Short Communication

EFFECTS OF ORGANIC AND INORGANIC FERTILIZERS ON THE YIELD OF SAFFLOWER

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Abstract

The present study was conducted to determine the effects of compost with reduced amount of chemical fertilizers on yield and quality of safflower seed (*Carthamus tinctorius* L.) cultivars "BARI Saf-1". Six treatments using different composition of fertilizers were replicated thrice in randomized complete block design (RCBD). The treatments were T_1 (RD (FRG 2018) $N_{75}P_{30}K_{60}S_{21}Zn_{2.6}B_2$), T_2 (75% RD + Compost at the rate of 2 t ha^{-1}), T_3 (50% RD + Compost at the rate of 4 t ha^{-1}), T_4 (25% RD + Compost at the rate of 6 t ha^{-1}) T_5 (Compost at the rate of 8 t ha^{-1}) and T_6 (Control). The results of field trial demonstrated the maximum plant height (164 cm), number of branches $plant^{-1}$ (8.77), number of capsules/plant (34.3) number of seeds $capsule^{-1}$ (47.4), thousand seed weight (41.1 g), straw yield (3110 $kg.ha^{-1}$) and seed yield (483 $kg.ha^{-1}$) recorded from combined application of 50% RD + Compost at 4 t ha^{-1} which was statistically different from all other treatments.

Keywords: Organic fertilizer, Inorganic fertilizer, Yield, Safflower

1. Introduction

Safflower is an annual oil crop (İlkdoğan, 2012). Safflower pulp which remains after taking its oil is a good feed source for animal breeding with the crude protein percentage of around 25%. Safflowers include water-soluble *carthamidin* and red-colored *carthamin* which is not water soluble. Safflower is also essential because of the substance named tocopherol which has similar properties with vitamin E in the composition of safflower oil (Yılmazlar, 2008).

Commonly used vegetable oils are rapeseed, soybean, sunflower, cotton seed, safflower, corn and palm oil (Oğuz *et al.,* 2012). Since organic fertilizers are essential sources providing substance and food formation. Balanced fertilizer use along with organic manures is considered as promising agro-technique to sustain yield, increase fertilizer use efficiency and restore soil fertility (Mishra *et al.,* 2011). In this study, with the scope of organic farming

which uses less chemical and which is more environment-friendly than conventional farming (Eckhoff *et al.,* 2005), the effect of organic origin fertilizer on yield and some quality features of safflower were investigated.

2. Materials and Methods

In the *rabi* season of 2022-2023, an experiment was conducted at BARI Central Research Station, Gazipur, using a randomized complete block design with three replications. Soil characteristics of the research field were assessed according to the method proposed by Rowell (1996). The soil texture was clay loam, the organic matter was 1.21% by the Walkley–Black method; exchangeable K (potassium) was 0.14 meq $100g^{-1}$ by 1N NH4OAc (ammonium acetate); the pH in a soil saturated extract was 6.1 and extractable P (phosphorus) was 11 µg g^{-1} by 0.5N $NaHCO_3$ (sodium bicarbonate) extraction and critical levels of other nutrients, particularly iron and manganese. Six treatments were tested: T_1 (RD (FRG 2018) $N_{75}P_{30}K_{60}S_{21}Zn_{2.6}B_2$), T_2 (75% RD + Compost at the rate of 2 t ha^{-1}), T_3 (50% RD + Compost at the rate of 4 t ha^{-1}), T_4 (25% RD + Compost at the rate of 6 t ha^{-1}) T_5 (Compost at the rate of 8 t ha^{-1}) and T_6 (Control). The fertilizers were applied according to specific methods and schedules. BARI Saf-1 was the crop under study, with specific planting and intercultural operations carried out. Yield and yield-contributing parameters were recorded and statistically analyzed. Post-harvest soil and plant samples were collected and analyzed using various methods to determine soil and nutrient characteristics. All necessary cultural practices and plant protection measures were followed uniformly for all the plots during the entire period of experimentation. Vermicompost contained 7.1 pH, 19.2% OC, 1.08% total N, 1.8% P, 1 me% K, 0.96% S, 0.01% both Zn and B.

3. Results and Discussion

The results of the experiment demonstrated that the number of primary and secondary branches, plant height, number of capsules per plant, number of seeds per capsule, 1000 seed weight, straw production, and safflower seed yield were all significantly impacted by varying fertilizer rates (Table 1). The treatment T_3 resulted in taller plants, longer roots, and increased branch numbers. The highest yield of safflower was obtained from the treatment with 50% RD fertilizer and 4 t/ha of compost. The application of compost also improved the nutrient status of the soil, increasing organic carbon content and nutrient uptake. Compost application resulted in significant variations in post-harvest soil properties. pH ranged from 7.1 to 7.5, with the highest value observed in the treatment with 50% RD + Compost at the rate of 4 t ha^{-1}. Overall, the results demonstrate the positive effects of 50% RD + Compost at the rate of 4 t ha^{-1} on the growth, yield, and soil quality of safflower crops. It is observed that crude fat percentage ranges between 7.5 and 13.21 by examining the applications in terms of protein percentage in seed composition. Accordingly, while the lowest ratio of protein,

which is 7.5%, has been observed in native fertility, the highest value has been observed as 13.21% in compost with 50% chemical fertilizers.

The higher yield and quality parameters of safflower in these treatments might be due to combination with organic sources which helped in sustaining nutrient supply and maintaining the residual soil moisture during dry period of crop growth, resulted in better utilization of applied nutrients through improved microbial activities that involved in nutrient transformation and fixation. Similar findings were reported by Malligawad (2010), Jalilian *et al.,* (2012), Yogesh (2013).

Table 1. Effects of organic and inorganic fertilizers on yield and quality of safflower

Treat.	Plant height (cm)	No. of branches/ plant	No of capsules/ plant	No. of seeds/ capsule	1000 seed wt. (g)	Straw yield (t/ha)	Seed yield (kg/ha)	Crude fat (%)
T1	143b	8.77a	32.2ab	43.3a	38.7b	2.73b	458b	12.63
T2	132c	7.8c	28.0c	38.0b	37.7bc	2.54b	428c	10.35
T3	164a	8.57ab	34.3a	47.4a	41.1a	3.11a	483a	13.21
T4	124d	8.03bc	31.1bc	35.1b	35.6c	2.1c	388d	10.50
T5	123d	6.83d	24.6d	27.4c	31.1d	1.72d	338e	7.50
T6	102e	6.10e	20.6e	23.6c	24.6e	1.14e	313f	8.14
CV%	3.05	0.44	5.98	6.96	3.35	6.23	1.12	-
S.E. (±)	2.32	0.19	0.98	1.43	0.67	0.08	0.05	-

Values having common letters in a column do not differ significantly at 5% level of significance by DMRT.

5. Conclusions

The study indicates that integrated nutrient management could potentially increase seed yield of safflower. The utilization of safflower as a valuable source for industrial, medical, and nutritional purposes could be a crucial strategy to boost the crop's appeal and reinstate its position as a significant oilseed crop.

Conflicts of Interest

The authors declare no conflicts of interest regarding publication of this paper.

References

Eckhoff, J., Bergman, J. and Flynn, C. 2005. A comparison of safflower (*Carthamus tinctorius* L.) grown under conventional and chemical-free conditions. 6th Int. Safflower Conf., Istanbul 6-10 June, 2005.

Jalilian, J., Modarres-Sanavy, S.A.M., Saberali, S.F., Sadat-Asilan, K. 2012. Effects of the combination of beneficial microbes and nitrogen on sunflower seed yields and seed quality traits under different irrigation regimes. Field Crops Res. 127:26- 34.

Malligawad, L.H. 2010. Effect of organics on the productivity of groundnut and its residual effects on succeeding safflower under rainfed farming situations. 19th World Congress of Soil Science, Soil Solutions for a Changing World 1-6 August 2010, Brisbane, Australia. 128-131.

Mishra, P.K., Shrivatava, G.K., Tripathi, R.K. and Khare, Y.R. 2011. Effect of conjunctive use of organic and inorganic sources of nitrogen on dry matter accumulation, uptake and nitrogen use efficiency of safflower (*Carthamus tinctorius* L.) in hybrid rice – safflower cropping system. Plant Archives.11:1113-1117.

Oğuz, H., Öğüt, H., Gkdoğan, O. 2012. The investigation of Turkey Agriculture Region production and support model to the effect of Biodiesel Industry. Iğdır University J. Inst. Sci. Technol. 77-84.

Yılmazlar B. 2008. The effect of different sowing dates on important agricultural characters and yield of some safflower (Carthamus Tinctorius L.) cultivars in Konya conditions. Ankara University Institute of Science and Technology, Field Crop Department.

Yogesh, T.C. 2013. Effect of In-situ green manuring of legumes, NP levels and organic manures on growth, yield and quality of safflower. Ph.D. Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India).