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**RESEARCH ARTICLE**

# GROWTH AND YIELD OF SAFFLOWER AS INFLUENCED BY INM UNDER IRRIGATION AND RAINFED PLANTING

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**ABSTRACT**

A field experiment on "Growth and yield of safflower as influenced by INM under irrigation and rainfed planting" was conducted during rabi, 2013 at College Farm, Rajendranagar, Hyderabad. The experiment was laid out in a split plot design with two main treatments viz., M1: irrigation at rosette, branching and flowering, M2 : rainfed planting; and seven sub treatments viz., S1 : Control (no fertilizers), S2: RDF, S3: soil test based fertilizers, S4: RDF + FYM @ 5 t ha-1, S5 : soil test based fertilizers + FYM @ 5 t ha-1, S6: RDF + vermicompost @ 2 t ha-1 and S7: Soil test based fertilizers + vermicompost @ 2 t ha-1 and replicated thrice. With respect to irrigations at critical stages gives higher plant height, number of branches per plant, leaf area index, dry matter production per plant (g) and seed yield were recorded with irrigation treatment and it was significantly higher than rainfed planting. With respect to organics and soil test based inorganic fertilizers gives higher plant height, number of branches per plant, leaf area index, dry matter production per plant (g) and seed yield were recorded with S7 (soil test based fertilizers + vermicompost @ 2 t ha-1) and it was significantly superior to S6 (RDF + vermicompost @ t ha-1) followed by S5 (soil test based fertilizers + FYM @ 5 t ha-1), S4 (RDF + FYM @ 5 t ha-1), S3 (soil test based fertilizers), S2 (RDF) and S1 (control) treatment. Interaction effect of plant height, number of branches per plant, leaf area index, dry matter production per plant (g) and seed yield of safflower crop as influenced by main and sub treatments were found to be non-significant.



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## INTRODUCTION

Safflower (*Carthamus tinctorius* L.) is an oldest oilseed crop cultivated in India, mainly for cooking oil and dyes. Besides, safflower is a multipurpose crop species used in preparation of medicines, cosmetics, salads and margarine production (Balasubramanian and Palaniappan, 2005). Safflower seed contains 28-34% of oil, flavourless and colourless, and nutritionally similar to sunflower oil, having enough amount of linoleic acid (78%), which is very useful for reducing blood cholesterol content (Kadu and Ismail, 2008). Across the world, safflower is grown in 7.52 lakh ha with a total production of 6.46 lakh tons. India ranks first in area (41%) and production (29%) of the safflower grown across the world. In India, safflower is grown in 3 lakh ha and production is 1.89 lakh tons (*http://www.theindhubusinessline.com, January, 2011*). In A.P. safflower is grown in 19,000 hactares with a production of about 20,000 tons, with a productivity of 435 kg $ha^{-1}$ (Vyavasaya panchangam, 2012-13).

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Safflower is an important *rabi* oil seed crop mainly grown in semi arid regions for use as vegetable and industrial oil, bird feed, forage plant, medicinal purpose and for its colourful petals used as food coloring, flavouring agent and preparing textile dyes (Dordas and Sioulos, 2008). Importance of safflower as oilseed crop has increased in recent years, especially with increasing interest in production of biofuels (Essendal, 2001) and its well adaptation to saline and drought stress conditions due to its strong tap root (Bitarfan *et al*., 2011). Safflower oil preferred for its higher poly unsaturated fatty acid (78% linoleic acid) which reduces blood cholesterol level (Belgin *et al*., 2007). But, the productivity of safflower is very low as the crop is cultivated under nutrient stress environment conditions. However there is ample scope to increase safflower yields and quality by adopting suitable water and fertilizer management. Major nutrients like N, P and K should be supplied in sufficient quantity and in a balanced way to enhance productivity of the crop (Vishwanath *et al*., 2006). Since fertilizer is major input for increasing productivity, but cost of fertilizer is increasing. Hence there is need for inherent soil fertility to be enhanced by inclusion of organic manures which not only minimizes the cost of inputs but also boost the production and sustains soil fertility (Raju *et al*., 2013). Also

dumping of chemical fertilizers by the farmers without information on soil fertility status and nutrient requirement by crop causes adverse effects on soil and crop regarding both toxicity and deficiency either by over use or inadequate use (Rajan Bhatt, 2013). Hence application of fertilizers based on soil testing is the mantra for sustainable agriculture which takes care of inherent soil fertility. Productivity of the safflower can also be substantially increased by adopting appropriate water management practices especially, scheduling irrigation at critical stages *i.e.,* rosette, branching and flowering. Therefore keeping in view of the said facts above, safflower crop yields can be enhanced through integrated nutrient management and adopting soil test based concept, for which the present investigation was initiated.

## MATERIALS AND METHODS

The field experiment entitled "Growth and yield of safflower as influenced by INM under irrigation and rainfed planting'' was conducted at College farm, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad during *rabi* 2013-14. The soil of the experimental site was sandy loam in texture, neutral in reaction, low in available nitrogen, and medium in available phosphorus and high in available potassium. Experiment was laid out in split plot design with two main treatments *viz.,* $M_1$: irrigation at rosette, branching and flowering, $M_2$: rainfed planting and seven sub treatments *viz., $S_1$: Control (no fertilizers), $S_2$: RDF, $S_3$: RDF based on soil test values, $S_4$: RDF + FYM @ 5 tons ha$^{-1}$, $S_5$: Soil test based fertilizers+ FYM @ 5 tons ha$^{-1}$, $S_6$ :RDF + vermicompost @ 2 tons ha$^{-1}$ and $S_7$: Soil test based fertilizers+ vermicompost @ 2 tons ha$^{-1}$ and replicated thrice.* Safflower variety Manjira was shown on 1-11-2013 at a spacing of 45 cm x 20 cm with one seed hill$^{-1}$. RDF under irrigation is 60: 60: 30 kg ha$^{-1}$ and in rainfed is 30: 40: 20 kg ha$^{-1}$. RDF as per soil test, under irrigation is 30: 39:15 kg and for rainfed is 20: 39: 10 kg NPK ha$^{-1}$. P and K through SSP and muriate of potash applied as basal. While RDN as urea and through organics were applied as per the treatments. The organics were chemically analysed before sowing and N P and K content of FYM was 0.49, 0.74 and 0.92 per cent respectively, 1.64, 0.86 and 1.08 per cent in vermicompost respectively. About 98 mm rain fall received during the crop growing season in 8 rainy days.

## RESULTS AND DISCUSSION

### Growth attributes

The data pertaining to growth attributes were presented in Table 1. Growth attributes *viz.,* plant height, number of branches, leaf area index and dry matter production of safflower were significantly influenced by main treatments and sub-treatments at harvest stage. The data revealed that the plant height, number of branches per plant, leaf area index and dry matter production per plant of safflower increased significantly under irrigated and rainfed planting. However, plant height (74 cm), number of branches (19.8), leaf area index (3.2) and dry matter production (55.6 g plant$^{-1}$) of safflower was found to be maximum under irrigation compared to rainfed planting (70 cm, 16.4, 2.88 and 50.4 g plant$^{-1}$) at harvest. Rapid increase in growth attributes of safflower under irrigation might be due to optimum soil moisture availability coupled with higher water potential and turgidity of plant cells and leaf expansion which ultimately lead to higher assimilation compared to rainfed safflower. Similar findings were also reported by Patel and Patel (1993), Katole and Meena (1988) and Singh and Singh (1989). Among the sub treatments, there was significant difference in plant height, no. of branches, leaf area index and dry matter production of safflower. The $S_7$ treatment fertilized with soil test based fertilizers + vermicompost @ 2 t ha$^{-1}$ had recorded significantly higher plant height (80 cm), number of branches (24.2), leaf area index (3.86) and dry matter production (62.4 g plant$^{-1}$) of safflower over $S_6$ treatment (RDF + vermicompost @ 2 t ha$^{-1}$) (75cm, 21.3, 3.57 and 59.9 g) followed by $S_5$ (73 cm, 19.1, 3.31 and 56.4 g ), $S_4$ (72 cm, 18.1, 3.01 and 53.9 g ), $S_3$ (71 cm, 16.7, 2.79 and 50.7 g) and $S_2$ (69 cm, 14.6, 2.55 and 47.9 g).

**Table 1. Growth and seed yield (kg ha-1) of safflower as influenced by INM under irrigation and rainfed planting**

| Treatments | Plant height at harvest (cm) | No.of branches plant$^{-1}$ | Leaf area index | Dry matter production plant$^{-1}$ (g) | Seed yield kg ha$^{-1}$ |
|---|---|---|---|---|---|
| Main plots | | | | | |
| $M_1$ : Irrigation | 74 | 19.8 | 3.20 | 55.6 | 1098 |
| $M_2$ : Rainfed | 70 | 16.4 | 2.88 | 50.4 | 876 |
| Sem± | 0.1 | 0.4 | 0.01 | 0.4 | 11.5 |
| CD (P=0.05) | 0.4 | 2.4 | 0.08 | 2.6 | 71.0 |
| Sub plots | | | | | |
| $S_1$: Control (no fertilizers) | 65 | 12.6 | 2.18 | 39.8 | 705 |
| $S_2$: RDF (NPK) | 69 | 14.6 | 2.55 | 47.9 | 811 |
| $S_3$: Soil test based fertilizers | 71 | 16.7 | 2.79 | 50.7 | 907 |
| $S_4$ :RDF + FYM @ 5 t ha$^{-1}$ | 72 | 18.1 | 3.01 | 53.9 | 982 |
| $S_5$: Soil test based fertilizers + FYM @ 5 t ha$^{-1}$ | 73 | 19.1 | 3.31 | 56.4 | 1062 |
| $S_6$: RDF + Vermicompost @2 t ha$^{-1}$ | 75 | 21.3 | 3.57 | 59.9 | 1148 |
| $S_7$: Soil test based fertilizers + Vermicompost @ 2 t ha$^{-1}$ | 80 | 24.2 | 3.86 | 62.4 | 1295 |
| Sem± | 0.35 | 0.4 | 0.02 | 0.7 | 22.1 |
| CD (P=0.05) | 1.46 | 1.2 | 0.07 | 2.1 | 66.0 |
| Interaction | | | | | |
| Sub treatment at same level of main treatment | | | | | |
| Sem± | 0.2 | 1.0 | 0.03 | 1.1 | 30.5 |
| CD (P=0.05) | NS | NS | NS | NS | NS |
| Main treatment at same or different level of sub treatment | | | | | |
| Sem± | 0.7 | 0.7 | 0.03 | 1.1 | 31.7 |
| CD (P=0.05) | NS | NS | NS | NS | NS |

The control treatment ($S_1$) had recorded less growth attributes (65 cm, 12.6, 2.18 and 39.8 g) compared to all the treatments. Application of organic manures like vermicompost and FYM integrated with balanced fertilizers might have stimulated plant growth by improving seed germination, enhanced seedling growth and development compared to availability of nutrients through RDF alone. Similar results were reported by Taleshi *et al.* (2011) and Nakhlway (1991). Added beneficial effect from inorganic nutrients integrated with organic manures from which continuous nutrient release through mineralization of organic N had enhanced the plant growth and canopy development. Bitarfan *et al.* (2011) reported similar findings. Interaction effect of growth attributes of safflower crop influenced by main and sub treatments was found to be non significant.

**Seed yield**

The data pertaining to safflower seed yield was presented in Table 1. Seed yield was significantly influenced by main treatments *i.e.,* irrigation and rainfed planting. Seed yield was significantly higher (1098 kg $ha^{-1}$) when the crop was irrigated at critical stages influencing the growth and yield parameters there by showing 20.21 % increase in the Seed yield of rainfed safflower (876 kg $ha^{-1}$). Higher seed yield of safflower was obtained with irrigations at critical stages of crop growth, owing to availability of more nutrients for plant growth parameters (plant height, branching, leaf area index, and dry matter accumulation per plant.) and higher yield attributes like capitula per plant, seeds per plant and test weight. Similar results were reported by Singh *et al.* (1995), Amoughin *et al.* (2012) and Dashora and Sharma (2006). Within the sub plots, the seed yield of 1295 kg $ha^{-1}$ of safflower was significantly higher with $S_7$ (fertilizers based on soil testing + vermicompost @ 2 t $ha^{-1}$) followed by $S_6$ *i.e.,* RDF + vermicompost @ 2 t $ha^{-1}$ (1148 kg $ha^{-1}$) followed by grain yield of 1062 kg $ha^{-1}$ ($S_5$), 982 kg $ha^{-1}$ ($S_4$), 907 kg $ha^{-1}$ ($S_3$) and 811 kg $ha^{-1}$ ($S_2$). The seed yield of safflower crop without fertilizers was found to be lower 705 kg $ha^{-1}$ compared to rest of the treatments. Balanced supply of nutrients through balanced application of fertilizers (based on soil test), and organic matter in soil contributed by the application of organic manures significantly improved soil physico-chemical characters via modifying the soil environment to hold more moisture and nutrients, better aeration and microbial activity influencing nutrient uptake and improving growth and yield components and ultimately yield of safflower. These results tend to support the results of Nalatwadmath *et al.* (2003). Interaction effect of seed yield of safflower crop influenced by main and sub treatments was found to be non significant.

**Conclusion**

The above results established that fertilizers based on soil testing + vermicompost @ 2 t $ha^{-1}$ is the best INM practice that can be adopted for safflower crop, which was significantly superior over RDF + vermicompost @ 2 t $ha^{-1}$, Soil test based fertilizers + FYM @ 5 tons $ha^{-1}$, RDF + FYM @ 5 tons $ha^{-1}$, RDF based on soil test values, RDF and control. The data led to conclude that soil testing + vermicompost @ 2 t $ha^{-1}$ is best treatment for safflower crop compared to other treatment combinations and control.

## REFERENCES


Amoughin, R.S., Tobeh, A. and Jamaati-e-Somarin, S. 2012. Study on the effect of different plant density on some morphological traits and yield of safflower under irrigated and rainfed planting conditions. *International Journal of Agronomy and Plant Production*, 3 (8): 284-290.

Balasubramanian, P. and Palaniappan, S.P. 2005. Principles and Practices of Agronomy. 2nd Edition, Agro bios publication: 45-46.

Belgin, C., G. Bilal and K. Mustafa, 2007. Oil content and fatty acid composition of some safflower (*Carthamus tinctorius* L.) varieties sown in spring and winter. *Inter. J. Nat. and Eng. Sci*., 1(3): 11-15.

Bitarafan, Z., Shirani-Rad, A. H and Delkhosh, B. 2011. Nitrogen rates and sowing date effect on yield and oil content of spring safflower. *International Journal of Science and Advanced Technology,* 1(6): 25-30.

Dashora, P and Sharma, R.P. 2006. Effect of irrigation and sulphur nutrition on yield attributes, yield and oil content of safflower. *Crop Res*., 31(1):56-57.

Dordas, C and Sioulas, C. 2008. Safflower yield , chlorophyll content, photosynthesis, and water use efficiency response to nitrogen fertilization under rainfed conditions. *Indian Crop Production*, 27: 75-85.

Essendal, E. 2001. Safflower production and research in Turkey. *Proceeding of the 5th International Safflower Conference*, Williston, July 23-27, North Dokota, Sidney, Montana, USA. pp:203-206.

*http://www.thehindhubusinessline.com*, January, 2011. Business Line print edition published by global production of safflower.

Kadu, P.S. and Ismail, S. 2008. Impact of organics and biofertilizers on yield, quality and uptake of major nutrients by safflower grown on vertisols. *Annals of Plant Physiology,* 22(2): 214-216.

Katole, N. S. and Meena, G. P. 1988. Effect of row spacing, nitrogen and irrigation on seed yield, oil content and water requirement of safflower. *Indian Journal of Agronomy*, 33 (3): 339-341.

Nakhlawy F.S. 1991. Response of safflower to different levels on nitrogen phosphorus and potassium. *Acta Agronomica Hungarica*., 40(1-2): 87-92.

Nalatwadmath, S. K., Rama Mohan Rao, M. S., Patil, S. L., Jayaram, N.S., Bhola, S. N and Arujun Prasad, 2003. Long term effects of integrated nutrient management on crop yields and soil fertility status in vertisols of Bellary. *Indian Journal of Agricultural Research*, 37 (1): 64-67

Patel, N. C and Patel, Z. G. 1993. Performance of safflower under different irrigation scedulings in south Gujarat. *Ann. Agric. Res*., 14(1): 109-110.

Rajan Bhatt, 2013. Soil test based fertilization to improve production of oil seed crops in kapurthala district of Punjab. *International Journal of Science, Enivornment*, 2(3):521-526.

Raju, B., Rao, P.C., Reddy, A. P. K and Rajesh, K. 2013. Effect of INM practices on nutrient uptake and seed yield in safflower. *Annals of Biological Research*, 4(7):222-226.

Taleshi, K., Shokoh, A., Rafiee, M., Noormahamadi, G and Sakinejhad, T. 2011. Effect of vermicompost and nitrogen levels on yield and yield components of safflower under late season drought stress. *International Journal of Agronomy and Plant Production*, 2(1):15-22.

Vishwanath, H., Pujari, B. T., Prakash, S. S., Ramesh Babu and Deshmanya, J. B. 2006. Growth attributes, dry matter production and its partitioning and nutrient uptake studies in spineless safflower var, NARI-6 as influenced by nitrogen and sulphur levels. *Karnataka Journal of Agricultural Sciences,* 19(4): 913-917.

Vyavasaya Panchangam, 2012-13. *Published by Agricultural Information & Communication Centre*, ANGRAU. pp: 92-97.


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