The Journal of Animal & Plant Sciences, 22(3): 2012, Page: 683-687
ISSN: 1018-7081

EFFECT OF ORGANIC MANURES WITH RECOMMENDED DOSE OF NPK ON THE PERFORMANCE OF WHEAT (*Triticum aestivum* L.)

G. Abbas, J. Z. K. Khattak[*], A. Mir[*], M. Ishaque[**], M. Hussain[***], H. M. Wahedi[*], M. S. Ahmed[*] and A. Ullah[****]

Adaptive Research Farm, Karor, District Layyah, Punjab, Pakistan.
[*]Department of Bioinformatics & Biotechnology, International Islamic University, Islamabad, Pakistan.
[**]Department of Forestry, [***]Department of Agric. Economics, University of University of Agriculture Faisalabad, Pakistan
[****]Agronomic Research Station Karor, District Layyah, Punjab, Pakistan.
Corresponding Author e-mail: ghulamabbas68@gmail.com

ABSTRACT

Recently, the interest in organic farming is increasing among the researchers and farmers due to the advent of high yielding cultivars and escalating fertilizer prices. Application of different organic manures in combination with inorganic fertilizer to wheat crop might give a substitute under field condition. A field experiment was conducted for two consecutive years (2007-09) with the objective to find out the best combination and type of organic and inorganic fertilizers for wheat (*Triticum aestivum* L.) production. The experiment was laid out in randomized complete block design (RCBD) with three replications. The treatments were: control (T1, no manure), departmental recommendation 128+114+62 NPK Kg ha^{-1} (T2), farmyard manure @ 10 tons ha^{-1} at time of seed bed preparation (T3), poultry manure @ 6 tons ha^{-1} + 128-114-62 Kg ha^{-1} NPK (T4). At maturity, plant height (cm), spike length (cm), number of spikelets per spike and grain yield from 1m^2 area of randomly selected plants were recorded. Results led to the conclusion that T4 gave the best result with combination of 6 t/ha poultry manure + 128-114-62 kg ha NPK.

Key words: Wheat; farmyard manures; NPK fertilizers; yield; Pakistan.

INTRODUCTION

The potential of wheat can only be fully exploited by judicious use of inputs, proper plant protection measures and sufficient irrigation at critical stages, because of this, agricultural scientists are engaged in establishing an agricultural system which can lower production cost and conserve the natural resources. Therefore, recent interest in manuring has reemerged because of high prices of inorganic fertilizers and the importance of green, farmyard and other types of organic manures that provide long term soil productivity besides meeting nutrient requirements becomes obvious.

Organic farming is a production system which provides or largely excludes the use of synthetic inorganic fertilizers, pesticides and growth regulators. Organic manures in combination with each other render greater beneficial effects (Channabasanagowda *et al.,* 2008) on plant growth and yield. The soils of Pakistan are generally low in organic matter (<1%). Firstly because of arid climate resulting in rapid decomposition of organic matter and secondly, because very little organic matter is added to soils during cultivation. Soil fertility can be increased through the utilization of minerasl as well as organic matter (Azad and Yousaf, 1982).

Worldwide, there is growing interest in the use of organic manures due to depletion in the soil fertility. Organic fertilizers including farmyard manure (FYM), sheep manure and poultry manure may be used for crop production as substitute of chemical fertilizers because the importance of organic manures cannot be overlooked. Economic premiums for certified organic grains have been driving many transition decisions related to organic farming. Farmyard manure and composts are in limited supply and may have low and variable nutrient contents. This has necessitated the practice of green manuring and the use of farmyard manure which are readily available and are valuable sources of both nitrogen and organic matter (Korsaeth *et al.,* 2002). Continuous use of fertilizers creates polluting effects in the environment. Synthesis of chemical fertilizers consumes a large amount of energy and money. However, an organic farming approach with or without chemical fertilizers seems to be possible solution for these problems. Type of organic material and its quality influence the soil characteristics and nutrient supply to the crops variably (Ahmad *et al.,* 2007).

The biological manure has many attributes. It supplies a wide variety of nutrients along with organic matters that improves the physical characteristics of soil. Its beneficial effects on plant growth are sometimes difficult to duplicate with other materials. There is also a positive interaction between the combination of organic manures and NPK (Pong and Laty, 2000). However, in the long term use, organic manures hold great promise for improving soil characteristics (Hussain *et al.,* 1999; Khaliq *et al.,* 2006).

Because of rapidly rising energy costs and the uncertain availability of chemical fertilizers, in the

developing countries, the need for using organic manures was realized. Present study was designed to evaluate the effect of organic manure with chemical fertilizers on the yield of wheat.

MATERIALS AND METHODS

Farm Site description: A field study was conducted at adaptive research farm Karor (Layyah) and farmer field Ahsan Pur during the year 2007-08 and 2008-09. Adaptive Research Farm Karor (ARF), District, Layyah lies between 30°-45' to 31°-24' N, and 70°-44' to 71°-50'E.

Statistical design and treatments: The experiment was laid out in randomized complete block design (RCBD) having three replications. Net plot size was 5.4m x 9 m. Experimental treatments comprised of controlled (T1), departmental recommendation 128+114+62 NPK kg/ha (T2), farm manure @ 10 tons/ha at time of seed bed preparation (T3), poultry manure @ 6 tons/ha + 128-114-62 kg/ha NPK (T4).

Methodology: Potassium and phosphorus were applied at the time of sowing while nitrogen was applied in splits i.e., half at the time of sowing and remaining at 1st irrigation. The crop was irrigated at continuous intervals according to the need of crop and the weeds which emerged during crop growth were manually pulled from whole of the experimental area. The crop was harvested at maturity & following parameters were recorded during the experiment: Number of tillers/plant, Number of spikelet's/spike, Number of grains/spike, 1000-grain weight (g) and grain yield (Kg ha^{-1}). All other agronomic practices were adopted as per recommendation. The observations were carried out at Research Farm during the year 2007-08 and 2008-09. The data regarding growth parameters like plant height (cm), number of plants per m^2, spike length (cm), spikelets per spike were collected at maturity and yield parameters like 1000 grain weight and yield (Kg ha^{-1}) were collected after harvesting of crop.

Analysis of soil and manures: The physiochemical properties of soil at a depth of 0-15cm of ARF were measured. Soil texture was loam having the following characteristics: sand (40.7%), silt (37.3%), clay (22.0%), pH (8.1), organic matter (0.8%), $CaCO_3$ (5.5%), EC 1.5 dSm-1, available N 0.6 g kg^{-1}, available P 10.5 mg kg^{-1}, exchangeable K 125 mg kg^{-1} and AB-DTPA extractable Zn 0.9 mg kg^{-1}, ABDTPA extractable Fe 2.9 mg kg^{-1} and AB-DTPA extractable Mn 1.2 mg kg^{-1}.

Farm yard manure and poultry manures were also subjected to nutrient analysis and observed as follows:

Organic Materials	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Farmyard manure	0.31	0.13	1.37
Poultry Manure	3.30	3.12	0.85

Statistical Analysis: The data were recorded and analyzed statistically. Least significant difference (LSD) at 5 percent probability level was computed to compare treatment means. (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Plant Height (cm): Data obtained showed significant difference in plant height at A. R Farm during 2007-08. The results showed that T2 - T4 had plants that were statistically at par but taller than T1. In 2008-09, there was no significant difference in plant height at all treatments. Results obtained from farmer's field during 2007-08 showed that T4 produced significantly taller plants that the other treatments while the T2 & T3 produced statistically similar plant heights that were however taller than those at T1. In 2008-09, T3 produced the tallest plant which did not differ from that at T4; but T4 plant were statisticallt similar to those of T1 and T2. Organic manures in combination with inorganic fertilizers render greater beneficial effects (Channabasanagowda *et al.,* 2008) on plant growth and yield. Significant improvement in growth components of wheat has been reported due to application of sewage sludge (Jamil *et al.,* 2006). Significant increase in plant height of spring wheat by FYM application was recorded by Sharma *et al.,* (2005). Similarly, El-Ghamri *et al.,* (2009) reported that plant height of maize with integrated use of FYM + ½ NPK fertilizers was statistically similar to that with full dose of NPK fertilizers.

Number of plants (m^{-2}): The effect of treatment on number of plants per m^2 indicated that at A. R. Farm in 2007-08 T4 produced the highest number while T1 has the least. This was followed by T3 & T2 in that order. In 2008-09, the number of plants/m^2 at T3 and T4 were statistically similar but higher than others which equally were at par Table 2.

Analysis of Farmer's Field results during 2007-08 showed the following relationship: T4>T3>T2>T1. The results collected during 2008-09 showed that all treatments were notsignificantly different.Significant improvement in yield contributing components of wheat including the number of tillers has been reported due to application of crop residues (Alam *et al.,* 1998) and sewage sludge (Jamil *et al.,* 2006).

Spike Length (cm): Analysis of data during 2007-08 and 2008-09 in A R Farm and Farmer's field showed that T4 had significantly higher spikes than the other treatments while T1 had the shortest spike length. The spike obtained at T2 and T3 were at par. Analysis of 2008-09 results in A R Farm showed that T4 and T3 were at par

but longer than T2 which in turn was longer than T1 (Table 3).

Farmer Field data during 2008-09 showed that T4 had the longest spike which however, was similar to that at T3. The spike lengths at T3 and T2 were equally at par but longer than that at T1. Organic manures are excellent source for multi-nutrient supply to crop plants although in a variable manner depending on their type and quality and cause increase in spike length (Ahmad *et al.*, 2007).

Table 1: Effect of organic and inorganic manures on plant height (cm) of wheat

Treatments	Adaptive Research Farm, Karor		Farmer Field, Ahsan Pur	
	2007-08	2008-09	2007-08	2008-09
T1= control	80.42[b]	98.27[a]	79.47[c]	83.30[b]
T2= departmental recommendation 128+114+62 NPK kg ha^{-1}	88.83[a]	100.90[a]	87.67[b]	84.47[b]
T3= farmyard manure at rate of 10 tons ha^{-1} at time of seed bed preparation	90.08[a]	105.90[a]	90.02[b]	89.23[a]
T4= poultry manure at rate of 6 tons ha^{-1} + 128-114-62 kg ha^{1} NPK	95.37[a]	107.80[a]	96.13[a]	86.10[ab]
LSD Value at 0.05	7.41	10.13	5.23	4.53

Mean followed by the same letter(s) within a column are not significantly different at 5% level.

Table 2: Effect of organic and inorganic manures on number. of plants per m^2 of wheat

Treatments	Adaptive Research Farm, Karor		Farmer Field, Ahsan Pur	
	2007-08	2008-09	2007-08	2008-09
T1= control	176.70[d]	207.70[b]	176.70[d]	309.30[a]
T2= departmental recommendation 128+114+62 NPK kg ha^{-1}	275.00[c]	234.30[b]	275.00[c]	295.30[a]
T3= farmyard manure at rate of 10 tons ha^{-1} at time of seed bed preparation	293.00[b]	274.00[a]	293.00[b]	298.30[a]
T4= poultry manure at rate of 6 tons ha^{1} + 128-114-62 kg ha^{-1} NPK	309.70 [a]	298.00[a]	309.00[a]	319.70[a]
LSD Value	15.35	29.3	16.70	25.80

Mean followed by the same letter(s) within a column are not significantly different at 5% level

Table 3: Effect of organic and inorganic manures on wheat spike length (cm)

Treatments	Adaptive Research Farm, Karor		Farmer Field, Ahsan Pur	
	2007-08	2008-09	2007-08	2008-09
T1= control	8.15[c]	8.96[c]	8.15[c]	7.98[c]
T2= departmental recommendation 128+114+62 NPK kg ha^{-1}	8.73[b]	9.66[b]	8.73[b]	8.80[b]
T3= farmyard manure at rate of 10 tons ha^{-1} at time of seed bed preparation	8.83[b]	10.53[a]	8.83[b]	8.88[ab]
T4= poultry manure at rate of 6 tons ha^{-1} + 128-114-62 kg ha^{-1} NPK	9.21[a]	10.40[a]	9.21[a]	9.17[a]
LSD Value	0.33	0.65	0.34	0.25

Mean followed by the same letter(s) within a column are not significantly different at 5% level.

Number of spikelets spike^{-1}: Analysis of data during 2007-08 and 2008-09 at A. R. Farm showed that the number spikelets per spike produce at T2, T3 and T4 were statistically similar but higher than that at T1 (Table 4).

Similarly data obtained from Farmer Field during 2007-08 and 2008-09 showed that there was no signfincant different in number of spikeletes per spike among all the treatments. Plant nutrients and organic compounds released during decomposition of organic matter enhance the crop growth and yield attributes (Hendrix *et al.*, 1994).

1000- Grain Weight (g): Analysis of results during 2007-08 at A. R. Farm showed the relationship T4> T3> T2> T1. The 2008-09 results showed that T4 and T3 produced statistically similar 1000-grain weight which was significantly higher than other treatments. This was followed by T2 and T1 in that order. Analysis of results showed similar results during 2007-08 and 2008-09 at Farmer Field as that of 2008-09 in A R Farm.

Yield (Kg ha^{-1}): Analysis of results during 2007-08 at A. R. Farm showed grain yield obtained at all the treatments was statistically similar. Analysis of data during 2008-09 showed T4 produced the highest grain yield which was however, similar to that produced at T3 the grain yield at T3 and T2 was similar but higher than that at T1 (Table). Farmer Field results during 2007-08 showed that all the applied manure rates produced statistically similar grain yield. But the yield at T1 and T4 did not differ significantly. Results during 2008-09 showed the

relationship T4> T3> T2> T1. that all treatments are non significant to each other. It has been reported that role of organic manures in improving crop yield is attributed to the supply of all essential nutrients due to their continuous mineralization. Organic manures or compost applied to preceding crops leave considerable amount of nutrients for the succeeding wheat and economize 25% inorganic NPK for both the crops (Ghosh *et al.,* 2004) and 50% NPK for wheat (Sarwer *et al*., 2008).

Table 4: Effect of organic and inorganic manures on number of spikelets per spike at a. r. farm and farmer field during 2007-08 and 2008-09.

Treatments	Adaptive Research Farm, Karor		Farmer Field, Ahsan Pur	
	2007-08	2008-09	2007-08	2008-09
T1= control	16.10[b]	16.05[b]	13.00[a]	13.03[a]
T2= departmental recommendation 128+114+62 NPK kg ha[1]	17.00[a]	17.07[a]	13.67[a]	13.64[a]
T3= farmyard manure at rate of 10 tons ha^{-1} at time of seed bed preparation	17.67[a]	17.60[a]	15.00[a]	15.07[a]
T4= poultry manure at rate of 6 tons ha^{-1} + 128-114-62 kg ha^{-1} NPK	17.80[a]	17.77[a]	14.33[a]	14.32[a]
LSD Value	0.88	0.97	1.41	1.49

Mean followed by the same letter(s) within a column are not significantly different at 5% level

Table 5: Effect of organic and inorganic manures on 1000 grain weight

Treatments	Adaptive Research Farm, Karor		Farmer Field, Ahsan Pur	
	2007-08	2008-09	2007-08	2008-09
T1= control	38.24	37.74[c]	37.44[c]	37.44[c]
T2= departmental recommendation 128+114+62 NPK kg ha^{-1}	40.54[c]	40.89[b]	39.64[b]	39.64[b]
T3= farmyard manure at rate of 10 tons ha^{-1} at time of seed bed preparation	41.52[b]	42.37[a]	41.56[a]	41.56[a]
T4= poultry manure at rate of 6 tons ha^{-1} + 128-114-62 kg ha[1] NPK	42.42[a]	43.26[a]	42.44[a]	42.44[a]
LSD Value	0.87	1.39	1.89	1.89

Mean followed by the same letter(s) within a column are not significantly different at 5% level

Table 6: Effect of organic and inorganic manures on grain yield (kg/ha) during 2007-08 and 2008-09 at a. r. farm and farmer field.

Treatments	Adaptive Research Farm, Karor		Farmer Field, Ahsan Pur	
	2007-08	2008-09	2007-08	2008-09
T1= control	760.30[a]	1557.00[c]	760.12[b]	835.20[d]
T2= departmental recommendation 128+114+62 NPK kg ha^{-1}	2654.00[a]	2825.00[b]	2657.00[a]	2736.00[c]
T3= farmyard manure at rate of 10 tons ha^{-1} at time of seed bed preparation	2887.00[a]	3360.00[ab]	2889.00[a]	2982.00[b]
T4= poultry manure at rate of 6 tons ha^{-1} + 128-114-62 kg ha[1] NPK	2284.00[ab]	3597.00[a]	2279.00[ab]	3412.00[a]
LSD Value	361.00	554.00	375.00	239.00

Mean followed by the same letter(s) within a column are not significantly different at 5% level.

Conclusion: Our results clearly depict that application of NPK with poultry manure increased wheat yield. Combined application of 128 kg N, 114 kg P, 62 kg K along with 6 tons/ha poultry manure proved better for both growth and yield parameters. Based on our study results, it is recommended that poultry manure at 6 t/ha + NPK 128-114-62 kg/ha be applied to obtain the best performance from wheat.

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