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Interaction between GA_3 and CCC on growth and yield of *Brassica campestris* L. (cv-M 27)

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SUMMARY

The experiment was designed to study the interaction between GA_3 and CCC (Chlorocholine chloride) on growth and yield of *Brassica campestris* L. (cv-M 27). CCC at different concentrations (50,100,250 and 500 µg/ml) was applied as foliar spray on the plant treated with GA_3 at varying concentrations (100, 250, 500 and 1000 µg/m). GA_3 was applied as pre-sowing seed soaking treatment. The combined effect of GA_3 and CCC registered better performances in all the parameters than either of the two compounds acted alone. GA_3 (500 µg/ml) in combination with CCC (500 µg/ml) recorded better growth and yield.

Key words : GA_3, CCC, *Brassica campestris* L. (cv-M 27), Growth and yield

Brassica campestris L. (Rapeseed) belongs to the family Brassicaceae. The plants of this family occupy the most important position in the list of daily consumable vegetable oils. Besides this the rapeseed has manifold uses. Seed is used as condiment in preparation of curries and pickles. Young leaves are used as green vegetable. The oil cake is used as cattle feed which has a cooling, digestive effect and can prevent skin diseases. Besides providing essential part of human diet, vegetable oils constitute an important raw materials for the agro- based industries and the manufacture of various other sophisticated products (Singh and Singh, 2001). It is also used as manure. The oil is used for illuminating purposes and it forms an ingredient in many Ayurvedic medicine and in medicated oils used as liniment for massage in many paralytic diseases of the nervous system. Rapeseed oil is used as lubricant in the manufacture of greases, quenching steel plates and for the manufacture of soft soaps.

Although several high yielding varieties have now been developed, our country has not yet been able to meet the demands of the population and is depending on imported edible oils (Saini *et al.*, 1989). The average yield of rapeseed and mustard in our country particularly in North east region of India is rather very low in comparision to its need. Insufficient production of rapeseed and mustard for our requirements is one of causes to make a way of adulteration in oils. The extent of adulteration had reached a dangerous levels in the year 1998 in causing "dropsy" (Menon, 1998).

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Hence, scientific study on growing rapeseed and mustard for its increased yield has become an urgent need of the country. Plant growth regulators which are generally used to modify growth and yield of crops have also been reported for amelioration of rapeseed plants by many workers (Saran and Mehta, 1983, 1985 and Mehta and Saran, 1986). The present experiment was designed to study the interactions between GA_3 a growth promoter and CCC (Chlorocholine chloride) a retardant on growth and yield of *Brassica campestris* (cv. -M 27).

MATERIALS AND METHODS

Healthy seeds of *Brassica campestris* (cv-M 27) were soaked for 12 hr in each of 100, 250, 500 and 1000 mg/ml of GA_3. Seeds soaked in distilled water for the same period was taken for control. The treated seeds were then planted in furrows in *rabi* season on October 15th (1998) in randomized block design which was replicated thrice. The row to row and plant to plant spacing was maintained at 30 cm and 15 cm, respectively. Foliar spary of varying concentrations of CCC was done at bud stage with the concentrations 50, 100, 250 and 500 mg/ ml. The land selected for the experiment was ploughed and reploughed with subsequent ladderings till the desired fine tilth for the crop was obtained. Basal application of farmyard manure at recommanded doses of 3 (three) tonnes/ ha and recommanded doses of urea, SSP (Superphosphate), MOP(Murate of Potash) in the proportion 130: 250: 60 kg/ha, respectively were applied in the field. To prevent the presence of soil insects BHC 10 (ten) per cent dust were applied along with the last ploughing in proper doses. Borax at the dose of 10 (ten) kg /ha was also applied along with the above fertilizer. The pH of the land was about 6.0.

Three plants of each plot of each replication were tagged randomly and used for recording data on stem length (80 days), number of branches, number of leaves (at 60 days), number of pods and the means were analysed stastisticaly. Seeds yield was calculated converting the plot area (90 cm x 60 cm) into hectare.

Oil content of seeds in terms of percentage was determined by cold Extraction Method (Kartha and Sethi, 1957)

RESULTS AND DISCUSSION

The height of the plants, number of leaves and branches, pod yield/plant and seed yield q/ ha as influenced by different concentrations of GA_3 and CCC were recorded (Table 1). GA_3 stimulated stem length and enhanced number of leaves, branches and pods upto the optimum range 500 μg/ml but declined at higher concentration 1000 μg/ml. These findings are in agreement with the findings of earlier workers *i.e.* Saran *et al.* (1992) in mustard, Khan *et al.* (2002) in mustard, Sharma and Sarma (1997) in *Raphanus sativus.* GA_3 at its optimal concentration (500 μg/ml) increased shoot length (85.0cm), leaf number (44.88), branch number (9.7 /plant). It ultimately led to more number of pods/ plant and increased yield (13.7 q/ha). The foliar spray of CCC reduced the stem length. This present finding in reduction of stem length substantiate the earlier finding of Pandya *et al.* (1974) in *Brassica juncea, Daniel et al.* (1982) in rapeseed plant, Rajput *et al.* (1996) in Indian mustard. The retardation in plant height caused by CCC may be due to shortening of internode by decreasing cell division (Zeevart, 1966).

In the experiment CCC alone and in combination with GA_3 maintains its retarding activities reducing elongation of stem. CCC lowers the auxin level and inhibits biosynthesis of gibberllic acid and thus reduces their concentration within the plant and ultimately it interferes with the activities of gibberelin resulting in growth retardation (Paleg *et al.*, 1965, Krishnamoorthy, 1981). Thus the stimulation elicited by GA_3 was checked by CCC which is reflected in the present findings. The resultant retardation can be observed by comparing the effects of GA_3 alone. When CCC in concentration ranging from 50 to 500 μg/ml combined with GA_3 at 500 μg/ml (optimal) exhibited the height as 70.6, 66.76, 65.5 and 65.0 cm, respectively against 85.0 cm at GA_3 500 μg/ml alone after 80 days. This shows a distinct counteracting effect of CCC on GA_3). The present finding collaborates the earlier observation made by Sharma and Sarma (1997) in *Raphanus sativus,* Saleh and Abdul (1980) in tomato.

Though an increased number of branches and leaves were recorded at 500 μg/ml of CCC, the combined effect of GA_3 and CCC in all the combinations caused more number of branches and leaves than those the compounds induced individually. GA_3 at its optimal concentration of 500 μg/ml in combination with CCC at 500 μg/ml produced highest number of branches (21.9 nos) and leaves (54.3 nos).

In response to CCC treatment the number of pods per plant was higher than control. This increased number of pods may be attributed to increased number of branches. The combined effect of GA_3 and CCC recorded higher pod numbers per plant than with GA_3, or CCC alone in different concentrations. GA_3 500 μg/ml in combination with CCC 500 μg/ml exhibited additive effect producing 471.7 number of pods compared to 247.3 number of pods at GA_3 500 μg/ml alone and to 254.0 number of pods at CCC 500 μg/ml alone, respectively. The increase in number pods may be due to retardation of linear growth of stem by CCC which manifested in better growth of laterals.

The stimulation of these growth parameters resulted in shifting the growth production balance towards increased number of flowers and thereby number of pods per plant. From the present finding it is evident that CCC was able to increase fruiting points and yield artibutes and this corroborates the earlier observations made by Cheema *et al.* (1987) in mustard and Bechyne (1982) in *B. alba, B. campestris* and *B. napus.*

The combined effect of GA_3 and CCC recorded higher seed yield than that with GA_3 or CCC acted alone. GA_3 500μg/ml combined at CCC 50, 100, 250 and 500 μg/ml exhibited highest additive effect yielding 14.3, 15.2, 15.3 and 16.7 q/ha, respectively compared to 13.7 q/ha at 500 μg/ml GA_3 (optimal) alone and 12.3, 13.0, 13.2 and 13.4 q/ha at 50, 100, 250 and 500 μg/ml CCC alone, respectively. Maximum seed yield (16.7 q/ha) was obtained at GA_3 500 μg/ml in conjunction with CCC 500 mg/ml. By inhibiting stem elongation CCC enhances the translocation of metabolites from source to sink. Reduction of stem length is an important effect of CCC treated plant which ultimately created favourable modification in growth and development of plant bringing higher seed yield. This finding is in agreement with those of earlier workers Daniel *et al.* (1982) in rapeseed plant, Cheema *et al.* (1987) Saini *et al.* (1987).

In case of oil content the data showed a minimum range of differences in production of oil content between treated and untreated plants but comparatively treated plants showed an increasing trend in producing more oil. Again the combined effect of GA_3 and CCC exhibited higher oil content than either of the two compounds

Table 1 : Growth performances of *Brassica campestris* L. (cv-M 27) due to interaction of GA_3 and CCC

Concentration combinations µg/ml GA_3 + CCC	Height (cm) 80 days	Leaves (in number)	Branches (in number)	Pods (in number)	Seed yield q/ha	Oil (%)
0+0	67.3	28.3	7.7	149.1	10.9	43.0
0+50	62.0	35.3	10.3	221.0	12.3	42.8
0+ 100	60.4	35.3	11.3	249.3	13.0	43.5
0+250	59.76	37.3	11.8	250.1	13.2	42.66
0+500	56.0	38.66	12.3	254:0	13.4	43.3
100+0	78.0	39.0	8.5	205.8	12.6	41.66
100+50	69.86	42.66	14.3	258.8	14.0	42.5
100+ 100	66.86	45.3	17.3	300.0	14.4	43.66
100+250	64.5	46.0	17.8	322.3	14.6	44.3
100+500	62.1	47.66	18.7	328.3	14.9	42.3
250+0	79.66	42.3	8.5	237.7	12.9	42.66
250+50	71.6	45.3	15.4	277.4	14.0	42.66
250+100	69.1	48.0	18.7	328.3	14.4	44.0
250+250	66.86	49.1	19.0	341.4	14.8	43.0
250+500	64.66	52.0	19.3	354.7	15.1	43.66
500+0	85.0	44.88	9.7	247.3	13.7	43.66
500+50	70.6	47.3	16.0	288.9	14.3	42.8
500+100.	66.76	50.0	19.6	358:6	15.2	44.0
500+250	65.5	50.3	20.1	368.6	15.3	44.66
500+500	65.0	54.3	21.9	471.7	16.7	44.0
1000+0	72.6	35.66	7.9	204.3	11.7	42.5
1000+50	66.0	39.66	13.9	200.3	12.0	42.66
1000+ 100	64.76	41.0	15.1	259.0	13.2	41.66
1000+250	63.86	42.3	16.2	290.2	14.3	44.0
1000+500	61.3	43.3	15.5	267.9	13.7	43.3
CD(G+CCC) at 5% probability level (n=15)	1.25	0.58	0.75	8.14	0.23	0.52
CD (GA_3 + CCC) at 1 % probability level (n= 15)	1.68	0.78	1.01	10.9	0.31	0.7
Interaction (Variance ratio)	3.89**	3.54 **	4.68**	16.42**	3.77**	2.7**

produced individually. This increase in oil content due to treatment of CCC may be attributed to the ascelaration of metabolism and formation of oil accumulating cell membrane by CCC (Mehrotra *et al.*, 1976, Prasad *et al.*, 1990). The increased production of pods per plant is one of the causes in yielding over all more oil in treated plants.

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