

Pomato: Harnessing twin benefits of potato and tomato through grafting

Grafted tomatoes onto potatoes (so that both are produced on the same plant) are christened as Pomato or tomtato. It is an innovative technology for harnessing dual benefit from single plant that can be produced on a small piece of land or pots or in balcony. Pomato seedlings are prepared by grafting of an improved cultivar of tomato or cherry tomato over seedlings of potato. ICAR-IIVR, Varanasi has got success in producing pomato very efficiently and economically. About 1.5-2.0 kg of tomatoes and 0.5-0.8 kg of potatoes are harvested from single pomato plant grown in pot. If indeterminate hybrid tomatoes are grafted onto potato and advanced production packages adopted, the productivity of pomato can be enhanced by two to three folds.

GROWING of tomato on shoots and potato on roots, thereby combining the two vegetable crops of the same family through grafting is known as 'Pomato' (Potato + Tomato). The grafted pomato, where the aboveground and underground parts of the plant remain genetically separate, is different from the pomato developed through somatic hybridization between potato and tomato mediated by protoplast fusion. It was Oscar Soderholm of the florist's greenhouse at Worcester, USA who developed 'Tomapotato' for the first time in 1930 through grafting after 20 years of his efforts. In 2005, Lazaro Peres and his teammates successfully demonstrated grafting of tomato mutants on potato rootstocks in Brazil. Recently, Thompson and Morgan Co., U.K. has commercially started to market the grafted pomato as 'TomTato' and Incredible Edibles Nursery in New Zealand as 'Potato Tom' in 2013. In India, grafted pomato was produced earlier in Western Himalayan region of Palampur (H.P.) under protected condition in 2015. Under Indo-Gangetic plains, pomato grafting has been successfully performed in open condition for the first time during 2013 at ICAR-IIVR, Varanasi. As



Pomato seedlings prepared by Cleft or Apical wedge and side grafting

Pomato is an innovative and novel plant developed by inter-specific grafting of two solanaceous vegetables i.e. potato as rootstock and tomato as scion, and harvesting both potato and tomato from the same plant. It can have significant impact in developing countries, where farmers can save space, time and labor without affecting the quality of their produce by growing pomato. Similar to other solanaceous vegetables, pomato seedlings can be prepared by apical wedge (cleft) or side grafting. Grafted plants are immediately transferred inside the grafting chamber for 4-5 days wherein humidity, light and temperature are kept optimal. After that the healed plants are kept for 7-10 days in partial shade with relatively less humidity and higher temperatures for acclimatization. Before transplanting to field or pot, the grafted plants are exposed to full sunlight for another 5-7 days for hardening. Thereby, it takes around 20 days from grafting to transplanting of the seedlings.



Appropriate stage for harvesting potato



Indeterminate tomatoes are most suitable for pomato

far as developing pomato through genetic engineering (hybridization/ protoplast fusion) is concerned, Georg Melchers of Max Planck Institute for Developmental Biology, Tubingen, Germany carried out first successful experiment on pomato through somatic hybridization in 1977. However, the pomato did not form either real potato or real tomato. A successful pomato through hybridization was developed at Max Planck Institute for Plant Breeding Research in Cologne, Germany by Inca Lewen-Dorr in collaboration with Green Tech. Company in 1994. Pomato plants have been a potential technology to make crops more efficient, harnessing dual benefit from single plant that can be produced even on a small piece of land or pots in a small urban place like a balcony, giving more production per unit area.

Production of grafted plants

For rootstock, potato can be raised through TPS or tubers; however the small sprouted tubers are the best for raising rootstocks, as they sprout easily and produce sturdy stem suitable for grafting tomato scion. Potato tubers are either sown directly in big pots or in small polythene bags (1/2 kg capacity) filled with mixtures of soil, sand and FYM or vermicompost in ratio of 2:1:1 between August to October, so that tuberization and tuber growth takes place in an optimal ambient temperature range of 15-20°C. Potato tuber should be sown in big pots (10-12 inch diameter) filled with well pulverized soils and organic manures. Tomato as a scion (open pollinated or hybrid)

is sown 5-7 days after tuber planting in pots or potting plugs. When potato sprout become 7-10 cm (usually it comes 25-30 days after planting) and tomato develops one true leaf pair (usually 22-25 days after sowing), then rootstock and scion are considered ready for grafting. For preparation of pomato seedlings, usually cleft or apical wedge grafting technique is the best, since it is easy to graft with high success rate (85-90%). In cleft grafting (CG), the potato seedling is decapitated cleanly below the first leaves of potato. V-shape cut of about 1.0 cm deep is made in downward direction from the center of the decapitated rootstock seedling. For preparation of tomato scion, approximately two-thirds of the seedling stump (lower portion) should be removed. The scion is pruned to 1-2 true leaves, and the lower stem is cut to slant angle (45°) both sides to make a tapered wedge. After placing the scion into rootstock split, a clip is placed to hold it in position until the union.

Another method which can be practiced for preparing pomato is splice grafting or side grafting or slant-cut grafting (SG). In this method, a slant cut at 45° angle is made both in rootstock and scion at matching diameter and cutting length then clipped together with a silicone clip. Side grafted plants are strong enough to take all the rough post-graft handlings, whereas the cleft grafted plants are weak at grafting union. The success rate of grafting in SG is about 80%. Minimum leaves should be kept on scion so as to reduce transpiration and excess weight of scion.

Advantages of pomato

- Two crops (potato and tomato) can be taken up from single plant
- Less space is required; thereby it can grow in small piece of land or pots, or in balcony.
- Less inputs such as water, fertilizers, labour, etc. are required.
- It provide tolerance to major soil borne diseases of tomato.
- The taste of tomatoes and potatoes is not affected.
- Pomato has properties of both of its parents as it stands well against the cold like the potato and is tolerant to high temperature like the tomato.
- It is surprising venture for the visitors.

Disadvantages of pomato

- There is delay of about 2 weeks of the season (until the graft establishment).
- Fruits and tubers are slightly smaller than they grow independently.
- There is reduction in yields by 25-30% in both the crops.
- A special care of the plants is needed until the graft success.
- The success rate of grafted pomato is about 80-85%.

Soon after performing grafting operation, the grafted plants are transferred in the grafting chamber wherein the relative humidity is maintained above 85%, temperature between 24-28°C and light intensity of about 5 lux (nearly dark). In such condition, the grafted plants are kept for 4-5 days; thereafter the grafted plants are acclimatized in partial shade for another 7 days with gradual increase in light intensity and RH between 75-80%. Before transplanting, grafted plants are exposed to full light and moderate humidity for 7-10 days. Thus, from seed/tuber sowing to final transplanting, it takes about 50-55 days. Pomato prepared in polybags may be transplanted carefully in field or big pots.

Cultural practices

Grafted pomato plant can be transplanted in field at 75 × 50 cm spacing or in big pots (10-12 inch) filled with soil, sand and vermicompost or FYM (2:1:1). Soil should be light (sandy loam or loam), good in organic matter. While planting in fields, FYM at 20 tones/ha or vermicompost at 10 t/ha is applied at least 15 days before planting. Besides, NPK fertilizers are supplied @ 150:60:80 kg/ha. Half of N and full P and K are supplied in soil at the time of planting while rest of N is supplied in three splits, 30, 45 and 60 days after transplanting. Under drip fertigation system, water soluble fertilizer (19:19:19), potassium nitrate and calcium nitrate are scheduled twice a week, from 3rd week after transplanting @ 10, 4.5 and 4.5 kg/ha /application. When seedlings are to be planted in pots with 10 kg soil volume, about 1.10 kg FYM/ vermicompost, 5.5 g each DAP and MOP is mixed in soil. Rest of N in the form of Urea @ 12 g is supplied thrice, 30, 45 and 60 days after planting. Besides, 2-3 sprays of water soluble fertilizer (19:19:19) and micronutrient mixtures @ 4 g/ lit of water should be done. Surface irrigation is carried out when 25% soil moisture at 30 cm depth is depleted, mostly at weekly interval in light soil. Drip irrigation should be carried out at every alternate day for one hour with 2 lph drippers. Staking is very essential in pomato crop for obtaining

optimum yield of tomato, particularly with indeterminate or cherry tomato. Two hand weedings, followed by hoeing and earthing are required for proper growth of potato tubers. Management of pests (white fly, leaf miner and fruit borer) and diseases (early and late blight, *Rhizoctonia* blight) is essential as and when appears.

Harvesting and yield

Harvesting of tomato fruits start from 75 to 90 days after transplanting. Indeterminate hybrids have long growing periods (150-170 days) than the determinate (135-150 days). Usually 3-5 pickings of tomato may be done, whereas potato is harvested after senescence in scion plant (tomato), usually 150-160 day after planting. Study conducted at ICAR-IIVR, Varanasi so far revealed that about 1.5-3.5 kg tomato fruits and 0.50-0.70 kg potato tubers can be harvested from a healthy pomato plant raised in big pot.

Economics

Two vegetable crops *i.e.* potato and tomato can be harvested from single plant with almost same crop duration (October-March). It has been noticed that there is reduction of about 25% yield in both tomato and potato as compared to when they grow independently. In our experiment, we have harvested an estimated yield of 286.0 q of tomato and 130.0 q of potato from one hectare field. The total cost cultivation of pomato was ₹ 2,55,350.00, while net profit of ₹ 1,91,850.00 with benefit: cost ratio (B:C) of 1.75 was achieved by cultivation of pomato in one hectare area.

For further interaction, please write to:

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