



Effect of Various INM Practices on Yield, Urease and Dehydrogenase activity in Safflower

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Abstract:

A field experiment was conducted to study the effect of organic manures in combination with inorganic nitrogen fertilizer on activity of urease and dehydrogenase and yield on safflower (*Carthamus tinctorius* L.) during *rabi* season 2009-10 at Students' Farm of College of Agriculture, Rajendranagar, Acharya N. G. Ranga Agricultural University. Among the different combinations tried, application of 50 % N through inorganic fertilizer + 50 % N through vermicompost (T7) resulted in highest seed and stalk yield (1239 kg ha⁻¹ and 3026 kg ha⁻¹, respectively). Similarly, the maximum activity of enzymes viz. Urease (31.54 µg of NH₄⁺-N released g⁻¹soil h⁻¹), dehydrogenase (154.83 mg of TPF produced g⁻¹soil d⁻¹) at flowering stage and Urease (6.97 µg of NH₄⁺-N released g⁻¹soil h⁻¹), dehydrogenase (12.29 mg of TPF produced g⁻¹soil d⁻¹) at harvest were observed with 50 % N through inorganic fertilizer + 50 % N through vermicompost (T₇).

Key words: Safflower, INM, Urease, Dehydrogenase and Yield.

Introduction:

Safflower (*carthamus tinctorius* L.) is a unique feature of salt as well as drought tolerance due to partially xerophytic nature, in addition to deep and extensive root system making efficient use of reserved soil moisture. It can safely be grown as a potential *rabi* crop in unirrigated areas. The average productivity of safflower in Andhra Pradesh is less than that of country's average productivity. The area under safflower crop is increasing but the productivity is not keeping pace with its yield potential. Among several reasons attributable to low productivity, the inadequate and imbalanced nutrition including almost all the essential nutrients can be considered as major one. Fertilizer is the major input through which the productivity can be increased by exploiting the varietal potential, since the cost of inputs of major nutrients through chemical fertilizers is increasing, the inherent fertility of soil has to be increased to make the soil more sustainable, and the use

of organic manure in manurial schedules is suggested. Hence, integrated nutrient management is more emphasized, not only to boost the production but also to preserve the ecosystem. Integrated nutrient management (INM) envisaging the use of organic manures, crop residues and other organic wastes, biofertilizers and inorganic fertilizers. Soil organic matter plays a vital role in keeping the soil productivity high. The conjunctive use of organics with the nitrogen fertilizer increased the efficiency of nitrogen, improves the soil health and controls soil pollution. Hence, the present paper deals with the Effect of various INM practices at flowering and at harvesting stage of safflower on yield, Urease and Dehydrogenase activity.

Materials and Method:

A field experiment was conducted to study the effect of organic manures in combination with inorganic nitrogen fertilizer on activity of urease and dehydrogenase and yield on safflower (*Carthamus tinctorius* L.) during *rabi* season 2009-10 at Students' Farm of College of Agriculture, Rajendranagar, Acharya N. G. Ranga Agricultural University. The treatments consisted of 25 % and 50 % recommended dose of nitrogen fertilizer substituted by each of farm yard manure, poultry manure and vermicompost in combination with 50 % and 75 % N through inorganic fertilizer along with control (no N) and 100 N (100 per cent N through inorganic fertilizer). In total, there were eight treatments which were laid out in a randomized block design and replicated thrice. Safflower variety NARI-6 was used for the study. Urease activity was assayed by quantifying the rate of release of NH₄⁺ from the hydrolysis of urea as described (1). Dehydrogenase activity was assayed by quantifying the µg of 2,3,5-triphenyl formazon (TPF) produced and expressed as µg of TPF produced g⁻¹ soil d⁻¹ as described by (2). The crop was harvested when most of the leaves turned yellow. Two rows on the border of all four sides in each plot were harvested as bulk and sun dried separately. Then net plots were harvested after thorough drying of the produce, threshing was done by beating the

plants with a stick. The threshed produce was winnowed and then seed was separated. The seed and stalk yields in each plot were recorded after proper drying. Statistical analysis of data was carried out as per the procedure given (3). Statistical significance was tested by applying F-test at 0.05 level of probability. Critical differences at 0.05 levels were worked out for significance

Results and Discussion:

The results showed that manures in conjunction with inorganic fertilizers recorded significantly higher seed yield and stalk yield than control (Table 1). The increase in seed yield due to 50 % N through inorganic fertilizer + 50 % N through vermicompost over control and 100 % nitrogen through inorganic fertilizer was 103 and 21 per cent respectively. Among the treatments, T₇ (50 % N through inorganic fertilizer + 50 % N through vermicompost) recorded the highest seed yield (1239 kg ha⁻¹) and stalk yield (3026 kg ha⁻¹) respectively, the lowest seed yield (610 kg ha⁻¹) and stalk yield (2076 kg ha⁻¹) was recorded with control which has not received nitrogen fertilizer. Treatment T₇ (50 % N through inorganic fertilizer + 50 % N through vermicompost) recorded 45 and 18 per cent stalk yield over T₁ (control) and T₂ (100 % N through inorganic fertilizer), respectively. The combination of 50 % nitrogen through vermicompost and 50 % nitrogen through inorganic fertilizer resulted in better seed and stalk yield over inorganic fertilizer alone and over other treatmental combinations. This might be due to the immediate release of nitrogen through inorganic nitrogen and the latter by the mineralization of nitrogen through vermicompost resulting in steady supply of nutrients throughout the crop growth period. These results were in accordance with findings of (4) in maize-soyabean cropping sequence. The beneficial effects of vermicompost in conjunction with inorganic nitrogen fertilizers on yield parameters have also been reported by (5) in ground nut, (6) in sunflower, (7) in wheat, (8) in greengram and (9) and (10) in safflower. The data on enzyme activity in soil at flowering and at harvest of the crop are presented in Table 2. The highest urease activity at flowering stage was recorded with treatment T₇ (31.54 µg of NH₄⁺-N released g⁻¹soil h⁻¹) which was statistically on par with T₆ (28.83 µg of NH₄⁺-N released g⁻¹soil h⁻¹) and T₈ (29.65 µg of NH₄⁺-N released g⁻¹soil h⁻¹). The treatment which has not received nitrogen fertilizer recorded the lowest urease activity at flowering stage. Among the treatments highest urease activity at harvest recorded with T₇ (6.97 µg of NH₄⁺-N released g⁻¹soil h⁻¹)

which was statistically on par with T₄ (5.60 µg of NH₄⁺-N released g⁻¹soil h⁻¹), T₅ (5.43 µg of NH₄⁺-N released g⁻¹soil h⁻¹), T₆ (6.02 µg of NH₄⁺-N released g⁻¹soil h⁻¹) and T₈ (6.46 µg of NH₄⁺-N released g⁻¹soil h⁻¹). Control (T₁) recorded the lowest urease activity at harvest.

The highest dehydrogenase activity at flowering stage was recorded with the treatment T₇ (154.83 mg of TPF produced g⁻¹soil d⁻¹), which was statistically on par with T₆ (134.46 mg of TPF produced g⁻¹soil d⁻¹) and T₈ (137.76 mg of TPF produced g⁻¹soil d⁻¹). Dehydrogenase activity (115.58 mg of TPF produced g⁻¹soil d⁻¹) recorded with T₄ which was on par with T₃ (93.16 mg of TPF produced g⁻¹soil d⁻¹) and T₅ (97.15 mg of TPF produced g⁻¹soil d⁻¹) these three treatments statistically lesser than T₆, T₇ and T₈. Dehydrogenase activity (76.85 mg of TPF produced g⁻¹soil d⁻¹) at flowering stage was recorded with treatment T₂ (100 % nitrogen through inorganic fertilizer) which was statistically lesser than all the treatments except control. The lowest dehydrogenase activity at flowering stage was recorded with control (no N). At harvest, among the treatments the plot which has received 50 % N through inorganic fertilizer + 50 % N through vermicompost (T₇) recorded the highest dehydrogenase activity (12.29 mg of TPF produced g⁻¹soil d⁻¹) which was on par with T₃ (9.26 mg of TPF produced g⁻¹soil d⁻¹), T₄ (10.62 mg of TPF produced g⁻¹soil d⁻¹), T₅ (9.78 mg of TPF produced g⁻¹soil d⁻¹), T₆ (11.21 mg of TPF produced g⁻¹soil d⁻¹) and T₈ (11.67 mg of TPF produced g⁻¹soil d⁻¹). Control was recorded the lowest Dehydrogenase activity at harvest. Enzymes in soil are biologically significant as they participate in the transformation, cycling of mineral element and influence their availability to plants. The enzyme activity is considered as an index of microbial activity. The activities of soil enzyme were influenced by the nature, age of crop and addition of fertilizers and manures. Results of the present study revealed that the activity of soil enzyme *viz.*, urease and dehydrogenase were significantly influenced by the application of different levels of organic N in combination with inorganic N applied to safflower. The enzyme activity at flowering stage and at harvest of safflower (Table 2) showed increases with increase in organic N levels. However, highest activity of all the enzymes were associated with the application of 50 % N through inorganic fertilizers + 50 % N through vermicompost (T₇). The increased enzymatic activity with increase in level of organic N application may be attributed to the increase in population of micro organisms like bacteria *etc.*, due to

increased availability of substrate (organic carbon) through manures releasing in these enzymes of extra-cellular origin. The lower activity of soil enzymes with control (T₁) as compared to combined treatments can be attributed to the lack of sufficient substrate i.e. organic carbon which acts as energy source for proliferating the

microbial population. Thus it is inferred that higher rates of N, P and K fertilization enhanced the activities of soil enzymes and the effect was more pronounced with organic manures in combination with fertilizers. Similar results were obtained (11) and (12) for urease; (13), (14) and (12) for dehydrogenase in soil.

Table 1: Seed yield and stalk yield (kg ha⁻¹) of safflower as influenced by integrated nutrient management

S.No	Treatments	Seed yield (kg ha ⁻¹)	Stalk yield (kg ha ⁻¹)
T ₁	No N-(Control)	610	2076
T ₂	N-(100 % through inorganic fertilizer)	1020	2551
T ₃	N-(75% through inorganic fertilizer + 25% through FYM)	1059	2657
T ₄	N-(75% through inorganic fertilizer + 25% through vermicompost)	1122	2815
T ₅	N-(75% through inorganic fertilizer + 25% through poultry manure)	1077	2723
T ₆	N-(50% through inorganic fertilizer + 50% through FYM)	1154	2898
T ₇	N-(50% through inorganic fertilizer + 50% through vermicompost)	1239	3026
T ₈	N-(50% through inorganic fertilizer + 50% through poultry manure)	1197	3016
	S.Ed.±	114	168
	C.D (P = 0.05)	245	361

Table 2: Effect of integrated nitrogen management on enzyme activity in soil at Flowering and at harvest stage of safflower

S.No.	Treatments	Urease µg of NH ₄ ⁺ -N released g ⁻¹ soil h ⁻¹		Dehydrogenase mg of TPF produced g ⁻¹ soil d ⁻¹	
		Flowering	Harvest	Flowering	Harvest
T ₁	No N-(Control)	10.49	3.65	57.78	5.29
T ₂	N-(100 % through inorganic fertilizer)	17.83	5.06	76.85	8.76
T ₃	N-(75% through inorganic fertilizer + 25% through FYM)	22.67	5.27	93.16	9.26
T ₄	N-(75% through inorganic fertilizer + 25% through vermicompost)	25.30	5.60	115.58	10.62
T ₅	N-(75% through inorganic fertilizer +25% through poultry manure)	23.72	5.43	97.15	9.78
T ₆	N-(50% through inorganic fertilizer +50% through FYM)	28.83	6.02	134.46	11.21
T ₇	N-(50% through inorganic fertilizer +50% through vermicompost)	31.54	6.97	154.83	12.29

T ₈	N-(50% through inorganic fertilizer +50% through poultry manure)	29.65	6.46	137.76	11.67
	S.Ed.±	1.47	0.72	10.63	1.59
	CD (P = 0.05)	3.16	1.54	22.82	3.41

Conclusion:

Among the different combinations tried, application of 50 % N through inorganic fertilizer + 50 % N through vermicompost (T₇) resulted in highest seed and stalk yield (1239 kg ha⁻¹ and 3026kg ha⁻¹, respectively).The enzyme activity at flowering stage and at harvest showed increase with increase in the organic levels. The highest activity of urease (31.54µg of NH₄⁺-N released g⁻¹soil h⁻¹), dehydrogenase (154.83 mg of TPF produced g⁻¹soil d⁻¹) at flowering stage and urease (6.97 µg of NH₄⁺-N released g⁻¹soil h⁻¹), dehydrogenase (12.29 mg of TPF produced g⁻¹soil d⁻¹) at harvest were observed with the application of 50 % N through inorganic fertilizer + 50 % N through vermicompost (T₇).

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