

Influence of Plant Growth Regulators, Chemicals and Nutrients on Growth, Yield and Yield Components in Safflower (*Carthamus tinctorius* L.)

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Abstract

A field experiment was conducted during *rabi* of 2000 to study the effect of plant growth regulators, chemicals and nutrients on growth, yield and yield components in safflower. The experiment consisted of two growth promoters (miraculan and NAA), one growth retardant (lihocin) and two chemicals (β -naphthol and salicylic acid) and two nutrients (FeSO_4 and KNO_3). The results revealed that the seed yield was significantly higher with miraculan (2000 and 1000 ppm) followed by lihocin (1000 and 500 ppm), NAA (100 and 50 ppm), β -naphthol (20 and 10 ppm) and FeSO_4 (1.0 and 0.5%) as compared to control. All the yield contributing characters viz., number of capitulum per plant, seed weight per plant, capitulum size and test weight except harvest index increased due to plant growth regulators, chemicals and nutrient treatments and all these parameters showed a significant positive correlations with seed yield. The data on benefit : cost ratio indicated that it was high in lihocin at 500 and 1000 ppm (2.871 and 2.402) followed by miraculan at 1000 and 2000 ppm (2.677 and 2.423) and β -naphthol at 10 and 20 ppm (2.567 and 2.306).

Key words : Plant height, PGRs, TDM, Safflower, Harvest index.

Safflower (*Carthamus tinctorius* L.) is one of the important oil seed crop commonly grown in *rabi* season of Indian conditions. Safflower oil is used as a high quality cooking oil and also as industrial oil in surface coatings. Seed yield and oil content are mainly dependent on the development of phenological characters. Plant growth regulators (PGRs) specially growth retardants are known to reduce internodal distance, there by enhancing the source-sink relationship and stimulates the translocation of photoassimilates to the seeds (1). The growth promoters enhances hormone modified translocation of photosynthates which will help in better seed filling. Phenolic chemicals and nutrients have important role in initiation and development of floral buds, metabolism, assimilation and a oxidation and reduction reactions and help in increasing the biomass and grain yield. With this background, the present investigation was carried out to assess the effect of plant growth regulators, chemicals and nutrients on growth, yield and yield components in safflower.

Methods

A field experiment was conducted at main re-

search station, University of Agricultural Sciences, Dharwad during *rabi* season 2000-01. The experiment consisted of two growth promoters (miraculan and NAA), one growth retardant (lihocin) and two chemicals (β -naphthol and salicylic acid) and two nutrients (FeSO_4 and KNO_3). The soil of the experimental site was medium black clay loam soil with pH 7.5, low nitrogen, medium phosphorus and high in potassium availability. The average rainfall received was 539.2 mm during 2000-01. The experiment was laid out in randomized block design with three replications. Sowing and cultural operations were followed based on the package of practice of the crop. Foliar application of growth regulators, chemicals and nutrients at two concentrations was done at 45 and 60 days after sowing (DAS) of safflower variety viz., Annigeri-1. Growth and yield observations such as plant height, total number of branches, total dry matter (TDM), number of capitulum per plant, capitulum size, oil content, and harvest index (HI) were recorded at the time of harvesting of the crop. The data collected were statistically analyzed for test of significance following the Fishers method of analysis of variance as given by Sundararaj et al. (2). The oil content in the seed

Table 3. Effect of plant growth regulators, chemicals and nutrients on economics of safflower. NAA=Rs 260/25g, Lihocin=Rs 85/100 ml, Miraculan=Rs 200/l, Salicylic acid=Rs 800/100 g, β -naphthol=Rs 260/25 g, FeSO_4 =Rs 90/kg, KNO_3 =Rs. 130/500 g.

Treatments (ppm)	Seed yield (kg/ha)	Gross returns (Rs/ha)	Additional cost due to PGRs chemical/nutrients (Rs/ha)	Total cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Benefit : cost ratio
1. Control (water spray)	1000	12000	–	3250	8750	2.692
2. Lihocin (500)	1163	13956	355	3605	10351	2.871
3. Lihocin (1000)	1171	14052	610	4130	9922	2.402
4. Miraculan (1000)	1183	14196	340	3860	10336	2.677
5. Miraculan (2000)	1198	14376	680	4200	10176	2.423
6. NAA (50)	1158	13896	875	4395	9501	2.162
7. NAA (100)	1160	13920	1750	5270	8650	1.641
8. β -naphthol (10)	1143	13716	325	3845	9871	2.567
9. β -naphthol (20)	1149	13788	650	4170	9618	2.306
10. Salicylic acid (50)	1083	12996	680	4200	8796	2.094
11. Salicylic acid (100)	1095	13140	1360	4880	8260	1.693
12. FeSO_4 (0.5%)	1132	13584	740	4260	9324	2.189
13. FeSO_4 (1.0%)	1134	13608	1480	5000	8608	1.722
14. KNO_3 (0.5%)	1115	13380	1760	5280	8100	1.534
15. KNO_3 (1.0%)	1122	13464	3520	7040	6424	1.096

1. Basic cost of cultivation=Rs 3250.00/ha
2. Price of safflower seeds=Rs 12.00 / kg
3. Cost of PGRs, chemicals and nutrients

Results and Discussion

Table 1 indicates that miraculan (2000 and 1000 ppm) treated plants recorded significantly higher plant height followed by NAA (100 and 50 ppm), β -naphthol (20 and 10 ppm) and FeSO_4 (1.0 and 0.5%) as compared to control. Increase in plant height might be due to the reaction of cell with NAA and there by high deposition of cell wall material through catalyzing activities of carboxylase and pectinase and also by inhibition of antagonistic effect of the inhibitors particularly abscission (4). However the plant height was significantly lower in lihocin (1000 and 500 ppm) as compared to other treatments. Application of lihocin (1000 and 500 ppm) recorded higher number of branches per plant followed by miraculan (2000 and 1000 ppm), NAA (100 and 50 ppm), β -naphthol (20 and 10 ppm) and FeSO_4 (1.0 and 0.5%), KNO_3 (1.0 and 0.5%) as compared to control.

The reduced plant height and increased number of branches per plant was due to retardation of transverse cell division particularly in cambium which is the zone of meristematic activity at the base of the internode (5). The application of growth regulators,

chemicals and nutrients significantly increased TDM and it was found that the increase was more with miraculan (2000 and 1000 ppm) followed by lihocin (1000 and 500 ppm) and NAA (100 and 50 ppm). The effect was more pronounced with chemicals and nutrient which indicated that growth regulators have known to reduce internodal distance there by enhancing the source-sink relationship and stimulate the translocation of photoassimilates to a greater extent. The application of miraculan (2000 and 1000 ppm) resulted in significantly higher seed yield followed by lihocin (1000 and 500 ppm), NAA (100 and 50 ppm), β -naphthol (20 and 10 ppm), FeSO_4 (1.0 and 0.5%) and KNO_3 (1.0 and 0.5%) and salicylic acid (100 and 50 ppm) as compared to control. This was attributed to significantly increase in yield components viz., number of capitulum per plant, capitulum size, 100 seed weight and harvest index due to application of growth regulators, chemicals and nutrients treatments. Similar results were observed by Ghosh et al. (6), Kene et al. (7), Kar et al. (8) and Sangale et al. (9). In general, plant growth regulators, chemicals and nutrients increased the harvest index (HI). Among the PGRs, miraculan (2000 and 1000 ppm) recorded higher HI followed by NAA (100 and 50 ppm) and lihocin (1000

and 500 ppm) treatments. In chemicals, β -naphthol (20 and 10 ppm) recorded higher HI as compared salicylic acid (100 and 50 ppm). Among nutrients FeSO_4 (1.0 and 0.5%) recorded higher HI as compared to KNO_3 (1.0 and 0.5 %). In all treatments showed a profound effect and increased oil content in seeds but no significant differences existed between the treatments. All the yield contributing characters viz., seed yield per plant, 100 seed weight, number of capitulum per plant, capitulum size except HI increased due to growth regulators, chemicals and nutrients treatments and all these parameters showed a significant positive correlation with seed yield (Table 2).

The present study revealed that among the various treatments, the benefit : cost ratio was highest with lihocin at 500 and 1000 ppm (2.871 and 2.402) followed by miraculan at 1000 and 2000 ppm (2.677 and 2.423) and β -naphthol at 10 and 20 ppm (2.567 and 2.306). This indicates that the application of lihocin is more effective and economical with higher benefit : cost ratio in safflower (Table 3).

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