed extracts are also capable of separating the seed from the pulp through a screen. In the case of very small-scale seed production, dry extraction of seeds is used, however, this is time consuming and laborious.

Seed drying is done by spreading the wet seeds, either in the sun or in an electric dehydrator. Stir the seed with hands at least 2–3 times a day, turning them over to dry uniformly. Seeds that stick together should be disaggregated. The seed should be completely dry to about 8% moisture content.

Seed yield

The seed yields of eggplant vary with different varieties or parents and production conditions. Generally, the standard of seed yield is between 600–800 kg/ha. The cost of hybrid seed production of eggplant is not as high as compared to other vegetables because each fruit contains a large number of seeds. The cost can be further reduced by the use of male sterile line in hybrid seed production. This advancement has made the exploitation of hybrid vigor in eggplant more economical.

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