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# Effect of biostimulants on the growth and biomass of secondary nursery seedlings of cardamom

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## ABSTRACT

A nursery experiment was undertaken at the Indian Cardamom Research Institute, Myladumpara to understand the effect of biostimulants on the growth and biomass of secondary nursery cardamom seedlings. Five biostimulants at different concentrations were sprayed at 30- day intervals for a period of 120 days. The results indicated that biostimulants such as vipul (a tricontanol - containing commercial product), Ergostim (N-acetyl thiazolidne-4-carboxylic acid & folic acid - containing commercial product), pure folic acid, low levels of simazine and 2,4-D significantly increased the growth and dry matter production. The results suggest, that application of biostimulants not only reduces the nursery period but also helps in getting vigorous seedlings for better establishment in the field.

Key words: biomass, biostimulants, cardamom seedlings, N-ATCA, folic acid, triacontanol.

The desire to get healthy and vigorous seedlings for planting in the main field has led to the use of many plant growth regulators otherwise called bio-stimulants. Cardamom *Elettaria cardamomum* Maton) takes about 10 to 18 months depending on the nursery practice for attaining sufficient growth and desirable characters to be ready for planting in the main field. The non-uniform germination and the slow growth rate of cardamom in the nursery lead to wide variations in flowering, fruit set and harvest. Any attempt to enhance the growth and biomass of seedlings is expected to reduce the nursery period and cost.

Biostimulants such as triacontanol (1-hydroxy tricontane), N-ATCA (a derivative of L-cystine), folic acid, low levels of simazine and 2,4-D have been reported to increase the growth and dry matter production in crop plants (Prasad *et al* 1991: Debata and Murthy 1981: Babu Lal and Yadav, 1989 and Suseela Devi and Perur 1978). However their influence in cardamom is not known. The present study was taken up to investigate the effect of various biostimulants on the growth and biomass of secondary nursery seedlings of cardamom, in turn to reduce the nursery life and to obtain vigorous seedlings for subsequent successful establishment in the main field.

The study was undertaken using the cardamom variety 'Malabar' at the Indian Cardamom Research Institute, Myladumpara, Kerala. Cardamom seedlings from the primary beds, when they were at 3-4 leaf stage, were transplanted to poly bags secondary nursery (which is a common practice in Kerala and Tamil Nadu). The seedlings were allowed to establish for a period of 15 days in poly bags containing forest soil, sand and farmyard manure (3:1:1). Five biostimulants viz., Vipul (containing triacontanol as active ingredient) 0.25 to 1.00%; Ergostim (N-acetyl thiazolidine-4- carbolic acid (N-ATCA) and folic acid as active ingredients) 0.01 to 0.04%; Folic acid 0.4 to 1.00%; simazine 2.00 to 6.00 ppm and 2,4-D 3.00 to 9.00 ppm were sprayed at monthly intervals using hand sprayer. Control was maintained by spraying only with water. Periodically growth observations like tiller height, number of tillers and number of leaves were recorded. At the end of 120 days the seedlings were uprooted and the roots were washed, roots, shoots and leaves were separated and measured. Leaf area was calculated by adopting the technique of Korikanthamath and Subba Rao (1983). Then these samples were oven dried at 55-60°C and recorded the dry weights. The experimental designs adopted was randomized block design (RBD) with three replications.

The data on growth parameters (tiller height, number of tillers, number of leaves and leaf area) and biomass of roots, shoots and leaves are furnished in tables 1 & 2. There was a significant increase in growth and biomass in biostimulant treated seedlings than in untreated control seedlings.

**Table 1. Growth of cardamom seedlings as affected by biostimulants**

| SI No. | Treatment details | Tiller height (cm) | Number of tillers | Number of leaves | Leaf area (sq.cm) |
|---|---|---|---|---|---|
| 1. | Control (water spray) | 28.1 | 3.1 | 8.8 | 267.2 |
| 2. | Vipul (triacontanol) | | | | |
| | 0.2% | 30.8 | 4.4 | 7.9 | 476.6 |
| | 0.50% | 40.8 | 4.8 | 9.8 | 547.5 |
| | 0.75% | 39.5 | 5.3 | 10.8 | 928.8 |
| | 1.00% | 42.6 | 5.5 | 16.2 | 1110.3 |
| 3. | Ergostim (N-ATCA + folic acid) | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | 0.01% | 42.1 | 4.5 | 15.0 | 956.8 |
| | 0.02% | 45.6 | 5.2 | 21.7 | 1297.5 |
| | 0.03% | 46.3 | 6.1 | 22.4 | 1311.3 |
| | 0.04% | 46.7 | 6.6 | 19.2 | 1353.0 |
| 4. | Folic Acid | | | | |
| | 0.04 ppm | 41.1 | 4.9 | 18.4 | 1251.0 |
| | 0.6 ppm | 41.8 | 5.4 | 20.1 | 1306.5 |
| | 0.8 ppm | 43.2 | 5.3 | 20.8 | 1297.7 |
| | 1.0 ppm | 40.8 | 5.5 | 21.1 | 1380.3 |
| 5. | Simazine | | | | |
| | 2.0 ppm | 41.8 | 6.9 | 20.2 | 823.3 |
| | 4.0 ppm | 37.2 | 4.7 | 16.9 | 652.0 |
| | 6.0 ppm | 35.0 | 3.9 | 11.2 | 436.0 |
| 6. | 2,4-D | | | | |
| | 3.0 ppm | 43.8 | 6.6 | 22.8 | 1168.3 |
| | 6.0 ppm | 33.2 | 4.2 | 17.7 | 711.3 |
| | 9.0 ppm | 32.2 | 3.6 | 16.6 | 522.9 |
| | SEM | 2.4 | 0.3 | 1.6 | 70.3 |
| | CD (5%) | 6.8 | 0.8 | 4.5 | 201.8 |
| | CV (%) | 10.4 | 9.0 | 16.1 | 12.9 |

**Table2: Dry matter (Biomass) of cardamom seedlings as affected ny biostimulants**

| SI No. | Treatment details | Dry weight (Biomass) of Roots | Shoots | Leaves | Whole plant |
|---|---|---|---|---|---|
| 1. | Control (water spray) | 2.6 | 3.4 | 3.5 | 9.4 |
| 2. | Vipul (triacontanol) | | | | |
| | 0.25% | 3.8 | 5.3 | 3.9 | 13.1 |
| | 0.50% | 7.2 | 6.0 | 4.2 | 17.1 |
| | 0.75% | 8.2 | 10.1 | 4.9 | 23.2 |
| | 1.00% | 9.3 | 10.3 | 5.7 | 25.3 |
| 3. | Ergostim (N-ATCA + folic acid) | | | | |
| | 0.01% | 6.4 | 6.8 | 3.6 | 16.8 |
| | 0.02% | 7.9 | 11.3 | 5.7 | 24.9 |
| | 0.03% | 13.3 | 12.5 | 6.3 | 32.2 |
| | 0.04% | 14.7 | 11.4 | 7.3 | 34.4 |

| | | | | | |
|---|---|---|---|---|---|
| 4. | Folic Acid | | | | |
| | 0.40 ppm | 9.3 | 8.0 | 6.2 | 23.5 |
| | 0.60 ppm | 12.0 | 9.8 | 7.7 | 29.4 |
| | 0.80 ppm | 11.7 | 10.8 | 10.3 | 33.8 |
| | 1.00 ppm | 11.1 | 10.4 | 10.8 | 32.3 |
| 5. | Simazine | | | | |
| | 2.00 ppm | 9.0 | 8.7 | 5.7 | 23.3 |
| | 4.00 ppm | 5.9 | 5.8 | 3.0 | 14.4 |
| | 6.00 ppm | 5.8 | 3.9 | 2.4 | 10.3 |
| 6. | 2,4-D | | | | |
| | 3.00 ppm | 10.7 | 8.2 | 5.2 | 23.7 |
| | 6.00 ppm | 8.8 | 4.3 | 3.0 | 17.2 |
| | 9.00 ppm | 3.9 | 3.0 | 2.8 | 11.6 |
| | SEM | 1.2 | 0.8 | 0.6 | 1.5 |
| | CD 95%) | 3.5 | 2.3 | 1.9 | 4.4 |
| | CV (%) | 24.7 | 17.6 | 21.5 | 12.0 |

Growth parameters

The height of the tillers significantly increased with the application of the biostimulants. The effect was maximum. in 0.04% Ergostim - 46.67 cm , compared to 28.08 cm in the control. Higher concentrations of Vipul, Ergostim and folic acid and lower concentrations of Simazine and 2,4-D recorded significantly higher tiller height. At higher concentrations of simazine and 2,4-D there was a reduction in height, an effect that is well known for these agents (Ashton and Craft, 1973; Audus., 1976).

Tiller number were highest in 2.00 ppm Simazine followed by 3 ppm 2,4-D and 0.03 and 0.04% Ergostim. Here also a gradual increase in tiller number was evident with the increase in concentrations in the case of Vipul, Ergostim and folic acid treatments.

Biostimulants also increased the number of leaves significantly. It ranges from 7.9 (0.25% Vipul) to 22.7 (3.00 ppm 2,4-D). Increased number of leaves also observed in seedlings which received 1.00% Vipul (16.2); 0.03% Ergostim (22.4); 1.00 ppm folic acid (21.0); 2.00 ppm Simazine (20.1) and in control it was 8.8 only.

Leaf area of seedlings, which is related to the photosynthetic activity, showed the same increasing trend with the application of biostimulants. However its effects varied with the kind and level of biostimulants. For Vipul, Ergostim and folic acid there was a graded increase in leaf area as the concentration increased and this trend may continue even further. In Simazine and 2,4-D there was a negative relationship between concentration and leaf area. The leaf area expansion is brought about by two mechanisms, mainly by a greater expansion growth of the cells and secondly by an enhancement of cell division (Delvin 1975, Pandey & Sinha, 1984, Salisbury & Ross 1977). Both these effects may have played their roles in the present case. The nega-

tive relationship between concentration and leaf area in Simazine and 2,4-D are understandable because both these agents are known to be having suppressive effect both on cell division and cell enlargement at higher concentrations. (Suseela Devi and Perur 1978, Chopra *et al* 1970).

Biomass

The dry weight of roots, shoots and leaves significantly increased with bio-stimulants which in turn reflected on the whole plant biomass of seedlings. The whole plant biomass varied from 9.1 to 34.4 g, highest in 0.04% Ergostim treatment and lowest in control. Among the other treatments 1.00% Vipul (25.3); 0.80 ppm folic acid (33.8), 2.00 ppm of Simazine 23.3), 3.00 ppm of 2,4-D (23.7) gave greater biomass than the control (9.1). Dry weight or plant biomass followed a positive increasing trend with the increase in concentration in the case of Vipul, Ergostim and folic acid, and a negative correlation with concentration in the case of simazine and 2,4-D. The biomass increase was very significant up to the third level of concentration used, there after the increase was minimal and in the case of folic acid there was even a fall. In contrast Simazine and 2,4-D registered a drastic reduction in biomass at higher concentration from the lowest, at the lowest concentration there was a highly significant increase. The biomass accumulation was highest in the case of Ergostim and folic acid.

The chemical substances tried in the present study are known to activate the physiological and biochemical process in cereals, pulses and vegetables resulting in higher growth and biomass production (Chopra *et al* 1970, Shetty and Furtick 1973, Ries *et al* 1977, Radice and Scacci 1982 and Davies 1987). In the present study a similar trend is recorded in cardamom seedlings also.

This study indicates application of biostimulants to cardamom seedlings in the nursery can be rewarding, even though it involves some additional cost. Among the five stimulants tried, application of 1.00% Vipul, 0.03 or 0.4% Ergostim, 0.80 ppm folic acid, 2.00 ppm Simazine and 3.00 ppm of 2,4-D at 25 to 30 days interval were found to be better for seedlings in nursery. These biostimulants, besides reducing the nursery life, assures good establishments in the main field.

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## References

Ashton F M 1976 (Ed) Mode of action of herbicides. John Willey & sons New York.

Babulal and Yadav R S 1989. Role of plant growth regulators in agriculture. Farmer and parliament, December, 7-8.

Chopra S L, Sudarshan Kumari & Bahtia I S 1970. Effect of herbicides on the chemical composition of groundnut crop. Indian J. Weed Sci. 2: 81-89.

Davies D D 1987. The biochemistry of metabolism In: Stump P K & Conn E E (Ed) The Biochemistry of Plants: a comprehensive treatise. Vol. II.

Debata A & Murthy K S 1981 Effect of

growth regulators on photosynthetic efficiency, translocation and senescence in rice. Indian J. of Expt. Biol. 19: 986-987.

Devlin R M 1975 (Ed) Plant Physiology. Affiliated East-West press Pvt. Ltd.

Korikanthmath V S & Subba Rao G 1983 Leaf area determination in cardamom (*Elettaria cardamomum* Maton) J. Plantation crops 11: 151-153.

Pandey S N & Sinha B K 1989 Plant physiology. Vikas Publishing House Pvt. Ltd. Ghaziabad, U.P. (India).

Prasad M, Prasad R, Sharma S N & Singh S 1991. Growth and yield of wheat as influenced by plant growth regulators. Indian J. Agron 36: 32-35.

Radice M & Scacchi A 1982 Ergostim from laboratory to field and again to laboratory: Research on its mechanisms of action. Farmoplant Monte Diron SPA Centro Antiparassitari Milano Italia (Pamphlet).

Ries S K, Wert V, Sweely C C & Leevit 1977 Triacontanol - a new naturally occurring plant growth regulator. Science 195: 1339-1341.

Salisbury F B & Ross 1977 Plant Physiology. Prentice Hall of India Private Ltd. New Delhi, India.

Shetty S V R & Furtick W R 1973. The regulatory effect of two S-triazine herbicides on the nutritive composition of seeds and leaves of sweet corn (*Zea mays*) Indian J. Weed Sci. 5: 33-37.

Suseela Devi L & Perrur N G 1978 Effect of simazine on some organic constituents of young corn seedlings. Mysore J. Agric. Sci. 12: 94-98.