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Evaluation Of Compost Fertilizer "Zarkhez" In Conjunction With Chemical Fertilizers For Rice And Wheat Production

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Abstract

Experiments conducted to evaluate a compost fertilizer "Zarkhez" showed that effect of compost alone (2000 kg ha^{-1} and 4000 kg ha^{-1}) on number of tillers, 1000-grain weight, yield and NPK uptake by rice and wheat was almost similar to control, whereas, significant improvements were observed when combination of compost and chemical fertilizers were applied. Maximum yield of paddy (4.25 t ha^{-1}) and wheat (2.61 t ha^{-1}) were obtained with 4000 kg ha^{-1} compost + chemical fertilizers (150-75-0 kg ha^{-1}), which were 170.70 and 272.86 percent increased over control, respectively.

Key words: Chemical Fertilizers, Compost, Rice, Wheat

Introduction

Organic materials are being traditionally used by farmers since long. However, these materials received less attention when chemical or inorganic fertilizers became commercially available. The interest in a more systematic and intensive use of organic materials is regaining momentum because as a consequence of energy crises chemical fertilizers have become expensive (Saleem *et al.*, 1986).

The importance of organic materials such as manure, mulch, compost, green manure and domestic and industrial wastes is well known due to their multiple functions in soil. These not only maintain good soil structure, improve water and nutrient holding capacity, aeration in soil but provide also plant nutrients (Prasad and Singh, 1980). Organic materials act as chelating agents and hold the minerals desorbed from the soil. During the decomposition of organic matter acids are also produced which increase the availability of mineral nutrients in soil for plants (Lorenz and Maynard, 1980). The major possible and practicable sources of organic matter are farm yard manure, green manure and compost. As the compost fertilizers contain low contents of major nutrients Mohanty and Patnaik, 1975; Azad, 1986; Salim *et al.,* 1986) to fulfil the requirements of plants, they should be supplemented with chemical fertilizers. The integrated use of organic and chemical fertilizers enhances each others efficiency. Organic manures also help in the substitution of costly chemical fertilizer for crop production (Hussain *et al.,* 1988; De Jesus, 1995). Uptake of nutrients by maize (Mahmood *et al.,* 1984), rice (Shiota *et al.,* 1984) and wheat (Tomar *et al.,* 1984) also increases as chemical fertilizers are applied in combination with kallar grass compost and rice straw compost, respectively. However, significantly increased yields of wheat and sorghum with alone compost application have been reported by Bhandari and Vyas (1993) and Ramanathan and Devi (1994), respectively.

An organic fertilizer locally known as "Zarkhez" was manufactured by Faroaq Compost Fertilizer Corporation Limited, Karachi. It was prepared by the process of decomposition from city svveeps/wastesi/refuses and was claimed to be a complete fertilizer to replace chemical fertilizers for all crops. Keeping in view "Zarkhez" was evaluated for rice and wheat production in conjunction with chemical fertilizers.

Materials and Methods

The field experiments were carried out in the research area of Soil Science Department, University of Agriculture, Faisalabad. After the layout and before fertilizer and compost application to rice crop samples were collected from 0-15 cm depth. These samples were processed and analysed for physical and chemical characteristics as out lined by Jackson (1986) and are given in Table 1. The compost samples were also analysed for nutritional status (Table 2).

Table 1: Physical and chemical characteristics of original soil

Determination	Value
Textural class	Sandy clay loam
pH	7.90
ECe	1.20 dS m^{-1}
CEC	9.20 me/1 00 g soil
Organic matter	0.54%
Total Nitrogen	0.05%
Available Phosphorus	9.50 mg kg^{-1}
Available Potassium	140.00 mg kg^{-1}

Table 2: Analysis of "Zarkhez" compost

Constituent	Quantity (%)
Organic matter	35.80
Phosphorus	0.26
Nitrogen	1.60
Potassium	1.08
Calcium + Magnesium	2.90

The compost "Zarkhez" was applied in conjunction with chemical fertilizers as following treatments:

T_1 = Control (No Zarklhez or fertilizer)
T_2 = Compost at 2000 kg ha^{-1}

T_3 = Compost at 4000 kg ha^{-1}
T_4 = NPK fertilizers (1 50-75-0 kg ha^{-1})
T_5 = NPK. fertilizers (150-75-0 kg ha^{-1}) +2000 kg ha^{-1} compost
T_6 = NPK fertilizers (150-75-0 kg ha^{-1}) + 4000 kg ha^{-1} compost

All P as single superphosphate and compost were applied before rice transplantation. Nitrogen in the form of urea was applied in two equal splits half at transplanting and half 35 days after transplantation. After treatment application the rice variety KS-282 was transplanted in the standing water keeping hill to hill and row to row distance of 20 and 25 cm, respectively. In the same layout then wheat variety LU-26S was sown in lines 30 cm apart. The same treatments were applied to wheat as used in case of rice with the exception that second 1/2 N was applied at first irrigation. During growth and at maturity of rice and wheat crops following observations were recorded:

(I) Number of tillers per hill m^{-1} length
(II) 1000-grain weight (g)
(III) Paddy/wheat grain yield (t ha^{-1})

Samples taken at harvest were analysed for NPK uptake. The data were statistically analysed according to Randomized complete block design (Steel and Torrie, 1980).

Results and Discussion

Yield And Yield Attributing Components Of Rice And Wheat: Observations on yield and yield attributing components of rice and wheat crops are presented in Table 3. It is evident from the data that maximum increase in number of tillers and 1000-grain weight of paddy and wheat was under the treatment 4000 kg compost ha^{-1} + 150-75-0 kg ha^{-1}. Paddy and wheat yields also increased to the maximum being 4.25 and 2.61 t ha^{-1}, respectively under the same treatment showing the superiority of this treatment to others. It was also noticed from the data that in its effectiveness both the low (2000 kg ha^{-1}) and the high rate (4000 kg ha^{-1}) of compost application were at par with each other and appeared almost similar to control treatment. Similar poor performance of the rice husk compost was reported by Azad (1986) and it was attributed to the poor status of available plant nutrients in rice husk compost. On the other hand favourable effects of kallar grass compost on the yield of maize were reported by Mahmood *et al*. (1984) which they attributed to its contents of humic substances known to increase crop yield directly or indirectly. They also stated that this compost contained sufficient amounts of N, P and K nutrients. Similarly, Bhandari and Vyas (1993) and Ramanathan and Deepa Devi (1994) also reported beneficial effects of compost on wheat and sorghum, respectively. Chemical fertilizers (150-75-0 kg ha^{-1}) when applied alone improved yield and yield contributing components significantly as compared to compost and control treatments. More pronounced results were obtained where chemical fertilizers were applied in conjunction with compost as Hussain *et al.* (1988) and De Jesus (1995) also got the maximum yield of rice with combined application of organic sources and chemical fertilizers. However, this effect of conjunctive application of two compost rates and chemical fertilizers was nonsignificant when compared with each other and chemical fertilizers alone applications. This observation showed that significant results as compared to control under these treatments were not due to compost but chemical fertilizers

Table 3: Yield and yield attributing components of rice and wheat as affected by Zarkhez and chemical fertilizers

Treatments applied (kg ha^{-1})				No. of tillers		% increase over control		1000-grain weight (g)		% increase over control		Yield (t ha^{-1})		% increase over control	
Compost	N	P_2O_5	K_2O	Rice ($hill^{-1}$)	Wheat (m^{-1})	Rice	Wheat	Rice	Wheat	Rice	Wheat	Paddy Rice	Grain Wheat	Rice	Wheat
0	0	0	0	9.04d*	58.87c*	-	-	22.67c	45.04c	-	-	1.57b	0.70c	-	-
2000	0	0	0	10.66cd	61.27c	17.92	4.08	24.33bc	45.23c	7.32	0.42	1.86b	0.73c	18.47	4.28
4000	0	0	0	10.29cd	71.47c	13.83	21.40	25.42b	45.68abc	12.13	1.42	2.06	0.89c	27.39	27.14
0	150	75	0	12.66b	122.13b	40.04	107.46	27.77a	46.58abc	22.50	3.42	3.53a	2.16b	124.84	208.57
2000	150	75	0	13.21ab	137.93a	46.13	134.29	28.26a	47.09ab	24.66	4.55	4.04a	2.55ab	157.32	264.28
4000	150	75	0	14.58a	144..60a	61.28	145.62	29.09a	47.30a	28.27	5.02	4.25a	2.61a	170.70	272.86

*Any two means within each character followed by the same letter are not significantly different at 5% probability level

Table 4: Uptake of NPK by rice and wheat crop under compost and chemical fertilizers application

Treatments applied (kg ha^{-1})				N uptake (kg ha^{-1})		% increase over control		P uptake (kg ha^{-1})		% increase over control		K uptake (t ha^{-1})		% increase over control	
Compost	N	P_2O_5	K_2O	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat
0	0	0	0	55.05c*	29.77c*	-	-	8.22d	7.59c	-	-	44.03c	74.83d	-	-
2000	0	0	0	60.75c	33.13c	10.35	11.29	8.92cd	8.54c	8.51	12.52	47.88c	100.54c	8.74	34.36
4000	0	0	0	66.32c	44.20c	20.47	48.47	9.58c	8.78c	16.54	15.68	55.30c	109.33b	25.60	46.10
0	150	75	0	106.58b	91.08b	93.60	205.94	10.91b	13.02b	32.72	71.54	72.33b	104.41bc	64.27	39.53
2000	150	75	0	121.32ab	111.28a	120.38	273.80	12.32a	15.06a	49.48	98.42	106.07a	123.58a	140.90	65.15
4000	150	75	0	132.94a	120.12a	141.49	303.49	13.42a	16.30a	63.26	114.76	106.80a	128.18a	142.56	68.62

*Any two means within each character followed by the same letter are not significantly different at 5% probability level

were responsible. It again proved the inferior quality of "Zarkhez" compost containing such a low quantity of plant nutrients which were not sufficient for proper growth and yield of crop. Similarly, lower grain yield and dry matter production of rice and wheat in the compost treatments were reported by Mohanty and Patnaik (1975) and Salim *et al.* (1986) respectively. They attributed these findings to inadequate availability of nitrogen, resulting from immobilization of inorganic nitrogen initially present as well as added through compost, because of high C/N ratio.

Nutrient Uptake: The data on uptake of NP and K by rice and wheat crops are presented in Table 4 which depicted that the uptake of nutrients under compost alone was almost similar to control except in case of P uptake by rice and K uptake by wheat crop. As the yield of rice and wheat in compost alone treatments was poor consequently uptake at nutrients was also poor and similar to control treatment. Mohanty and Patnaik (1975) also reported that although application of compost showed increased uptake of nitrogen when compared to control but it was non-significant. The application of urea and SSP (150-75-0 kg ha^{-1}) significantly increased the uptake of NPK. So it was concluded that compost fertilizer was inefficient to increase the uptake of nutrients as compared to chemical fertilizers. Although no K was applied through soil fertilization even then its uptake increased. Probably it might be due to increased growth of crop and the availability of native K. The most significant effect was observed when chemical fertilizers were supplemented with higher dose of compost resulting in significant increase of N, P and K uptake over control and compost alone, Conjunctive use of compost and chemical fertilizers was also favoured by Mahmood *et al.* (1984), Shiota *et al.* (1984) and Tomar *et al.* (1984) as they reported enhanced uptake of nutrients in maize and rice and wheat crops, respectively.

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