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EFFECT OF SPRAYS OF THE BIOSTIMULANT ERGOSTIM ON GROWTH, RECOVERY FROM PRUNING AND YIELD OF TEA (*CAMELLIA SINENSIS L.*)

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The effect of a range of concentrations of Ergostim on growth, recovery from pruning and yield of tea of different ages were studied. Foliar sprays of the concentration range 0.025-1.6 ml/l on young plants showed that best overall growth was obtained at the range 0.05-0.2 ml/l when the recommended fertilizer level was applied. A better response was obtained when the plants were given double the recommended level of fertilizer. Ergostim sprayed onto the pruned frames of mature bushes resulted in better recovery in terms of numbers of emerging buds and increased yields at 17 and 25 weeks after first spray application. Irrespective of harvesting bud + 2 leaves or bud + 3 leaves, improved crop was obtained after Ergostim spraying.

INTRODUCTION

Tea plants in the nursery are fertilized at regular intervals commencing from the time of rooting as fertilizer is needed for the vigorous growth of these plants. In tea nurseries a widely used fertilizer mixture is T 65 (Tolhurst and Visser, 1961). Several biostimulants have appeared in the market which, at best, could be regarded as supplements to the commonly used fertilizer mixtures. One such biostimulant is Ergostim, a formulation containing the amino acid L-cysteine and the vitamin folic acid which is claimed to allow the best utilization of the nutrient elements already available to the plants.

This study reports the results of a series of experiments on the effect of Ergostim on growth, recovery and yield of tea at different stages of growth.

MATERIALS AND METHODS

Studies on young tea

Effect of different concentrations of Ergostim on growth of young tea maintained at two levels of fertilizer

Ergostim was sprayed at the following concentrations on 6-month-old plants of clone TRI 2025:

(1) Control; (2) 0.2 ml Ergostim in 1 l water; (3) 0.4 ml/l; (4) 0.8 ml/l; (5) 1.6 ml/l.

The fertilizer levels were: F_1 = the recommended level of fertilizer, and F_2 = double the recommended level.

Both the Ergostim sprays and the fertilizer applications commenced on the same day. Ergostim was sprayed on seven occasions at about 5-day intervals. There were 10 plants for each Ergostim treatment at each fertilizer level.

Effect of low concentrations of Ergostim on growth of young tea

Ergostim was sprayed on 12 occasions at 5-day intervals on 10-month-old plants of clone TRI 2025 at the following concentrations:

(1) Control; (2) 0.025 ml/l; (3) 0.05 ml/l; (4) 0.1 ml/l; (5) 0.2 ml/l; (6) 0.4 ml/l.

The treatments were replicated 4 times.

Studies on mature tea

Effect of different concentrations of Ergostim on recovery after pruning and on yield

Ergostim was sprayed on four occasions onto the pruned frames of mature tea clones TRI 2025 and DT 1 at the following concentrations:

(1) Control; (2) 0.02 ml/l; (3) 0.04 ml/l; (4) 0.08 ml/l; (5) 0.16 ml/l; (6) 0.32 ml/l.

The treatments were replicated 4 times. A bud count was made 3 months after the first spray. The yield of the treated plots were recorded at weekly intervals.

Effect of Ergostim on yield of tea harvested as two plucking units and at three frequencies

Ergostim was sprayed four times at 5-day intervals at a concentration of 200 ppm on clone TC 9 which was in plucking. In this trial three plucking frequencies (7, 10 and 14 days) were compared with two plucking units (bud + 2 and bud + 3 leaves). The treatments were replicated 4 times. Yield records were maintained over a period of 5½ months.

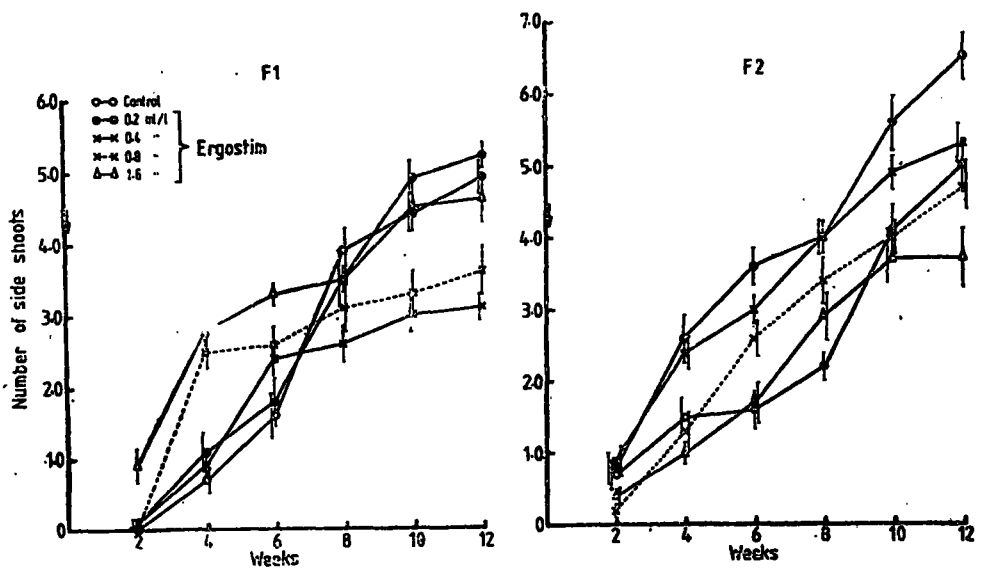

Fig. 1. — Effect of different concentrations of Ergostim on number of side shoots (means of 10 plants). Vertical lines indicate ± standard errors for each point, offset for clarity.

TABLE 1 — *Effect of different concentrations of Ergostim on mean length (cm) of side shoots of young tea plants maintained at two levels of fertilizer (means of 10 plants)*

Treatments	*Weeks after first spray*					
	2	*4*	*6*	*8*	*10*	*12*
F_1						
Control	0	2.1 ± 0.31	6.0 ± 0.43	15.7 ± 0.36	26.5 ± 0.38	30.0 ± 0.36
0.2 ml/l	0.3 ± 0.11	3.7 ± 0.64	6.9 ± 0.55	16.1 ± 0.55	29.3 ± 0.36	34.5 ± 0.38
0.4 ml/l	0.2 ± 0.13	3.0 ± 0.73	10.8 ± 0.51	13.9 ± 0.66	17.3 ± 0.64	19.5 ± 0.60
0.8 ml/l	0	9.0 ± 0.42	12.4 ± 0.43	14.2 ± 0.62	17.7 ± 0.40	21.3 ± 0.43
1.6 ml/l	2.4 ± 0.76	10.6 ± 0.27	16.5 ± 0.45	19.1 ± 0.55	23.8 ± 0.50	27.9 ± 0.51
F_2						
Control	1.7 ± 0.63	6.0 ± 0.40	7.1 ± 0.46	10.0 ± 0.46	20.8 ± 0.48	30.6 ± 0.56
0.2 ml/l	2.0 ± 0.57	9.0 ± 0.39	12.9 ± 0.31	17.9 ± 0.38	33.4 ± 0.44	44.5 ± 0.51
0.4 ml/l	2.2 ± 0.18	8.5 ± 0.32	14.2 ± 0.50	19.5 ± 0.51	33.6 ± 0.49	40.1 ± 0.55
0.8 ml/l	0.4 ± 0.50	5.1 ± 0.67	14.2 ± 0.49	22.5 ± 0.50	28.5 ± 0.50	35.4 ± 0.58
1.6 ml/l	1.2 ± 0.58	3.6 ± 0.45	7.8 ± 0.38	15.9 ± 0.44	36.5 ± 0.48	41.0 ± 0.55

TABLE 2 — *Effect of different concentrations of Ergostim at two fertilizer regimes on dry weight (g) of young plants (means of 10 plants)*

Treatments	Stems			Leaves			Roots	Plants
	Main stem	Side shoots	Main + side shoots	Main stem	Side shoots	Main + side shoots		
F1 level								
Control	2.48	0.28	2.76	3.11	1.12	4.23	2.45	9.44
0.2 ml/l	2.65	0.34	2.99	3.19	1.31	4.50	2.47	9.96
0.4 ml/l	2.19	0.21	2.40	2.88	0.87	3.75	2.29	8.44
0.8 ml/l	2.71	0.24	2.95	3.31	1.02	4.33	3.05	10.33
1.6 ml/l	2.91	0.35	3.26	3.26	1.33	4.59	3.60	11.45
F2 level								
Control	2.71	0.28	2.99	4.68	0.91	5.59	2.42	11.00
0.2 ml/l	3.16	0.45	3.61	4.19	1.58	5.77	2.78	12.16
0.4 ml/l	2.66	0.42	3.08	4.53	1.56	6.09	2.55	11.72
0.8 ml/l	2.63	0.39	3.02	4.56	1.39	5.95	2.78	11.75
1.6 ml/l	2.51	0.42	2.93	4.09	1.49	5.58	2.84	11.35

TABLE 3 — *Effect of low concentrations of Ergostim on growth in height (cm) of young tea (means of 40 plants)*

Treatments	*Weeks from first spray application*												
	0	*2*	*4*	*6*	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*
Control	16.50	17.75	19.25	19.25	21.50	23.50	27.75	30.25	34.50	39.00	45.00	49.25	56.25
0.025 ml/1	17.25	18.25	18.75	19.25	21.75	24.25	27.00	30.50	33.50	37.25	45.00	47.50	53.25
0.05 ml/1	18.50	19.25	19.75	20.00	21.75	24.75	27.50	29.75	32.75	38.00	42.50	48.00	52.50
0.1 ml/1	16.75	18.25	19.50	19.75	22.25	26.00	30.75	32.50	35.50	41.00	43.75	53.50	58.00
0.2 ml/1	17.25	18.25	19.25	19.75	21.75	25.00	28.25	31.25	34.00	39.75	48.00	58.75	55.50
0.4 ml/1	17.00	18.25	19.00	19.50	22.25	25.25	29.00	31.25	34.25	38.50	45.00	50.00	56.50
LSD (P = 0.05)	NS	NS	NS	NS	NS	1.16	1.92	NS	NS	NS	NS	NS	NS

RESULTS AND DISCUSSION

When different concentrations of Ergostim were sprayed to young tea plants maintained at two levels of fertilizer it was seen that the 0.2 ml/l concentration produced more and longer side shoots when the plants were maintained at the recommended level of fertilizer application from the 8th week from first spray until the conclusion of the experiment at 12 weeks (Fig. 1, Table 1). The higher concentrations of Ergostim (0.8 ml and 1.6 ml) were effective only during the first 8 weeks which resulted in greater dry weight of the plant and its parts (Table 2) indicating that the responses to the higher concentrations decreased as such high levels may have proved inhibitory. At the higher level of fertilizer the 0.2 ml/l concentration again proved to be the most effective and the response was even better than at the F_1 level as the dry weight of the plant was also greater. It has been shown that clones differ in their fertilizer requirements and that enhanced levels of fertilizer are needed for the vigorously growing clones (Kathiravetpillai, Kulasegaram, Senanayake and Gunasena, 1976). Ergostim is a biostimulant for crops, claimed to contain an amino acid L-cysteine and a vitamin folic acid. It is possible that the amino acids and vitamins in the Ergostim enabled the better utilization of higher levels of fertilizer resulting in better plant growth. When lower concentrations of Ergostim were applied on 10-month-old plants their height was increased by the higher concentrations (0.05 ml/l, 0.1 ml/l, 0.2 ml/l, 0.4 ml/l) at 10 weeks after first spray, the effect lasting for 2 weeks (Table 3). Leaf production was greater in plants sprayed with 0.025 ml/l, 0.05 and 0.1 concentration at 4 weeks after first spray, the response lasting for 4 weeks (Table 4). However, at 20 weeks after first spray only the higher concentrations (0.1 ml/l, 0.2 and 0.4) produced more leaves. No differences were noted between any of the treatments in respect of the dry matter of the plant. Since free growing tea plants show a rhythmic alternation of phases of active growth and dormancy the timing of foliar sprays may perhaps be important as the effect of an application would be seen in about 2 weeks and last for a further month or so. Maximum response can hence be expected when the foliar application is made at the commencement of flushing followed by repeated sprays as the response diminishes. It is apparent that young tea responds best to Ergostim in the concentration range 0.05 ml/l-0.2 ml/l.

TABLE 4 — *Effect of low concentrations of Ergostim on leaf number (means of 40 plants)*

	Weeks from first spray application					
Treatments	*4*	*8*	*12*	*16*	*20*	*24*
Control	16.50	19.25	20.75	22.75	26.00	27.75
0.025 ml/l	17.75	20.00	21.00	23.00	26.50	29.00
0.05 ml/l	17.75	19.75	21.00	22.75	26.50	28.50
0.1 ml/l	18.50	20.25	21.00	23.25	28.25	29.25
0.2 ml/l	16.75	19.75	21.50	22.25	27.75	29.25
0.4 ml/l	17.25	19.25	21.00	22.50	28.00	29.50
LSD (P=0.05)	1.24	NS	NS	NS	1.41	NS

Counts of buds on pruned frames 3 months after the first spray showed that there were more buds on bushes treated with Ergostim in clone TRI 2025 (Table 5). No differences were noted in clone DT 1. Plots sprayed with 0.02 ml/l gave greater yield at 17 and 25 weeks after first spray. An interaction between the levels of Ergostim and clones was seen at 17 weeks after first spray. Harvesting bud + 2 or bud + 3 leaves at 7-day intervals consistently yielded more crop in the treated plots though it did not reach significance (Table 6). Irrespective of the harvested units, Ergostim improved crop. Delaying plucking rounds generally reduced crop and when harvested at 10 and 14 day rounds Ergostim did not have any beneficial

TABLE 5 — *Effect of sprays of Ergostim on recovery from pruning, yield (g) and the interaction between level of Ergostim sprays and clones on yield (g) of tea*

	Recovery from pruning in clone TRI 2025		*Yield (g) (mean of 2 clones)*		*Level of Ergostim sprays X clone*	
Treatments	*No. of buds*	*Percentage of control*	*17 weeks*	*25 weeks*	*Clone TRI 2025*	*Clone DT 1*
Control	111.20	100	416.18	521.92	571.82	472.03
0.02 ml/1	147.85	133	491.87	590.81	660.27	521.36
0.04 ml/1	131.85	119	380.74	485.64	532.41	438.86
0.08 ml/1	142.10	128	455.87	552.54	623.98	481.10
0.16 ml/1	144.45	130	427.23	479.97	454.73	505.20
0.32 ml/1	142.55	128	438.86	516.82	582.03	451.33
LSD (P = 0.05)	—	—	65.49	65.49	92.70	

effect on crop. It is to be noted that the normal practice is to harvest bud + 2 leaves every 7 days and Ergostim should prove to be beneficial in increasing crop. In mature tea that is being harvested growth is not synchronised and some shoots are found to grow all the time. Maximum response in this case may be expected at the commencement of maximum flushing followed thereafter at monthly intervals.

TABLE 6 — *Effect of sprays of Ergostim on yield (Kg) of tea harvested at different plucking units at 7-day intervals*

Harvesting Units	*Treated*	*Control*	*Percentage control*
Bud + 2 leaves	94.74	88.08	8
Bud + 3 leaves	99.69	89.57	11

Thus the results of the above study indicate that the biostimultant Ergostim is effective in improving overall growth, recovery from pruning and yield of tea in addition to improving the colour of the leaves and should prove a useful chemical for general routine use in tea. It must, however, be pointed out that for a continued response repeated sprays of Ergostim have to be given and is no substitute for regular and adequate application of fertilizer.

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