TOMATO GRAFTING:
RAISING TECHNOLOGY IN INDIA

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HISTORY OF VEGETABLE GRAFTING:

Grafting is an asexual propagation process in which two living parts of plants (rootstock and scion) are combined to grow as a single plant. Grafting of woody plants has been prevalent for centuries, but herbaceous grafting in agricultural systems has only recently become common. Grafting of vegetable seedlings is a modern horticultural technology that is used globally under different conditions of environmental stress to resolve soil-borne diseases and pests or to improve plant vigour. Today particularly when there are restricted rotation or soil fumigation options, grafting is used. However almost all watermelons grown in Japan, Korea, southern Spain, southern Italy, Turkey, and Greece, are grafted, and the number of grafted tomatoes, eggplants, peppers, cucumbers, and melons are growing worldwide. Actively, 81% of Koreans and 54% of Japanese vegetable growers use grafting. Grafting has become a standard practise in hydroponic greenhouses to improve plant vigour and yield. Grafting is used not only to protect against diseases, but also to withstand abiotic stress such as floods, drought and salinity, temperature extremes, and excessive soil moisture. As a major component of an integrated management strategy for the management of soil borne diseases and increasing crop production, the use of grafting has been proposed

TOMATO GRAFTING:

Grafting on a variety of crops will take place however it is usually associated with melons, cucurbits, and members of the Solanaceae family, such as eggplants and tomatoes, because of the increased expense. As a way to minimise certain diseases caused by soil borne plant pathogens such as *Ralstonia solanacearum*, tomato grafting became prominent in the 1960.In Spain, the production of grafted tomato transplants increased from less than one million plants in 1999-2000 to more than 45 million plants in 2003-2004. Grafted tomatoes are also grown in France and Italy, and more than 20 million tomato plants were grafted in Morocco in 2004 as a way of reducing soil-borne diseases and increasing crop production.

In the production of saline-tolerant plants, grafting tomatoes with tolerant rootstocks has been extremely successful. Research shows that the translocation of sodium and chloride into the shoot is prevented by several rootstocks. Throughout vegetative growth and reproduction, the most economically important vegetable crops such as tomatoes are highly susceptible to thermal stress in the roots. The use of temperature tolerant rootstocks also contributes to the prolongation of the growing season in direction, resulting in better yield and economic stability throughout the year, whether using rootstock tolerant to hot or cold temperatures. Increase in fruit yield is usually the effect of increased fruit size in tomatoes. Research has shown that possible mechanisms for increased yield among vigorous rootstock genotypes are likely due to increased water and nutrient uptake. Conductance through the stoma was enhanced when grafted onto robust rootstock in tomato plants. The absorption of nutrients for macronutrients, such as phosphorus and nitrogen, was increased by grafting.

TOMATO GRAFTING METHODS:

For grafting vegetable crops, there are a number of techniques. When a V-shape is cut into therootstock, cleft grafting occurs and a complementary wedge-shaped scion is inserted. With a small clip, the graft is then retained until healing occurs. Approach grafting involves notching opposite sides of the rootstock and scion stems, and then using a clip to keep the stems together as they are combining. The original scion is then cut off from the desired rootstock until the graft has healed, and the unused rootstock is detached from the scion. Micrografting is a modern technique that has recently been implemented into hybrid tomato micropropagation processing. Micropropagated scion shoots grafted onto 3 week-old rootstock seedlings are

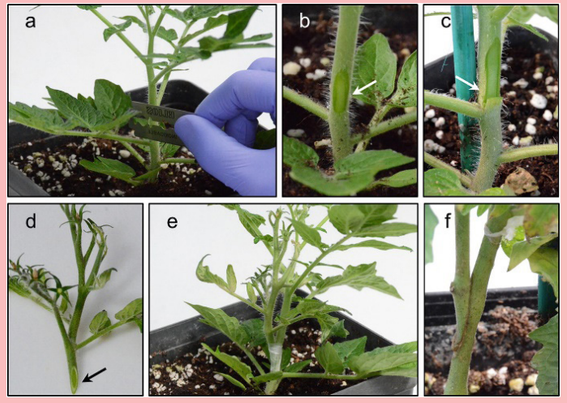
used in this technique. Tube grafting is the most widely used commercial technique for grafting tomatoes. When the scion and rootstock are severed as seedlings and re-attached with a thin, silicone tube or clip, tube grafting takes place. This method has been extremely efficient as it can be done when plants are very small, reducing the need for large healing chambers while increasing the yield. As the main method for vegetable grafting on the field, tube grafting has been adopted as it can be easily carried out with small healing chambers with standard success rates ranging from 85 to 90 per cent.

CLEFT GRAFTING:

When the plants are slightly larger, cleft grafting is carried out and a V-shaped cut is made in the scion stem. The scion is then implanted into the rootstock, which has the centre of the stem is cut down with a vertical slice. A spring clip then holds the rootstock and scion together while the graft union forms.

APPROACH GRAFTING:

By cutting opposing and complementary notches in the stem of the rootstock and scion, approach grafting is performed. With a spring clip or other sort of tape, the complementary notches match together and are retained. The root system is cut from the scion plant until the graft union has healed, and the shoot is stripped from the rootstock plant.

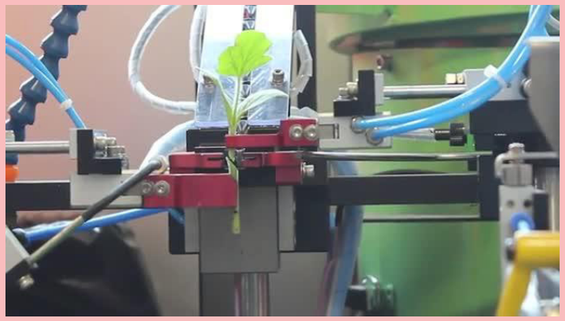


TUBE GRAFTING OR JAPANESE TOP-GRAFTING:

When the plants are very small, tube grafting or Japanese top-grafting is carried out and the rootstock and scion are held together with a 1.5-2 mm silicone clip or tube.

ROBOTIC GRAFTING:

1) Semi-automated Machine: The first model graft both cucurbits and tomato was widely marketed in Asia and North America, 600-950 grafts per hour at 5% or better success rate. Need 2-3 worker for asses that machine.



2) Fully automated Machine: Introduced in Japanese Market in 2009. Prepare 900 grafts per hour at 5% or better success rate need one worker for asses that machine.

TOMATO GRAFTING TODAY AND TOMORROW:

Despite the issue associated with the cost of grafted plants, the tomato grafting industry in the world has rapidly expanded in recent years. In the country, more seed companies are now bringing commercial solanaceous and cucurbit rootstock cultivars. Plants are now grafted in commercial nurseries in many states, targeting diverse markets of different production sizes, including supermarkets, greenhouses, high tunnels, and open fields. Currently new nursery operations are being established in partnership with different sectors of the vegetable fruiting industry. The number of tomato root stocks available in the world is increasing each year. Experimentation with grafted tomato processing is processing as a means of addressing problems associated with marginal land cultivation. Although it is currently difficult to document the exact number of grafted plants used in the world, grafting is now accepted in most regions as a sustainable cultivation technique and usage is expected to increase as the grafting industries develop and growers learn how to use grafting technology more effectively and efficiently, with increasing economic viability.