

Effects of Organic, Inorganic and Integrated Fertilizer Systems on the Zinc Absorption and Yield of Sunflower Cultivars

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INTRODUCTION

Maintaining soil and water quality and obtaining optimum crop yield are major components of a sustainable agriculture. Animal manure can improve soil moisture and has long-term positive effects on biological and chemical properties (Lotfollahi 2005, Stevenson et al. 1998). Investigations of plant quality and nutrient uptake in different nutrient systems (organic, inorganic and integrated fertilizer) to use environmental factors, agronomic management and application of agricultural inputs effectively and efficiently could benefit the optimization of fertilizer usage, increase efficiency and decrease soil and water pollution. Thus, the objective of this study was to determine the effects of organic, inorganic and integrated fertilizer treatments on yield and agronomic N- efficiency of sunflower cultivars.

METHODS

The field experiment was conducted at the Agricultural and Natural Research Center farm in Miandoab Research Station (Lat.-36° 58 'N, Long. 46° 09'E, Alt. 1371m) in 1999 and 2000. The soil of the experimental field was a silty loam (bulk density 1.2, pH 8.1, EC 0.81 mmhos cm⁻¹). Organic carbon was less than 1% in the top 25 cm and lower than that in the sub-soil. Available N, P, K, Fe and Zn concentrations were 0.11%, 7.2, 210, 2.76 and 1.2 ppm, respectively. This experiment was conducted in a Randomized Complete Block Design (RCBD) with 3 replicates. Plots were treated with various levels of chemical fertilizer (40, 80, 120, 160 and 200 kg N ha⁻¹), organic fertilizer (6, 12, 18, 24, 30 tons farm yard manure (FYM) ha⁻¹), integrated fertilizers (40 + 24, 80 + 18, 120 + 12, 160 + 6 kg N ha⁻¹ + tons FYM ha⁻¹, respectively), and control (no fertilizer). Well-decomposed cow manure compost was used in March with 20% moisture, and N, P, K, Fe and Zn concentrations of 1.4, 0.6, 2.62%, 633 and 54 ppm, respectively. Finally, data were analyzed for variance, and if significance was found, the Duncan's multiple range test was carried out.

RESULTS AND DISCUSSION

Results for grain yield, Zn uptake and Zn yield under different fertilizer treatments are in Table 1. There were significant differences in sunflower grain and Zn uptake in response to applied N, animal manure or integrated fertilizers compared with controls. The grain yield, and Zn yield of sunflower increased substantially and significantly with increasing level of N under the chemical fertilizer and the organic treatment, but Zn yield did not increase with N levels in the integrated treatment. The integrated fertilizer treatments showed a significant higher yield than other treatments and control. The organic and integrated fertilizer treatments showed the highest Zn yield. The Zn yield of sunflowers increased with increasing levels of FYM application. The integrated fertilizer treatment 80 kg N + 18 tons FYM ha⁻¹ resulted in the highest Zn uptake and yield in this treatment group.

Table 1. Grain and Zn yield and Zn content as effected by different fertilizer treatments
Data was pooled from 2 years.

Fertilizer system	Treat number	manure	+	Inorganic N	Zn content	Zn yield	Grain yield
		T ha ⁻¹		kg ha ⁻¹	ppm	kg ha ⁻¹	kg ha ⁻¹
Control	1	0	+	0	51.25c	0.081	1695.2j
Chemical	2	0	+	40	51.50c	0.150	3028.1h
	3	0	+	80	50.45c	0.157de	3320.0fg
	4	0	+	120	51.08c	0.173d	3603.6de
	5	0	+	160	51.54c	0.192c	4027.3c
	6	0	+	200	51.29c	0.200bc	4084.2c
Organic	7	6	+	0	54.50bc	0.151e	2901.7h
	8	12	+	0	55.67ab	0.172d	3155.7gh
	9	18	+	0	57.46ab	0.194c	3444.3ef
	10	24	+	0	58.37ab	0.219b	3745.1d
	11	30	+	0	59.54a	0.266a	4566.1b
Integrated	12	24	+	40	56.71ab	0.254a	4693.6ab
	13	18	+	80	57.0ab	0.263a	4872.3a
	14	12	+	120	56.0ab	0.249a	4633.1ab
	15	6	+	160	56.87ab	0.260a	4768.7ab

CONCLUSIONS

Based on our results, the combined application of inorganic and organic fertilizers would reduce the fertilizer input and increase Zn uptake and yield, which would reduce the input of inorganic fertilizer even more. A combined application could maintain a sustainable agriculture.

REFERENCES

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