Effect of Chloromequat, Daminozide, Ethepon and Maleic hydrazide on certain vegetative characters of cardamom (*Elettaria cardamomum* Maton) seedlings

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ABSTRACT

The effect of application of growth regulators such as Maleic hydrazide, Daminozide (Alar), Chloromequat (Cycocel) and Ethepon (Ethrel) on growth and development of cardamom (*Elettaria cardamomum*) seedlings of various age groups was studied. Maleic hydrazide (250 ppm), Daminozide (500 ppm), Chloromequat (250 ppm) and Ethepon (100 ppm) siginificantly enhanced tiller production and other vegetative characters when applied on 7 month old seedlings. These treatments were economical based on cost-benefit ratios that were worked out.

Key words : cardamom, *Elettaria cardamomum*, growth regulars, vegetative characters.

Abbreviations

CCC : Cycocel (Chloromequat)
MH : Maleic hydroxide

Introduction

Cardamom (*Elettaria cardamomum* Maton) seedlings raised in secondary nurseries are generally transplanted to the mainfield at 10 months of age in Karnataka region or at 18 months in Kerala region. Generally three to five healthy suckers are essential for a cardamom seedling at transplantable age. However, more number of suckers per seedling is beneficial for their growth and yield in the field. Sucker production is retarted in nurseries possible due to apical dominance of mother suckers. Apical dominance of mother sucker can be suppressed by external application of growth retardants (Cathey 1964). Aplication of higher concentration of CCC and MH on China asters resulted in

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steady increase of biomass (Gowda 1985). Annadurai & Shanmugavelu (1977) attributed the increase in biomass in banana plants after application of Ethrel and Alar to increased IAA oxidase activity. Pattanshetti (1980) and Srinivasamurthy (1984) found that application of higher concentrations of Ethrel in cardamom seedlings could result in increased sucker production but lesser biomass. However, no information is available on the effect of different growth regulators on sucker production and biomass in nursery seedlings of cardamom, and hence, the present investigation was undertaken.

Materials and Methods

The experiment was laid at the Regional Research Station, Indian Cardamom Research Institute, Sakaleshpur during 1989-91 with seedlings raised in polybags of 25cm x 25cm size. There were 15 treatments which included MH, Alar, CCC (each at 250, 500, 750 and 1000 ppm) and Ethrel (100 and 200 ppm) with no growth regulator as control. A plot size of 15 seedlings was maintained. The design adopted was Randomised Block Design with three replications. A single application of growth regulator spray was given to 3,5, and 7 month old seedlings. Observations on number of leaves, height and girth of mother sucker and number of suckers per seedling were recorded before and after imposition of treatments at monthly intervals up to 10 months of age. Fresh and dry weight per seedling were also determined when the seedlings were ready for transplanting in the field. The cost-benefit ratios for various treatments were also worked out.

Results and discussion

When the treatments were imposed on seedlings at 3rd month, the girth of mother suckers was siginificantly more in control, MH (1000 ppm), Alar (750 ppm), CCC (500 & 750 ppm) and Ethrel (100 ppm) compared to other treatments (Table 1). However, there was no significant variation in the number of leaves per mother sucker, height of the mother sucker, fresh weight and biomass of seedlings among the treatments. The number of suckers per seedling was significantly more with Ethrel (100 & 200 ppm) and CCC (250, 500 & 750 ppm) compared to control and other treatments. Pattanshetti (1980) however reported an increase in number of suckers per clump after application of higher concentrations of CCC and Ethrel. Even though more number of suckers were recorded from CCC and Etherel treated plants, it did not influence their biomass. This could probably be due to less production of leaves per mother sucker leading to less photosynthetic area available. Since biomass is also very essential for further growth and development of plants, application of growth regulators at 3 months of age may not be beneficial.

Table 1. Influence of growth regulators on nursery seedlings of cardamom (treatments imposed at 3 months of age)

Treatment		Number of leaves / mother sucker	Height of mother sucker (cm)	Girth of mother sucker (cm)	Number of suckers/ seedling	Fresh weight/ seedling (g)	Biomass/ seedling (g)
Growth regulator	Concn. (ppm)						
Control	—	10.8	102.8	12.3	9.4	141.2	20.5
Maliec hyrazide	250	9.4	103.4	11.8	9.5	162.2	21.5
	500	10.2	113.1	12.0	8.8	152.2	22.4
	750	9.9	106.7	12.0	10.1	133.3	19.9
	1000	10.0	100.7	12.3	9.8	125.5	19.7
Alar	250	10.0	105.2	11.9	9.5	131.1	19.1
	500	10.1	102.7	11.9	10.0	150.5	19.2
	750	10.2	110.6	12.1	9.4	125.0	16.9
	1000	8.8	100.9	11.9	9.2	106.7	15.7
Cycocel	250	9.7	112.8	11.9	10.3	183.3	26.3
	500	9.3	105.7	12.2	10.3	157.8	21.8
	750	9.6	109.6	12.1	10.3	151.7	20.4
	1000	9.2	105.2	11.9	10.0	152.8	24.4
Ethrel	100	10.4	105.9	12.1	10.3	174.4	24.1
	200	9.1	99.6	11.7	11.5	148.3	19.8
C D at 5%		—	—	0.3	1.3	—	—

When the treatments were imposed on seedlings at 5th month, number of leaves per mother sucker was siginificantly more in Alar (750 ppm) (Table 2). Treatment such as Alar (250 & 500 ppm), MH (250 & 500 ppm), CCC (750 ppm) and control also has siginificantly more number of leaves per mother sucker compared to other treatments. The height of mother suckers was siginificantly higher in Alar (250 to 1000 ppm), MH (250 & 750 ppm) and CCC (500 & 750 ppm). Ethrel application did not influence height of mother sucker siginificantly. The number of suckers produced was siginificantly more in MH (250 ppm), Alar (250 & 500 ppm), CCC (750 & 1000 ppm) and control. Fresh weight and biomass production of seedlings were siginificantly more in Alar (250 to 750 ppm), MH (1000 ppm) and CCC (750 & 1000 ppm) treated seedlings. The application of higher concentrations of MH and CCC on China aster (Gowda 1985) and Alar on banana (Annadurai & Shanmugavelu 1977) was also reported to result in a higher biomass.

Table 2. Influence of growth regulators on nursery seedlings of cardamom (treatments imposed at 5 months of age)

Treatment		Number of leaves/ mother sucker	Height of mother sucker (cm)	Girth of mother sucker (cm)	Number of suckers/ seedling	Fresh weight/ seedling (g)	Biomass/ seedling (g)
Growth regulator	Concn. (ppm)						
Control	—	10.1	81.5	12.4	9.4	142.2	21.3
Maliec hyrazide	250	10.3	88.3	12.5	9.8	169.9	22.1
	500	10.0	86.3	12.3	9.1	162.2	24.3
	750	9.7	88.4	12.9	9.1	195.5	27.4
	1000	9.5	85.8	12.6	9.2	232.2	32.5
Alar	250	10.0	90.5	12.5	9.2	218.9	35.0
	500	10.0	95.4	12.7	9.2	202.2	28.3
	750	10.5	96.5	13.0	9.0	197.7	27.7
	1000	9.8	89.7	12.5	9.1	176.7	25.5
Cycocel	250	9.7	75.1	11.9	8.8	166.7	23.3
	500	9.1	89.1	11.8	8.8	181.1	25.4
	750	10.0	97.0	12.7	9.2	245.8	34.4
	1000	9.5	93.8	12.6	9.0	211.1	29.5
Ethrel	100	9.7	79.9	12.4	8.9	138.4	19.4
	200	9.1	71.8	11.9	8.3	143.3	20.0
C D at 5%		0.6	9.7	—	0.6	62.2	8.9

When the treatments were imposed at 7th month, they did not influence the number of leaves per mother sucker and height of mother sucker significantly (Table.3). The girth of mother suskers and number of suckers per seedling were significantly more in Alar (250 to 1000 ppm), MH (250 to 1000 ppm) and CCC (250 ppm) compared to control and other treatments. Fresh weight of seedlings was siginificantly affected by the treatments. The highest value (338.3 g) was recorded by MH -750 & 1000 ppm followed by Alar - 1000 ppm (331.1 g) and CCC - 750 ppm and Ethrel - 250 ppm (311.7 g each) . Significantly less fresh weight per seedling was recorded in control and Alar (250 ppm) treatments. Biomass production was non significant among the various treatments.

Table 3. Influence of growth regulators on nursery seedlings of cardamom (treatments imposed at 7 months of age)

Treatment		Number of leaves/ mother sucker	Height of mother sucker (cm)	Girth of mother sucker (cm)	Number of suckers/ seedling	Fresh weight/ seedling (g)	Biomass/ seedling (g)
Growth regulator	Concn. (ppm)						
Control	—	10.1	77.4	11.1	9.4	145.0	22.3
Maliec hyrazide	250	10.9	84.0	12.3	10.5	265.0	35.7
	500	10.4	90.2	12.4	10.3	245.0	37.3
	750	10.4	85.5	12.4	10.3	338.3	48.0
	1000	10.6	94.6	12.5	10.7	338.3	38.3
Alar	250	10.5	84.5	12.2	10.4	220.0	38.3
	500	11.3	92.0	12.6	10.4	295.0	43.3
	750	11.1	83.8	12.0	10.2	236.7	35.0
	1000	11.2	91.3	12.1	10.4	331.7	47.3
Cycocel	250	10.3	86.4	12.3	10.0	273.3	38.3
	500	10.9	90.9	11.8	9.6	275.0	39.7
	750	11.1	88.9	11.7	9.4	311.7	47.7
	1000	10.3	87.8	11.8	9.3	278.3	35.7
Ethrel	100	10.8	87.4	11.5	9.4	260.0	36.7
	200	10.1	88.4	11.7	9.1	311.7	45.0
C D at 5%		—	—	0.8	0.8	91.6	—

Since seedlings of 7 months of age responded well to application of MH (750 ppm), Alar (1000 ppm), CCC (750 ppm) and Ethrel (200 pm) in terms of increased girth of mother sucker, number of suckers, fresh weight and biomass, application of growth regulators at this stage could be considered as the best stage to obtain healthy and vigorous seedlings in cardamom. The cost of application of Alar was highest due to the high cost of the chemical compared to other growth regulators. The cost was minimum in Etherel followed by MH and CCC. The response of seedlings to MH was higher compared to other two chemicals (Table 4). The cost benefit ratio for application of MH on 7 month old seedlings in relation to control was worked out (Table 5). Application of MH at 250 ppm could give a cost benefit ratio of 1:14 followed by MH at 500 ppm (1:6). Thus, taking into account the cost involved as well as the response, application of MH is ideal for obtaining better growth and development of cardamom seedlings.

Table 4. Cost of spraying growth regulators on nursery seedlings of cardamom at different ages

Growth regulator concs. (ppm)		At 3 months of age				At 5 months of age				At 7 months of age			
		Qty. of growth regulator (g or ml)	Cost of growth regulator (Rs.)	Labour wages (Rs.)	Total cost (Rs.)	Qty. of growth regulator (g or ml)	Cost of growth regulator (Rs.)	Labour wages (Rs.)	Total cost (Rs.)	Qty. of growth regulator (g or ml)	Cost of growth regulator (Rs.)	Labour wages (Rs.)	Total cost (Rs.)
Maleic hydra-zide	250	11.25	45.0	11.50	56.50	37.50	150.0	34.50	184.50	60.00	240.0	55.20	295.20
	500	22.50	90.0	11.50	101.50	75.00	300.0	34.50	334.50	120.00	480.0	55.20	535.20
	750	33.75	135.0	11.50	146.50	112.40	450.0	34.50	484.50	180.00	720.0	55.20	775.30
	1000	45.00	180.0	11.50	191.50	150.00	600.0	34.50	634.50	240.00	960.0	55.20	1015.20
Alar	250	11.25	3746.0	11.50	3757.50	37.50	12487.0	34.50	12521.50	60.00	19980.0	55.20	20035.20
	500	22.50	7503.5	11.50	7503.50	75.00	24975.0	34.50	25009.50	120.00	39960.0	55.20	40015.20
	750	33.75	11239.0	11.50	11250.50	112.50	37462.0	34.50	37496.50	180.00	59940.0	55.20	59995.20
	1000	45.00	14985.0	11.50	14996.50	150.00	49950.0	34.50	49984.50	240.00	79920.0	55.20	79975.20
Cycocel	250	11.25	108.0	11.50	119.50	37.50	360.0	34.50	394.50	60.00	576.0	55.20	631.20
	500	22.50	216.0	11.50	227.50	75.00	720.0	34.50	754.50	120.00	1152.0	55.20	1207.20
	750	33.75	324.0	11.50	335.50	112.50	1080.0	34.50	1114.50	180.00	1728.0	55.20	1783.20
	1000	45.00	432.0	11.50	443.50	150.00	1440.0	34.50	1474.50	240.00	2304.0	55.20	2359.20
Ethrel	100	11.25	33.8	11.50	45.30	37.50	112.5	34.50	150.00	60.00	180.0	55.20	235.20
	200	22.50	67.5	11.50	79.00	75.00	225.0	34.50	300.00	120.00	360.0	55.20	45.20

Rate

Maleic hydrazide : Rs 4.00/g
Alar : Rs 333.00/g
Cycocel : Rs 9.60/g
Ethrel : Rs 3.00/ml
Labour wages : Rs 22.82/day

No. of seedlings : 3000
Quantity (per seedling)
At 3 months of age : 15 ml
At 5 months of age : 50 ml
At 7 months of age : 80 ml

Table 5. Cost benefit ratio for application of Maleic hydrazide in relation to control (at 7 months of age)

Concentration (ppm)	Total no. of suckers/ seedling	Increase in no. of suckers over control	Cost of growth regulator spray (Rs.)	Gross benefit* (Rs.)	Cost benefit ratio
Control	9.4	0.0	—	40,500	—
Maleic hydrazide					
250	10.5	1.1	295	44,755 (4255)	1:14
500	10.3	0.9	535	43,948 (3448)	1:6
750	10.3	0.9	775	43,948 (3448)	1:4
1000	10.7	1.3	1015	45,561 (5061)	1:5

Figures in parentheses indicate increment over control

* From Ist year's yield

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