NEW ERA AGRICULTURE MAGAZINE

Grafting in Vegetable crops: An Overview

Dr. Budhesh Pratap Singh[1], Vidushi[2], Abhishek Gautam[3], Dr. Vijay Kumar Vimal[4] Badri Lal Nagar[5]

Introduction

For people to have a well-balanced diet, vegetables provide a substantial amount of dietary fibre, minerals, vitamins, and phytochemicals. Vegetable cultivation is crucial to Indian agriculture's ability to provide food security and nutrition. Vegetables are known as the "protected food" because they provide defence against certain degenerative diseases. Vegetables with grafts will boost the economy and help farmers improve their practices. India's varied year-round agro-climatic conditions allow for the year-round cultivation of a large range of vegetable crops. Data released later showed that India had significantly increased its vegetable production in comparison to global rankings since it started methodically increasing its vegetable yield in 1970. Grafting is a common method used in vegetable crops to boost output. The root structure of a vigorous plant. The new root system is called the rootstock, and the upper part, or cultivar of interest, is called the scion. The grafting success rate was for vegetable grafting. Grafting between species within the same genus is more compatible than grafting across genera within the same family, based on several research.Grafted vegetables are "physical hybrids" consisting of a rootstock and one or more scions, the first of which is utilised to provide necessary characteristics and the second of which bears fruit.

History of Vegetable Grafting

- In Japan and Korea in the 1920s, watermelon (*Citrullus lanatus* L.) was grafted onto pumpkin (*Cucurbita moschata* L.) in an attempt to combat fusarium wilt disease (Ashita, 1927; Yamakawa, 1983). This was the first attempt at vegetable grafting.
- On Scarlet eggplant (*Solanum integrifolium* L.) rootstock, grafting of eggplants (*Solanum melongena* L.) began in the 1950s (Oda, 1999).

Dr. Budhesh Pratap Singh[1], Vidushi[2], Abhishek Gautam[3], Dr. Vijay Kumar Vimal[4] Badri Lal Nagar[5]

[1]Ph. D. Research Scholar, Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, U.P.

[2]Ph.D. Scholar, School of Agriculture, Department of Horticulture, Phagwara , Punjab

[3]M.Sc. Student, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh

[4]Subject matter Specialist (Horticulture) Krishi vigyan Kendra, Kotwa Azamgarh-I

[5]Ph.D. Scholar, Department of Vegetable Science, Rajmata Vijayraje Scindia Krishi Vishwa Vidyalaya, Gwalior M.P.

Cucumber and tomato grafting followed in 1960 and 1970, respectively (Lee and Oda, 2003).

- In 2013, Dr. R.M. Bhatt & Co. started grafting at IIHR, Bangalore, India, with the goal of identifying rootstocks that thrive in damp environments.
- TNAU, Coimbatore: brinjal is grafted onto *S. nigrum* rootstock.
- NBPGR, Thrissur, Kerala's Regional Station *Momordica cochinchinensis* is a cucurbit plant that is grown for its edible oil.
- CSKHPKV, Palampur, started grafting and discovered the best rootstocks for resistance to nematodes and bacterial wilt in brinjal, chilli, tomato, and cucurbit rootstocks.
- Chhattisgarh's VNR Seed Private Limited is one of these seed companies, offering farmers grafted brinjal seedlings that are resistant to bacterial wilt. Another seed company working on vegetable grafting in India is called "Takii seed India private limited" (Kumar *et al*., 2015).

Objectives of Vegetable Grafting

1. To reduce both biotic and abiotic stresses.
2. Better attributes
3. Reduce the usage of pesticides
4. Increased energy and output
5. Environmental stress tolerance
6. Increased nutrition and water intake
7. Assist in producing unique attributes
8. Resistance to salt

Advantages of Grafting

1. The production and yield are significantly influenced by temperature, abiotic pressure, changes, and enhanced yield when feasible.

2. Grafting, which encourages the formation of disease and nematode tolerance, has been utilized to great efficacy in place of synthetic fungicides and pesticides to battle disease-causing pathogens prevalent in the soil.

3. Grafting has benefited the production of organic crops by eliminating the requirement for harsh chemicals to cure sickness. The ecosystem benefits from grafting as well.

4. It has the following benefits: improved water and nutrient uptake, high salt tolerance, wet soil tolerance, resistance to heavy metals and organic pollutants, quality variations, longer harvest times, and the ability to plant numerous or successive crops.

Disadvantages of Vegetable Grafting

1. Skilled labor is needed.

2. Selecting scion/rootstock pairings with care
3. Different farming season combinations;
5. Exorbitant seedling costs
6. An increase in the number of illnesses transmitted by seeds
7. A profusion of green vegetation
8. The picking of fruit could be interrupted.
9. Fruit with worse quality sugar content, colour, and flavour
10. An increase in the frequency of physiological circumstances
11. Signs of incompatibility in later stages
1. It is necessary for cultural behaviors to change.
12. The cost of grafted seedlings is higher.

Techniques for grafting

The methods used to graft a given rootstock and scion differ based on a variety of factors, including the goal of the grafting, the availability of manpower, infrastructure, and machinery, and the required grafting number.

Taking everything into account, there are two kinds of grafting methods: manual and mechanical. Hand grafting is still a popular practice, despite the development of several grafting machines and robots. The primary methods Grafting clefts, one cotyledon, and using a hole insertion Grafting Tubes Graft healing and pin grafting.

Grafting of Solanaceous vegetable crops

Grafting technique has been regularly employed in Vietnam to control tomato bacterial wilt, a disease that may otherwise completely destroy crops. Commercial tomato grafting began in the 1960s (Lee, *et al*.). Grafting onto resistant rootstocks can be a good therapy for some soil-borne diseases when breeding has not yet produced types with effective disease levels, however it can be expensive (Anonymous 2013). But due of high temperatures, floods, and precipitation, production-related issues including weeds, insect pests, and diseases like late blight and

Table 1. Rootstock and different methods for grafting in different vegetable crops Source: Maurya *et al.*

Scion plant	Rootstock	Grafting Methods
Tomato	*L. pimpinellifolium S. nigrum*	Cleft grafting and Tongue grafting
Eggplant	*S. torvum, S. sissymbrifolium, S. khasianum*	Tongue grafting, cleft grafting and both tongue and cleftGrafting
Cucumber	*Cucurbita moschata, C. maxima*	Tongue grafting and hole insertion grafting
Bitter gourd	*C. moschata, Lagenaria siceraria*	Hole insertion grafting and tongue grafting
Water melon	*Benincasa hispida C. moschata, C. melo, C. moschata × C. maxima, L. siceraria*	Hole insertion grafting, cleft grafting and splice grafting

Fusarium wilt can drastically lower the yield. One solution to the issues mentioned above is to graft tomatoes (Pogonyi, *et al*.) Flooding-related problems may be minimised and the plants will become more resilient to Phytophthora blight, bacterial wilt, and root knot nematodes by grafting sweet pepper onto certain rootstocks of chilli (hot) and sweet pepper (Anonymous 2009). Brindaval is widely planted worldwide and may be grafted, growing well in both tropical and temperate areas. According to Collonier et al., it is vulnerable to a variety of diseases and parasites, including nematodes, insects, Fusarium, and Verticillum wilts.

Graft compatibility and survival rate

Rootstocks have a variety of effects on the quality of scion fruit. The most common is when the scion and rootstock are incompatible, resulting in either an overgrowth or an undergrowth of the scion. This finally results in withering by reducing the flow of water and nutrients via the grafted union (Davis *et al*.). Rootstock/scion combinations should be carefully chosen for specific climatic and geographic circumstances in order to get a beneficial grafting impact on vegetable quality (Davis *et al*.). According to Petron and Hoover's research, grafted plants using *Solanum torvum* rootstock have the highest survival rate.

Current status of vegetable grafting

Because there is a high concentration of grafted vegetables, particularly cucurbits, East Asia is the greatest market for vegetable grafting. Grafted transplants make up 94%, 40%, and 99% of the watermelons grown in China, Japan, and Korea, respectively (Bie *et al*., 2017). Among other solanaceous crops, grafted transplants are utilised to grow about 60–65% of tomatoes, eggplants, and 10–14% of peppers. Grafted tomato transplants are used for all tomato growing in the Netherlands, which is done without the need of soil (Bie *et al*., 2017). Vegetable grafting is becoming more and more commonplace worldwide these days, but it is especially well-liked in the Philippines, India, North and South America, and Eastern Europe. Approximately 1500 commercial nurseries in China cultivate grafted transplants.