Labor-Saving Method of Tea Cutting by Using Vinyl Film Cover

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The traditional technique of tea cutting had been studied and developed by Oshida[1] and many other researchers of the Tea Research Station of the Ministry of Agriculture and Forestry[2),3)] as well as by other experiment stations. But the cuttings planted by the traditional method must be irrigated so many times that the culture of cuttings will need much labor. Thus, it was hoped the labor-saving method of cutting would be developed.

Moreover, we have tried to solve this problem by using vinyl film cover over the cutting bed, and finally, have concluded that this vinyl film covering method is less laborious and more stable for the propagation of cutting[8)].

The vinyl film which we have used is transparent. Its width is 180 cm and its thickness, 0.05 mm.

The cutting bed was irrigated sufficiently before and after the cutting, and then the cutting bed was covered with the vinyl film in a semi-circular form like the Quonset hut.

The height of this cover was about 40 cm and its lower parts were buried in the earth to close up the vinyl chamber. The cutting bed was never irrigated during the covered period.

As soon as the cover was accomplished, the sunshade was set horizontally to the cutting bed at a height about 10 cm above the top of the vinyl cover. This sunshade was kept as it was even after the removal of the cover, however, its thickness was gradually decreased as days passed by, and the whole shade was taken off at the end of about 30 days.

The width of the cutting bed was 120 cm and the other treatments except the experimental matters were the same as the traditional method.

Comparison between vinyl covering and traditional methods

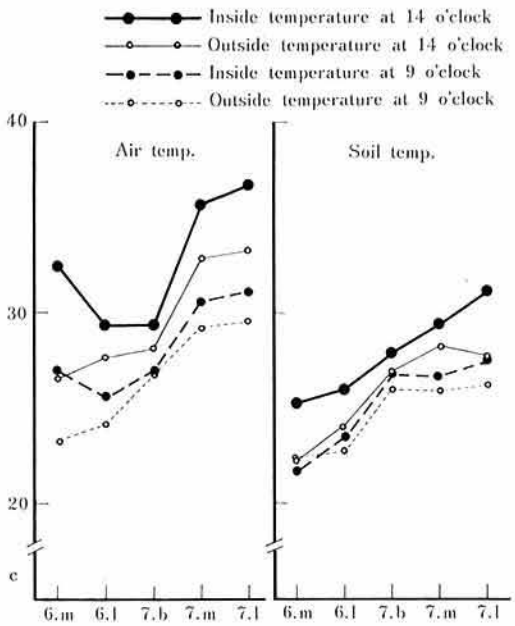
The tea plant variety used in this experiment was YABUKITA. The cutting was carried out on June 9 and the vinyl cover was removed at the end of 45 days after the cutting (the rooting was generally finished at this time).

The covered cutting bed was not at all irrigated during the covering period while the traditional non-covered cutting bed was irrigated about 30 times during the same period.

The temperatures of air and soil inside the vinyl cover were higher than that of outside, that is, about 1°C at 9 o'clock in the morning and 2–3°C at 2 o'clock in the afternoon.

The plant growth inside the cover was rapid but the plant bodies were rather feeble compared with that of the outside. As for the root formation of covered plants, the ramification of root was numerous but the roots were rather thin.

When the cover was removed the plant growth stopped temporarily affected by the sudden fall of humidity. Therefore, the growth of new shoots and roots of the plants covered in autumn were inferior to that of non-covered plants. But all the cuttings covered with the vinyl film survived, and many good saplings were produced.



6. m : middle 10 days of June
6. l : last 10 days of June
7. b : beginning 10 days of July, etc.

Fig. 1. Difference of temperature between the inside and outside of vinyl film cover (mean values of every 10 days)

Thus, the cutting in June, when it was covered with the vinyl film, is successful and labor-saving without any irrigation during about 45 days, as the humidity of the soil is maintained in proper condition even in the long rainy season.

Duration of covering and light permeability of sunshade

We conducted a successful experiment to find out the duration of covering for tea cutting. The cuttings of the variety YABUKITA were planted on June 13 and immediately covered with vinyl film for 30 days, 45 days and 60 days. And at the end of each covering duration, the covers were removed and the plants were investigated.

As for the plants covered for 30 days, 15% of them had not yet rooted and the rest of the 85% were rooted but for a short time. The new shoots and roots of the cuttings which were covered for 45 days developed better than those covered for 30 days.

The growth of the plants covered for 60 days was still more better, but some of the leaves of their new shoots were damaged due to the high temperature (more than 40°C at the inside of the cover) caused by the summer heat.

Consequently, we have estimated that the adequate covering duration for tea cutting in June must be from 45 to 50 days.

The sunshade must be set as soon as possible after the covering to protect the plant leaves from sunburn. Sunshade which is too thin may cause damage to the growth of cuttings because their leaves could be injured by the high temperature under the vinyl cover. Subsequently, we examined the proper light impermeability of sunshade for the growth of cuttings. The light impermeable values of used cloth (No. 600 black lawn) were as follows; single sheet—48.0%, double sheets—77.0% and triple sheets—87.0%.

In this experiment, the sunshade was kept horizontally 10 cm above the vinyl cover so as not to touch directly with it. The used variety of plant was YABUKITA, the cutting was

Table 1. Comparison of the development of tea cuttings between vinyl film covering and traditional methods

Time of investigation	Method	Survival percentage (%)	Length of new shoots (cm)	Dry weight of new shoots (g)	Number of roots	Length of roots (cm)	Dry weight of roots (g)
45 days after cutting	Covered	100.0	6.17	0.124	105.0	5.74	0.098
	Traditional	96.6	1.89	0.044	77.1	7.67	0.154
5 months after cutting	Covered	100.0	12.64	0.146	89.3	15.83	0.113
	Traditional	95.0	18.37	0.211	90.4	17.50	0.110

Table 2. Development of tea cuttings at removal time of vinyl film cover in the investigation of sunshade thickness

Number of lawn cloth sheets	Survival percentage	Length of new shoots	Number of roots	Length of roots	Dry weight of roots
	%	cm		cm	g
1 sheet	0.7	—	—	—	—
2 sheets	90.0	3.04	30.7	4.79	0.062
3 sheets	96.4	6.50	82.5	7.53	0.186

operated on June 20 and the cutting bed was covered with the vinyl film for 45 days. (Table 2)

As the results, the single sheet of No. 600 black lawn was not sufficient to prevent sunshine, the temperature inside the cover rose to 52°C and almost all of the cuttings were dead.

On the contrary, under the shade of double sheets, practically all the cuttings (99%) survived. However, the development of their new shoots and roots was not good because one-half of them were inferior to that of the triple sheets shade.

The growth of cuttings under the triple sheets shade was the best so it seemed that the best light impermeability of sunshade must be kept at about 85% for which the triple sheets of No. 600 black lawn appear to be convenient.

Maturity of cuttings and the number of leaves remaining on the cuttings

We have carried out some experiments to find out when the cutting must be brought about and how many leaves must remain on the cuttings to get more vigorous saplings.

The variety of tea plant used for this experiment was YABUKITA, and the cuttings were planted on May 10, May 20, May 30 and June 10. The body plant of cuttings, planted earlier was soft and feeble and the air-dried weight of plant cut on May 10 was as much as one-half of that cut on June 10.

Even the cuttings planted on May 10 (the season of the first tea crop) survived quite well because the transpiration from leaves was prevented by the high humidity under the cover.

As for the relation between the date of cutting and the survival as well as rooting of cuttings at the end of 45 days after the cutting, the later, the better.

But in autumn, the growth of new shoots and roots of the cuttings planted on May 20 was the best. The survival percentage of the cuttings planted on May 10 was 75% and that of May 20 was 88%, that is, the later, the better.

In the tea cutting method using vinyl film cover, the cutting may be successful when it was accomplished after May 10. However, the production of cuttings is not yet abundant at this time and also this is the time of the first tea crop season so it is desirable to accomplish the cutting as soon as possible after

Table 3. Investigation on the number of leaves remaining on the cutting (development at the end of 45 days after cutting)

Number of remained leaves	Survival perecentage	Number of new shoots	Length of new shoots	Number of leaves	Dry weight of new shoots	Number of roots	Length of roots	Dry weight of roots
	%		cm		g		cm	g
1 leaf	100.0	0.55	1.17	0.90	0.034	19.5	3.74	0.037
2 leaves	100.0	0.75	2.26	1.45	0.063	45.8	5.89	0.071
3 leaves	100.0	1.10	4.50	2.50	0.095	41.7	7.05	0.104
4 leaves	98.8	0.90	4.30	3.55	0.094	137.1	9.15	0.318

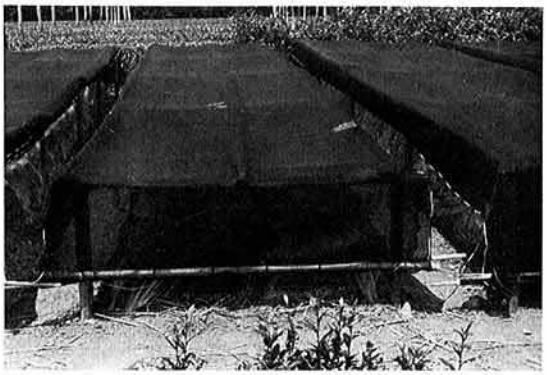
the first tea crop.

As for the number of leaves remaining on the cuttings, the more, the better, for the development of new shoots and roots unless the survival percentage of the cuttings decreases[6),7)].

On June 13, we planted the cuttings of YABUKITA which were kept with 1, 2, 3 and 4 leaves respectively. At the end of 45 days after the cutting, almost all of them survived. The development of new shoots of the cuttings which had two leaves was two times as much as that of one leaf, that of three leaves attained twice as much as that of two leaves, and there was not much difference between the development of new shoots of the cutttings which had three leaves and that of four leaves.

Regarding the relation between the number of remained leaves and the development of roots, the more leaves remained, the more roots developed. Also in the investigation conducted in autumn, 87% of the cuttings which were kept with four leaves survived and it was the best of all.

Before covering



After covering

Fig. 2. Labor-saving method of tea cutting by using vinyl film cover

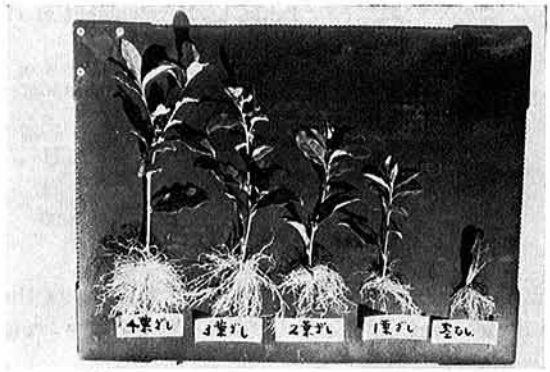


Fig. 3. Number of leaves on the cutting (after three months)

The development of new shoots and roots of the cuttings which retained more leaves was more abundant. And from these cuttings, many good saplings were obtained. Thus, the leaves can be kept unwithered by the utilization of vinyl film cover so it is better to have three to four leaves remain on a cutting for the development of the plant.

Cuttings in spring and autumn

The cuttings planted by the traditional method in October formed only the callus but did not root well, and practically all of them blighted in winter[5)].

We tried out some experiments on the cutting in autumn using the vinyl film cover. The variety of tea plant used for this experiment was YABUKITA, and the cuttings were planted on Sept. 20, Oct. 2 and Oct. 17. The plant were examined at the end of 45 days after the cutting but the vinyl cover was not removed until about the middle of April.

As the temperatures of the air and soil inside the vinyl cover were raised 2–3°C higher than that of the outside, the percentage of rooting of the cuttings planted before Oct. 2 attained to 100% in November, and that of planted on Oct. 17 attained to 60%. And they

Table 4. Development of cuttings planted in autumn (Dec. 5)

Dates of cutting	Root formation percentage	Number of new shoots	Length of new shoots	Number of leaves	Dry weight of new shoots	Number of roots	Length of roots	Dry weight of roots
	%		cm		g		cm	g
Sept. 20	100.0	0.8	2.71	2.0	0.058	48.9	5.54	0.112
Oct. 2	100.0	0.9	0.71	0.65	0.019	13.9	3.19	0.036
Oct. 17	60.0	0.8	0.20	0	0.008	4.9	0.31	0.001

were not blighted at all even in winter as the vinyl cover protected them from the cold weather.

The cuttings planted on Oct. 17 did not root in November, however, they rooted in spring, and in the following autumn, many good saplings whose length attained to more than 60 cm were produced, and the saplings of uniform length were obtained from the cuttings planted in later season.

The cutting by the vinyl film covering method in autumn should be accomplished at the beginning of October because it is the farmer's slack season and surplus labor is abundant. (Table 4)

We have carried out some experiments to find out the limit of the possibility to accomplish the successful tea cutting in March by the vinyl film covering method.

The varieties of tea plant used for this experiment were YABUKITA, HIMEMIDORI and Z-1, and the vinyl cover was removed on June 21. The results of experiments were compared with that of the traditional method.

The soil temperature was not so high as to make sufficient development of roots until the beginning of May so the roots began to develop from the end of 45 days after the cutting (middle of May), and fully developed at the end of 65 days after the cutting (June 2).

On June 2, the survival percentage of the cuttings covered with vinyl film reached more than 90%. This value was superior to that of traditional cutting and their new shoots and roots developed were about twice as good as that of the traditional one.

In autumn, the growth of saplings produced by the vinyl film covering method was also found to be twice as good as that of the traditional one (the saplings of YABUKITA developed to the length of 41 cm).

Thus, the cutting with vinyl film cover is available to propagate new variety of tea plant as it is successful even at the end of March.

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