

Grafting of Tea Plant and Its Use for Propagation

By KIYOSHI KATSUO

Chief, Laboratory of Breeding, Tea Agronomy Division, Tea Research Station

Grafting of tea plant was carried out for the first time in Japan in 1902. Then it has been studied in Formosa, Indonesia and the U.S.S.R., and to make the process practicable has been considered as extremely difficult. This is, it is said, because tea plant has high tannin content, the stem tissue is compact, and so the callus development is slow.

Recently, the techniques on polyethylene bag, watering, and shading have been improved, so grafting of tea plant has become easy. It is seen that the union of the grafted parts is favorable, flowering is stimulated and the growth of the plants is remarkably rapid.

Consequently, grafting of tea plant is cleared to have a great utility value in shortening the period of breeding a new variety, in spreading the new one by rapid multiplication, and in replanting or renewing a low productive tea garden. Its practicability is highly expected in Japan, India and other countries.^{1), 2), 3)}

Time and method of crown grafting

1) Time of grafting

Grafting is favorably carried out during the time the stock tree begins to run its sap and the scion is still in dormancy. Grafting is practically conducted on the days of cloudy sky in the early spring, the middle or end of March, which results in the favorable union of the grafted part.

Grafting is still possible in May to July, though the rate of union is slightly reduced, and in case of the rapid multiplication of the plants selected during the first plucking season it is seen to be highly effective.

2) Scion

Scion in the early spring is taken from green-colored part near the tip of the shoot grown in the autumn of the previous year. The scion of which the lateral bud is substantial is more favorable in both union and growth. As in Fig. 1, these scions are pre-

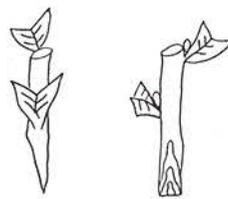


Fig. 1. Preparation of scion.

pared to have two nodes and two leaves respectively; the latter is cut off at about 1 cm from the leaf base. Then the lower end of the scion is sliced off about 1.5 cm to a degree that its cambium becomes visible, and the other side of the sliced part is cut off slightly. The scions are preserved in the cold and darkness at 5 to 10 degrees Centigrade taking care to prevent drying.

3) Stock

As stock that is used in crown grafting, it is desirable that the butt is single and big, and that the cortex is thick and easy to be peeled off. When a stock variety is early in comparison with the scions variety, the union of the grafted part is seen to be favorable.

4) Grafting method

We have two methods: cleft grafting and crown grafting; the latter is easy to be done, more favorable in union, and excellent in efficiency. In case of using a stock which is over

5 cm in diameter, the number of scions for crown grafting is adequate to be 3 or 4 per stock.

On a cloudy weather day stocks are cut off respectively at about 2 cm from the butt. The scions as is required to a stock are prepared previously and held in the grafter's mouth. The cut end of the stock is neatly prepared with a knife, then the cortex is made vertically two parallel cuts slightly wider than scions with a bud grafting knife. The cortex between the cuts is softly taken off with a spatula and its cambium comes to be exposed, in which a scion is inserted. The grafted part is tightly fastened with a vinyl tape (Fig. 2).

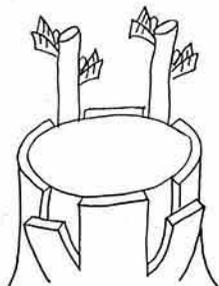


Fig. 2. Crown grafting.

The efficiency of grafting is, in case of 3 scions per stock, 120 to 160 stocks per person per day.

5) Preventing of drying

In grafting of tea plant, prevention of drying is of great importance, of which the methods are as follows:

a) Shading by polyethylene bag: The grafted stock, except the tips of the scions, is covered with the soil, and a small quantity of water is sprinkled on it with a watering pot, then a polyethylene bag (15 cm by 15 cm in dimensions; 0.05 mm thick) is put on the stock, being placed the soil round it to prevent it from being blown off (Fig. 3). And water is sprinkled thoroughly on it.

b) Watering: After grafting, watering is necessary for the grafted stock to have better union. Especially for the week after grafting, enough water should be sprinkled; in a day of fair weather 300 to 500 ml per stock twice a day, and during the next two weeks once

a day and after that once every three days.

c) Shade: To shelter the grafted stock from the direct sun, a horizontal shade, about 30 cm high, of rice or wheat straw is set up, preventing rise of the temperature in the polyethylene bag (Fig. 3).

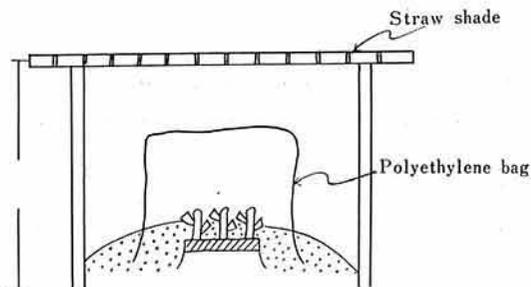


Fig. 3. Prevention of drying up after grafting.

6) Management of the stock after grafting

a) Removal of the polyethylene bag and of the shade: At about two weeks after grafting the lateral buds of the scion begin to grow slowly but the growing stops soon after. In 45 to 60 days after grafting a second growth will start, and when the shoots come to push up the polyethylene bag it is removed, which is safely carried out, in the days of rainy or clouded weather, exposing the shoots to the air gradually instead of removing at a stroke.

When the new branches will reach the straw shade three or four months after grafting, it should be removed in the days of rainy or cloudy sky. The scions will grow remarkably after removing the shade.

b) Countermeasure for wind: In grafting of tea plant a complete union of the grafted part takes seven months. In the season of strong wind or typhoon the soil is kept around the collar of the stock tree and the shores are set up to prevent peeling off or breaking down of the grafted parts.

c) Removal of axillary buds grown from the stock: When over two scions do complete union in a stock, the axillary buds seldom grow from the stock. Growing of them is often seen in the stock of incomplete union, and in the branch or root left uncut. In such a case they should be removed quickly, or the union

and growth of the scion are hindered afterward. Removal of the axillary buds can be carried out with ease in case of grafting in a discernible combination between stock and scions. Growing of the axillary buds is hardly seen the second year afterward in case of a complete union of more than two scions.

Union of the scion, the growth after grafting, and acceleration of flowering

The degree of union of the scion with the stock tree varies with the kinds and combination of them, the age of the stock tree, and the time of grafting. In grafting of three or four scions per stock at the proper time for grafting in the early spring, using mature stock trees, the rate of union is usually seen to reach over 95% in case of per stock and over 85% per scion.

Growth after grafting is remarkably rapid in comparison with that of cutting seedling. The height and width of the plant and the number and diameter of the shoot in the year of grafting correspond to those of cutting seedling in the second or third year after fix planting in the farm; the growth of the scion in the following year of grafting corresponds to that of the cutting seedling in the third or fourth year of fix planting, and the tea plants come to have nearly the growth, yield and garden phase of a mature tea garden in two years after grafting.

It takes seven to ten years to use in mating the tea plants which are grown from cutting or seedling and come into flower after fix planting to the farm.

On the contrary, in case of grafting flowering will start in the year of grafting or in the following year, and mating becomes possible two years later, and full seeds of which fruiting rate is high and germination is favorable will be obtained.

Effect of stock tree on growth, quality and chemical components of scion

Of the effects of stock tree on scions the

greatest is acceleration of growing. When the stock tree is big and vigorous, after grafting the scions show rapid growth and come to develop a mature tea garden in a short period of time. Any relation is not seen clearly between the degree of union and the scion's growth after the completion of union. The shapes of plants may be thought to be scarcely affected by the stock tree, for they show similar shapes when their scions are similar.

It is indicated that the tea quality of scions after grafting is not affected by the stock tree and the characteristics of the stock also do not appear in the scions. The stock's effect on the tea quality, therefore, is thought to be practically nothing. In addition, from the result of qualitative analysis of amino acids and catechins by paper partition chromatography, the chemical components of scions seem to be not affected by the stock tree.

Use of grafting and its effectiveness

Flowering of tea plants is accelerated by grafting. For example, about 500 flowers per stock bloom two years after grafting and about 250 grains of highly germinative seed per stock are obtained in the following year. In this way these valuable parents are quickly used for mating, and shortening the breeding period may be helpful for rapid growing of a new variety.

Up to this day tea plants have been propagated by cutting. Among them the Assam variety and the Assam hybrid are especially poor in rooting and therefore rapid propagation of their nursery plants cannot be done. Using, therefore, vigorous growth after grafting it is designed to produce a number of cuttings rapidly and to help spreading of a new variety by them. For instance, it takes seven years to obtain more than 200,000 nursery plants for 20 hectares of farm by the customary cutting method, using 100 mature mother plants. However, by grafting more than 300,000 cuttings can be obtained in the following year of grafting and over 200,000 nursery plants above mentioned are produced

in the four years after grafting.

Recently a simple rice straw shade and a grafting method using no water have been studied, and labor saving in the management of plants after grafting is being improved. From the results it can be prospected to use grafting effectively for replanting or renewal of the existing low productive tea gardens.

References

- 1) Sanai, H., Amma, S. and Matsushita, S.: On the Grafting of Tea Plant. Study of Tea Plant. 26, 5-11, 1962.
- 2) Grice, W. J.: Cleft Grafting. Two and a Bud 15 (2), 61-69, 1968.
- 3) Barua, D. N.: Bud Grafting. Two and a Bud. 15 (3), 103-109, 1968.