Control of Tea-Plucking Time by Using Plant Growth Regulators

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Tea plucking is performed three to four times a year in Japan. The first crop is harvested late in April to early in May and called "Ichibancha" (first crop of tea). For plucking, hand shears or power pluckers are used to harvest nearly all flushes growing at that time. After plucking new flushes grow again after 40–50 days to be harvested as the next crop.

In this way the harvest is repeated 3–4 times a year, but the best plucking period in each harvest season is so short that a small number of operating days in tea factories and a shortage of labor for plucking come into question.

For solution of these problems various methods to control the coming of plucking time have been studied these several years.

There are such controlling methods as combined planting of clones different in sprouting time, change of training time and use of shading, etc. However, each of these methods has some weak points, being subject to restriction in its application.

Contrary to these, the use of plant growth regulators has such advantages that it can be applied to control the approach of plucking time systematically and performed in existing tea fields.

The study of this method started around 1965 and has recently developed into a practical technique.[1), 2), 3)] An outline of it will be introduced in the following:

Chemicals for promotion of sprouting and growth of tea shoots

Some dozens of growth regulators were investigated for the purpose of controlling the growth of tea shoots, and gibberellin only was found to have a remarkable effect on the promotion of sprouting and growth.

The spraying of gibberellin in early spring breaks the dormancy of buds and induces considerably earlier start of sprouting than in non-treated tea plants, promoting also the growth of shoots. (Fig. 1)

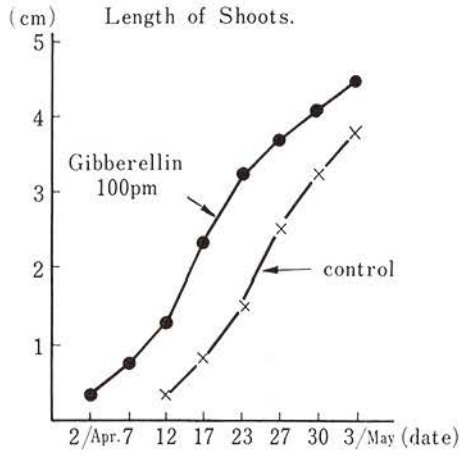

Fig. 1. Growth of tea shoots sprayed with gibberellin.

The treatment with gibberellin causes vigorous internodal growth of shoots and, as a result, an increase in their length. The leaf color changes to yellow, but this change has no influence on the quality of green tea produced from them.[4)]

The effective concentration of gibberellin is 50–200 ppm for this purpose. The applica-

tion of a weak solution by 2–3 times repeated sprayings is more effective than that of a strong solution at a time.

The best time of gibberellin spraying for the first plucking season is about two weeks before the sprouting (middle to end of March), and the spraying is repeated once or twice at intervals of a week if it is necessary.

For the second plucking season, spraying immediately before sprouting gives the best result.

If the growth of shoots is promoted in this way in the first and second plucking seasons, early sprouting is brought about without spraying in the third season, resulting in early plucking.

Chemicals for the inhibition of sprouting

If plant growth is delayed by an inhibition of sprouting for a certain time, the approach of the plucking period will naturally be put off.

To obtain sprouting-inhibitors fulfilling the above-mentioned requirement, various chemicals, as auxin-type herbicides, Anti-auxin and Retardant, and MCP (2-methyl-4-chlorophenoxyacetic acid), MCPP (α-(2-methyl-4-chlorophenoxy) propionic acid) and MDBA (2-methoxy-3, 6-dichlorobenzoic acid) were picked up.

These chemicals are all auxin-type herbicides. But if they are applied at a proper time at a suitable concentration, sprouting, consequently the beginning of growth, is delayed in tea plants, and the plucking period can be put off (Fig. 2).

When the chemicals are sprayed repeatedly at a low concentration, the inhibitory effect is greater in proportion to the frequency of spraying.

The best time of spraying these chemicals is about two weeks before sprouting (middle-end of March) for the first crop season and immediately after the first plucking for the second season. Spraying is not necessary for the third crop because the delays caused by the treatments in the first and second seasons remain as they are to delay sprouting in the third season.

If repeated sprayings are necessary, it is recommended to do them 2 or 3 times before

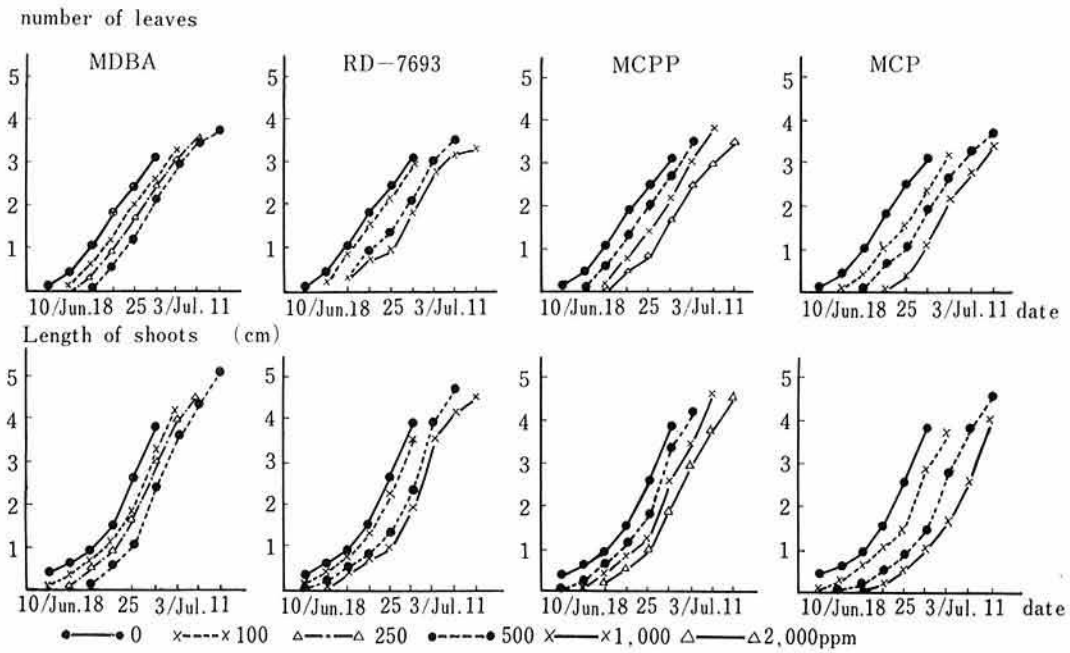

Fig. 2. Growth of tea shoots sprayed with sprouting inhibitors.

and after the best spraying time for each season at intervals of about a week. In any event spraying must be avoided after the beginning of sprouting to prevent injury to the flushes.

A suitable range of chemicals to be applied is 100–1,000 ppm in MCP, 500–2,000 ppm in MCPP and 100–500 ppm in MDBA. The concentration of chemicals applied has relation to the length of the effective period for inhibition of sprouting. And the higher the concentration is, the longer the effective period.

But if the concentration is higher than the above-mentioned limits, spraying will do damage to mature leaves, causing them to fall.

When the chemicals are sprayed repeatedly, they must be applied at the lowest concentration in the range mentioned above. The suitable amount of chemical solutions to be sprayed is about 2,000 *l*/ha.

According to the experiments carried out until now, the relation between the concentration of chemicals applied and the regulated range of the best plucking period (a duration within which the plucking period can be advanced or delayed) is as shown in Table 1.

Table 1. Relation between the amount of chemicals applied and the regulated range of the best plucking period

Chemical	Amount per ha	Regulated range of the best plucking period (days)		
		1st plucking season	2nd plucking season	3rd plucking season
Gibberellin	200 g	−2∼−4 days	−2∼−4 days	−2∼−4 days
MCPP	1,000	4∼ 6	3∼ 4	2∼ 4
	2,000	6∼10	10∼15	6∼12
	4,000	12∼14	15∼20	10∼16
MCP	200	3∼ 5	3∼ 5	3∼ 5
	1,000	12∼14	14∼15	10∼14
	2,000	16∼20	20∼25	18∼20

Note −: Advance of plucking time

The relation between the number of spraying times and the regulated range of the best plucking period in the first season is shown in Table 2.

Table 2. Relation between the number of spraying times and the regulated range of the best plucking period

Number of spraying times	MCPP 1,000 g/ha	MCP 400 g/ha	MDBA 200 g/ha
	days	days	days
1	4∼ 6	5∼ 8	3∼ 5
2	6∼10	10∼14	7∼10
3	10∼14	15∼18	12∼16
4	14∼18	20∼22	—

Namely, to arrange for the successive approach of the best plucking times at intervals of four to five days (plucking in each lot of a tea field is finished during the days) in the first season, it is recommended to spray MCPP at three-graded concentrations, 500, 1,000 and 2,000 ppm, and also to apply MCP at 1,000 ppm and gibberellin at 100 ppm. By these treatments green leaves at the best plucking time will be harvested over more than three weeks.

Scheduled plucking by the application of chemicals

The length of each plucking period can be regulated by application of the chemicals at different concentrations or by different times of spraying of them. And if a tea field is divided into several lots and scheduled sprayings are performed in them at different concentrations of chemicals or by different times of applications, tea leaves at the best plucking time will be harvested over a period of 2–3 weeks.

If the chemicals are sprayed immediately after the plucking in the first season at half the concentration of each grade for the first season, the tea-plucking period in the second season can be regulated to nearly the same extent as in the first season.

The results of regulations in the first and second seasons are brought into the third season as they are, so spraying of chemicals is not needed for the third crop as mentioned above.

Such a plucking schedule is shown diagramatically in Fig. 3.

Effects on the control of plucking times by application of growth regulators on the yield and quality of green tea

The foregoing effects are shown in Table 3.

There was practically no effect of the control on an annual yield, though the treated lots showed a slight increase in yield in the first season and a little decrease in the second and third seasons.

The green tea from the treated lots was a little inferior in quality to that of the non-

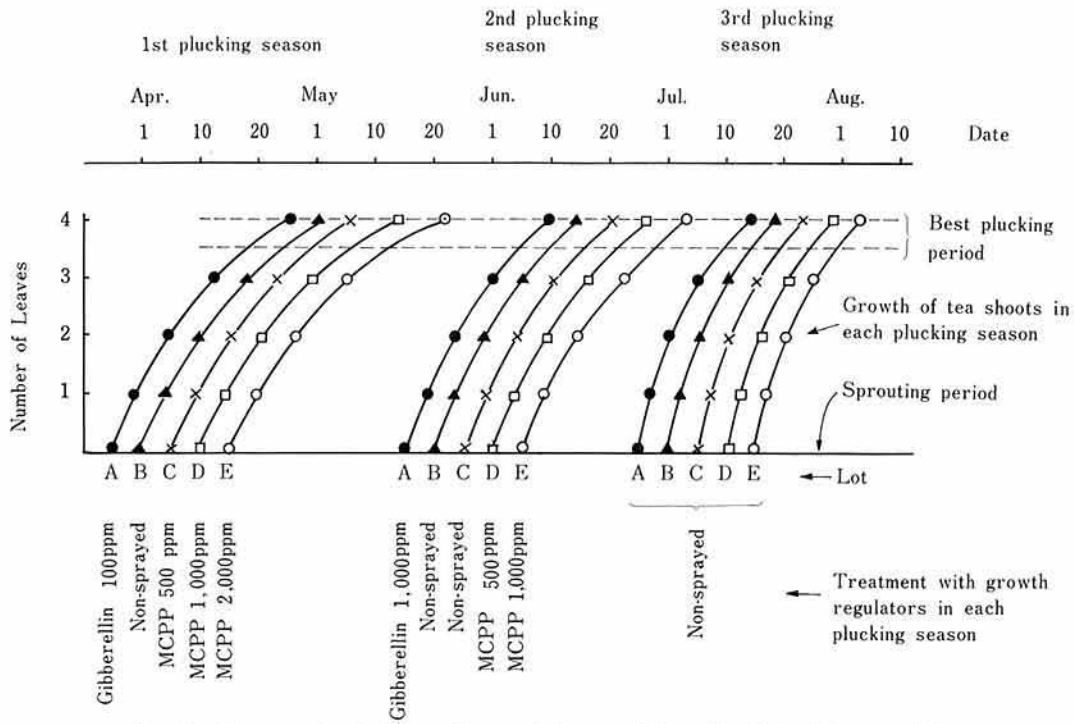

Fig. 3. Treatment with growth regulators and length of plucking periods.

Table 3. Effects of the regulation of plucking periods by the application of growth regulators on the yield of green leaves and the quality of tea produced

Item	Amount of chemicals applied (g/ha)		Regulated range of plucking period (days)			Yield of green leaves (kg/ha)				Quality of tea (Index)			
Season	1st	2nd	1st	2nd	3rd	1st	2nd	3rd	Total	1st	2nd	3rd	mean
Chemical													
Gibberellin	200	200	−2	−4	−2	5,890	6,780	6,390	19,060	101	96	101	99.5
MCP	200	0	5	3	3	5,830	8,170	7,220	21,220	105	95	96	99.1
	1,000	200	12	15	10	8,720	6,500	6,220	21,440	88	91	90	89.8
	2,000	1,000	16	25	18	8,170	5,940	5,390	19,500	92	86	83	87.5
MCPP	1,000	0	7	4	3	8,170	7,830	6,890	22,890	94	101	105	99.5
	4,000	2,000	14	23	16	8,170	6,890	5,890	20,950	90	94	84	89.8
Non-sprayed	—	—				5,780	7,060	7,220	20,060	100	100	100	100.0

Note —: Advance of plucking time

treated one. And the later the plucking period was, the more remarkable this tendency.

But an annual gross earning from the treated lots bore comparison with that of the non-treated one. It is considered, therefore, that the purpose of regulating labor for tea plucking can be achieved sufficiently by using plant growth regulators.

References

1) Nakayama, A. and Sanai, H.: The effect of growth regulators on development and growth of tea bud. (Part 1) Retardation of growth by some chemicals. *Study of Tea* No. 31 23–38 (1965).
2) Sugii, S. and Yanase, Y.: Studies on the extension of tea-plucking period by the plant growth regulator. (Part 1) On the effect of the concentration and opportunity of the leaf spray by some growth regulators. *Study of Tea* No. **36**, 6–20 (1968).
3) Sugii, S., Yanase, Y., Tanaka, S. and Kikkawa, S.: Studies on the extension of tea-plucking period by retarded plucking regulators. (Part 2) On the effect of retarded plucking period upon the yield and qualities of tea in each season. *Study of Tea* No. 37, 1–10 (1969).
4) Torii, H. and Nakagawa, M.: Growth-promoting effect of gibberellin upon the tea shoot. *Study of Tea* No. 20, 19–33 (1959).