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Effect of pruning severity and growth retardants on vegetative growth, flower yield and oil content of damask rose (*Rosa damascena* Mill.)

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Abstract

Effect of pruning severity and growth retardants on vegetative growth, flower yield and per cent oil content of damask rose was studied under Udaipur conditions. At light pruning (30 cm from ground level) plant height, number of shoots per plant, spread of plant, flower yield and per cent oil content were recorded maximum, whereas the declining trend was observed with increasing pruning severity. Similarly, at lower concentration of growth retardants (2000 ppm) more plant growth, flower yield and per cent oil content were recorded as compared to higher concentrations of growth retardants. Among all interactions of pruning and growth retardant treatments, spread of plant and flower yield were recorded significantly higher under 30 cm pruning height and CCC 2000 ppm treatment over control. For obtaining higher yield of damask rose flowers and essential oil, the plants may be pruned at 30 cm height from ground level and sprayed with 2000 ppm CCC.

Key words: Damask rose, pruning, growth retardant, CCC, MH, vegetative growth, plant height, flower yield, oil content.

Introduction

Damask rose is an essential oil producing crop with great export potential. It is greatly influenced by climatic factors, nutritional and cultural practices. Importance of cultural practices like pruning and use of growth retardants in plant growth regulation and production of flowers have been stressed by several workers. Pruning at different heights are reported to affect growth and flower yield of rose plants (Gowda and Jayanthi,1985; Singh and Ram,1987; Mukhopadhyay *et al.,* 1987 and Gowda and Uma, 1992). Spray of cycocel and maleic hydrazide has been reported to reduce plant growth of various flower crops (Sen and Maharana, 1971 and More and Dohare, 1985). Shanmugam *et al.* (1973) observed reduction in yield with MH and CCC at higher concentration in chrysanthemum. Bhattacharjee and Chandravadana (1990) in *Jasminum grandiflorum* recorded increased production of essential oil as a result of spray of CCC at low concentration at vegetative stage. Hence, the present study was undertaken to know the effect of pruning severity and growth retardants on vegetative growth, flower yield and per cent oil content of damask rose.

Materials and methods

Investigation was conducted on 8 years old plantation of damask rose at Horticulture farm, Rajasthan College of Agriculture, Udaipur (Rajasthan). Three pruning heights (l0, 20 and 30 cm) and two growth retardants CCC (Cycocel)[2-chloroethyl trimethyl ammonium chloride] and MH(Maleic hydrazide) [1,2-dihydro 3,6- pyradizinedione] both at 2000, 4000 and 8000 ppm levels and distilled water spray as control treatment were designed in Split Plot Design, comprising of 21 treatment combinations with three replications. Plants, planted at l x l m spacing, were pruned according to pruning height from ground level on 25th December in both the years. Two foliar sprays of growth retardants were done. First spray was done after sprouting when 4-5 leaves were fully developed on the shoots and second spray was repeated after fifteen days of first spray. Plant height (cm), number of shoots per plant and plant spread (m) were recorded. Flower yield per plant (g) was recorded and calculated in flower yield per hectare (kg). By hydrosteam oil distillation extraction method, oil collected in graduated micro-burette, was measured in ml and converted into g weight of oil (1 ml = 0.844g). Percentage of oil was calculated on the basis of fresh weight of rose flowers.

Results and discussion

Perusal of data, presented in Table 1, revealed that maximum plant height, number of shoots per plant and plant spread were recorded with light pruning treatment. Further increase in pruning severity reduced the growth characters. Likewise, application of growth retardants also significantly affected the vegetative growth. As concentration of both CCC and MH increased the plant height, spread of plant and number of shoots per plant reduced proportionately in both the years. The combined effect of pruning and growth retardant treatments was found to be non-significant except plant spread (Table 2). Among all the interactions of pruning and growth retardant treatments, maximum spread of plant was observed under pruning height 30 cm and CCC 2000 ppm (P_3T_1) treatment. Increased vegetative growth under light pruning treatment might be due to more supply of metabolites towards growing shoots which resulted into increased height and number of shoots per plant which ultimately enhanced the spread of plant. Larson (1983) and Mukhopadhyay *et al.* (1987) recorded increased plant growth by light pruning of rose plants. The reduction in plant height and increase in number of shoots as a result of growth retardants (CCC & MH) application may be due to the inhibitory action of these retardants on cell

Table 1. Effect of pruning severity and growth retardants on vegetative growth

Treatment	Plant height (cm)			No. of shoots/plant			Plant spread (m^2)		
	1993-94	1993-94	Mean	1993-94	1993-94	Mean	1993-94	1993-94	Mean
Pruning height									
10cm (P_1)	20.80	21.10	20.90	13.90	14.40	14.10	0.86	0.86	0.86
20cm (P_2)	22.50	23.00	22.70	25.10	25.70	25.40	0.92	0.93	0.92
30cm (P_3)	23.80	24.40	24.10	34.50	35.30	34.90	1.12	1.12	1.12
SEm	0.04	0.07		0.04	0.08		0.00	0.00	
CD (p=0.05)	0.16	0.28		0.17	0.30		0.01	0.01	
Growth retardants									
Control (T_0)	23.50	24.20	23.80	23.50	24.20	23.80	0.97	0.98	0.97
CCC 2000 ppm (T_1)	23.10	23.70	23.40	27.60	28.30	27.90	1.02	1.02	1.02
CCC 2000 ppm (T_2)	22.40	22.80	22.60	25.30	25.90	25.60	0.98	0.98	0.98
CCC 6000 ppm (T_3)	21.50	21.80	21.60	23.00	23.50	23.20	0.94	0.95	0.94
MH 2000 ppm (T_4)	22.80	23.30	23.00	26.20	26.80	26.50	0.99	1.00	0.99
MH 4000 ppm (T_5)	22.10	22.50	22.30	24.40	24.90	24.60	0.95	0.95	0.95
MH 6000 ppm (T_6)	21.20	21.60	21.40	21.50	22.00	21.70	0.89	0.89	0.89
SEm	0.13	0.11		0.09	0.20		0.01	0.01	
CD (p=0.05)	0.35	0.31		0.24	0.55		0.02	0.02	

Table 2. Interaction effect of pruning severity and growth retardant treatment on vegetative growth

Treatment	Plant height (cm)			No. of shoots/plant			Plant spread (m^2)		
	1993-94	1993-94	Mean	1993-94	1993-94	Mean	1993-94	1993-94	Mean
P_1T_0	22.00	22.50	22.20	12.50	13.10	12.80	0.86	0.87	0.86
P_1T_1	21.50	21.90	21.70	16.60	17.20	16.90	0.92	0.92	0.92
P_1T_2	20.80	21.00	20.90	15.00	15.50	15.20	0.87	0.88	0.87
P_1T_3	20.00	20.20	20.10	12.00	12.40	12.20	0.83	0.83	0.83
P_1T_4	21.30	21.60	21.40	15.50	16.10	15.80	0.89	0.90	0.89
P_1T_5	20.50	20.70	20.60	14.00	14.40	14.20	0.83	0.83	0.83
P_1T_6	19.60	19.90	19.70	11.50	11.90	11.70	0.79	0.74	0.76
P_2T_0	23.50	24.20	23.80	24.00	24.70	24.30	0.94	0.96	0.95
P_2T_1	23.30	23.90	23.60	28.70	29.40	29.00	0.98	0.99	0.98
P_2T_2	22.60	23.10	22.80	26.00	26.60	26.30	0.95	0.95	0.95
P_2T_3	21.70	22.00	21.80	23.40	23.90	23.60	0.90	0.91	0.90
P_2T_4	23.00	23.50	23.20	27.00	27.60	27.30	0.96	0.96	0.96
P_2T_5	22.30	22.70	22.50	25.00	25.50	25.20	0.93	0.94	0.93
P_2T_6	21.40	21.80	21.60	21.50	22.00	21.70	0.81	0.82	0.81
P_3T_0	25.00	25.80	25.40	34.00	34.90	34.40	1.12	1.13	1.12
P_3T_1	24.50	25.20	24.80	37.50	28.40	37.90	1.16	1.15	1.15
P_3T_2	23.80	24.40	24.10	35.00	35.80	35.40	1.12	1.13	1.12
P_3T_3	22.90	23.30	23.10	33.60	34.30	33.90	1.10	1.11	1.10
P_3T_4	24.20	24.90	24.50	36.00	36.80	36.40	1.14	1.14	1.14
P_3T_5	23.50	24.10	23.80	34.20	34.90	34.50	1.10	1.09	1.09
P_3T_6	22.60	23.00	22.80	31.50	32.10	31.80	1.07	1.07	1.07
SEm	0.22	0.20		0.15	0.34		0.01	0.01	
CD (p=0.05)	NS	NS		NS	NS		0.03	0.03	

division, cell elongation, IAA-oxidase enzyme activity and gibberellin production (Cathey, 1960; Leopold,1964 and Waring, 1982) which hinders the terminal growth and promoting development of lateral buds into shoots ultimately resulting into increased spread of plant. Further increase in concentration of growth retardant decrease the plant growth which may be attributed to the specific and selective action of growth retardants on plants. Puppaih and Muthuswamy(1974) in dahlia and Sen and Maharana (1971) in chrysanthemum reported increased number of shoots and plant spread by application of CCC and MH at lower concentration.

Flower yield and oil content: Data (Table 3) indicate that flower yield per plant, flower yield per hectare and per cent oil content were significantly affected by pruning and growth retardant treatments in the both the years. The interaction effect of pruning and growth retardant treatments was also found to be significant except in per cent oil content (Table 4). Among all the interactions of pruning and growth retardant treatments, maximum flower yield was recorded under pruning height 30cm and CCC 2000 ppm (P_3T_1) treatment. Light pruning treatment produced more yield which might be due maximum number of shoots and leaves per plant which increase photosynthetic area and more photosynthate are available for plant growth. Translocation of

Table 3. Effect of pruning severity and growth retardants on flower yield and per cent oil content

Treatment	Flower yield /plant (g)			Flower yield /ha (kg)			Oil content (%)		
	1993-94	1993-94	Mean	1993-94	1993-94	Mean	1993-94	1993-94	Mean
Pruning height									
10cm (P_1)	76.8	75.3	76.0	768.0	753	760.5	0.023	0.023	0.023
20cm (P_2)	92.8	90.3	91.5	928.0	902	915.0	0.024	0.025	0.024
30cm (P_3)	119.2	116.4	117.8	1192.0	1163	1177.5	0.026	0.026	0.026
SEm	0.1	0.0		1.4	2.77		0.001	0.001	
CD (p=0.05)	0.5	0.2		5.7	10.8		0.001	0.002	
Growth retardants									
Control (T_0)	87.9	85.7	86.8	879.0	857	868.0	0.023	0.024	0.023
CCC 2000 ppm (T_1)	109.8	107.5	108.6	1098.0	1075	1086.5	0.024	0.027	0.026
CCC 2000 ppm (T_2)	99.6	97.5	98.5	996.0	975	985.5	0.025	0.025	0.025
CCC 6000 ppm (T_3)	90.9	88.9	89.9	909.0	889	899.0	0.024	0.024	0.024
MH 2000 ppm (T_4)	104.6	101.9	103.2	1046.0	1019	1032.0	0.025	0.025	0.025
MH 4000 ppm (T_5)	95.2	92.7	93.9	952.0	927	939.5	0.024	0.024	0.024
MH 6000 ppm (T_6)	86.0	83.6	84.8	860.0	835	847.5	0.023	0.023	0.023
SEm	0.3	0.2		4.3	3.32		0.000	0.001	
CD (p=0.05)	0.8	0.5		11.9	9.2		0.001	0.002	

Table 4. Interaction effect of pruning severity and growth retardant treatment on flower yield and percent oil content

Treatments	Flower yield /plant (g)			Flower yield /ha (kg)			Oil content (%)		
	1993-94	1993-94	Mean	1993-94	1993-94	Mean	1993-94	1993-94	Mean
P_1T_0	70.8	69.5	70.2	709	695	702.0	0.022	0.022	0.022
P_1T_1	85.5	84.0	84.8	855	840	847.5	0.025	0.026	0.026
P_1T_2	78.0	76.5	77.3	780	765	772.5	0.023	0.024	0.024
P_1T_3	73.5	72.0	72.8	735	720	727.5	0.023	0.023	0.023
P_1T_4	83.0	81.3	82.2	830	813	821.5	0.024	0.023	0.024
P_1T_5	76.5	75.0	75.8	765	750	757.5	0.022	0.022	0.022
P_1T_6	70.5	69.0	69.8	705	690	697.5	0.022	0.021	0.022
P_2T_0	85.7	83.2	84.5	857	832	844.5	0.023	0.024	0.024
P_2T_1	105.0	102.5	103.8	1050	1025	1037.5	0.026	0.027	0.027
P_2T_2	93.2	91.0	92.1	932	910	921.0	0.025	0.025	0.025
P_2T_3	86.2	83.7	85.0	862	837	849.5	0.024	0.024	0.024
P_2T_4	102.5	99.8	101.2	1025	998	1011.5	0.025	0.024	0.025
P_2T_5	92.3	89.7	91.0	923	896	909.5	0.024	0.025	0.025
P_2T_6	84.8	82.2	83.5	848	821	834.5	0.023	0.024	0.024
P_3T_0	107.2	104.5	105.9	1072	1045	1058.5	0.025	0.026	0.026
P_3T_1	139.0	136.0	137.5	1390	1360	1375.0	0.028	0.029	0.029
P_3T_2	127.0	125.0	126.0	1275	1250	1262.5	0.026	0.027	0.027
P_3T_3	113.0	111.2	112.1	1130	1122	1126.0	0.025	0.025	0.025
P_3T_4	128.2	124.8	126.5	1282	1248	1265.0	0.026	0.027	0.027
P_3T_5	116.8	113.5	115.2	1169	1135	1152.0	0.025	0.025	0.025
P_3T_6	102.8	99.5	101.2	1028	995	1011.5	0.024	0.024	0.024
SEm	0.5	0.3		7.44	5.75				
CD (p=0.05)	1.4	0.8		20.6	15.9		NS	NS	

carbohydrate in abundant amount to flower parts increased more flower yield. Mukhopadhyay *et al.* (1987), Gowda and Uma (1992) and Nagda (1994) have obtained maximum rose flower yield with light pruning treatments. The increase in flower yield with the application of CCC and MH might be due to reduction in the plant height and diverting the available food towards lateral shoots which resulted into more number of shoots and ultimately produce more number of flowers and increased flower yield. Further increase in concentration of growth retardants decreased flower yield which may be because of the specific and selective action of growth retardants on plants. Puppaih and Muthuswamy (1974) in rose have observed highest flower yield by CCC application at lower concentration. Gowda and Gowda (1990) in *Jasminum sambac* obtained increased flower production by MH application. The per cent oil content increased with the light pruning whereas it decreased with severe pruning of rose plants. Application of CCC and MH also significantly affected the oil content over control in both the years. The increase in per cent oil content of flowers was found more at light pruning which might be due to more supply of metabolites to flower parts which synthesized more oil in flowers. The application of growth retardants (CCC & MH) also increased oil content at lower concentration which might be because of the fact that the growth retardants reduce terminal growth and thus divert more metabolites towards flower parts leading to increased oil synthesis in flowers. Bhattacharjee and Chandravadana (1990) in *Jasminum*

grandiforum obtained increased essential oil by CCC application at lower concentration. The effect of CCC and MH at higher level may be attributed to selective and specific action of the growth retardants on plants.

On the basis of the present investigation it may be concluded that for obtaining higher yield of *Rosa damascena* flowers and its essential oil, the plants may be pruned at 30 cm height from the ground level, and sprayed with CCC 2000 ppm.

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