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Short Communication

Influence of Different Organic Manures on Wheat Productivity

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ABSTRACT

Manures are significant organic source of plant nutrients. Farmer's awareness is increasing towards organic farming due to high cost of synthetic fertilizers and nutrient composition in Wheat grain all over the world. A spring wheat cultivar was used in an experiment. In this experiment five organic manures were used; green manure (GM), farm yard manure (FYM), poultry litter (PL), press mud (PM) and sewage sludge (SS). Each manure was used at the rate of (@) 10 ton per hectare (t ha^{-1}). Six different treatments were made with different combination of these manures along with one treatment having recommended dose of NPK (150, 115, 60 kg ha^{-1} NPK, respectively) and one control treatment with no fertilizer at all. The results indicated that the combination of GM+PL+SS each @ of 10 t ha^{-1} gave maximum economic yield (3.65 t ha^{-1}), which was 137% more from control. PL and SS each @ 10 t ha^{-1} followed by green manuring should be used as organic manure in wheat crop.

Key Words: Wheat productivity; Organic manures; Manure sources

INTRODUCTION

Wheat (*Triticum aestivum* L.) is grown all over the world for its high nutritious value. It is ranked among the top three most produced cereal crops in the world, along with corn and rice (Byerlee & Polanco, 1983). Wheat grain is consumed in several ways in a number of industrial and commercial products. It is also a cheaper source of feed for livestock and poultry. Organic farming is a production system, which avoids or largely excludes the use of synthetic or inorganic fertilizers, pesticides and growth regulators (Reddy, 2005). Organic agriculture is contributing to most of the points listed (where these points are listed) and to a certain extent this is also true for integrated production systems. However, manure handling; storage and disposal continue to present major problems for poultry producers throughout the world (Petric *et al*., 2009). Alternative farming, characterized by a reliance on local agricultural bio-resources is now in great demand, because they are more cost-effective (Bhattacharyya *et al*., 2008). Organic matter in soil improves soil structures, nutrient retention, aeration, soil moisture holding capacity and water infiltration (Deksissa *et al*., 2008). Although organic amendments can provide available nutrients for plants and nutrient transformation during organic matter decomposition strongly interacts with plant nutrient uptake, leading to a competition for nutrients between soil microorganisms and plants (Kaye & Hart, 1997). Further, these systems are beneficial for the overall health of the agri-environment (Defra, 2002). Development and management of effective fertilization practices, such as by manipulating the quantity and type of organic amendments, improve soil ecosystems and fertility (Manqiang *et al*., 2009) Organic fertilizers including farmyard manure, sheep manure and poultry manure may be used for crop production as a substitute of the chemical fertilizers. Poultry manure may be used as an organic amendment to restore degraded soils (Sanchez-Monedero *et al.,* 2004). Similarly animal waste and green manures are used to replace nitrogen and other elements and to build up soil organic matter content (Lampkin, 2002).

Worldwide, interest in the use of organic manures is increasing day by day due to depletion in the soil fertility. Economic premiums for certified organic grains have been driving many transition decisions related to the organic farming (Delate & Camberdella, 2004). Continuous use of fertilizers potential pollutes the environment (Oad *et al.*, 2004). Synthesis of chemical fertilizers consumes a large amount of energy and money. However, the integration of organic sources and synthetic sources of nutrients not only

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supply essential nutrients but also have some positive interactions leading to increase efficiency and thereby, reduce environmental hazards (Ahmad *et al.*, 1996). For organic production to be competitive, it has to meet certain quality standards. Unfortunately, organic farmers find it difficult to meet the quality standards for wheat (especially protein & gluten content), although they are paid a much higher price for organically produced grain (Ceseviciene *et al*., 2009).

The aim of present study was to determine the influence of organic sources of nutrients in different combination on growth and yield of wheat, as wheat is the cereal crop, which is most commonly grown in organic farming systems.

MATERIALS AND METHODS

The study was carried out at the Adaptive Research Farm Karor, Layyah Pakistan. The experiment was laid out in randomized complete block design (RCBD) with four replications in plots measuring 7 m^2. Spring wheat (*Triticum aestivum* L.) cultivar Bhakar 2002 was sown manually by hand drill on 16th November, 2006 with seed rate of 125 kg ha^{-1}. Five organic manures were used in this experiment. Five organic sources were utilized namely *Sesbenia aculeate* as green manure crop (GM), farm yard manure (FYM), poultry manure (PM), press mud (PM) and sewage sludge (SS) in different combination (GM+FYM+PL, GM+FYM+PM, GM+FYM+SS, GM+PL+PM, GM+PL+SS & GM+PM+SS) each @ 10 t ha^{-1}. A control was maintained without any fertilizer and organic manure. Also a treatment with recommended fertilizer dose (NPK @ 150+115+60 kg ha^{-1} respectively) was included to compare organic farming with inorganic fertilizer. All organic manures were added well before sowing, while full dose of PK and 1/3 N also applied at the time of sowing; remaining N was applied in two split (at tillering & earing stage). Weeds were controlled manually by hoeing and hand pulling in all treatment. First irrigation was given twenty days after sowing and subsequent irrigations were applied as per requirement of crop keeping in view the climatic conditions. Samples from all organic sources as well as soil samples taken from the experimental field were chemically analyzed for NPK determination (Table I).

Standard procedures were followed to collect data for growth and yield parameters of wheat. Number of fertile tillers was counted at maturity from randomly selected two sites (m^2) from each experimental unit and average was obtained. For plant height ten plants were selected randomly from each plot at maturity and plant height was measured from base of the tiller to tip of spike with a meter stick and average plant height was computed.

Ten mature spikes were selected at random from each plot and spikes length, spikelet per spike and number of grains per spike was recorded and then average was calculated. Similarly, 1000-grains of every plot were counted by seed counter (Seed Buro, Model Number 801-10/C & Serial Number CO 452) and weighed on an electric balance The crop was harvested on maturity and sun dried for few days. These samples were threshed manually to take grain yield. Biological yield of sun-dried samples in kilogram (kg) was recorded for each plot and reported in t ha^{-1}. Harvest index (HI) of each plot was determined by using the formula given by Hunt (1978) try to find some recent reference also along with this:

$$HI = (\text{Economic yield}/\text{Biological yield}) \times 100$$

Data collected on crop characteristics were computed for analysis of variance technique (Steel *et al*., 1997) using statistical package M-Stat C. The differences among treatments' means were compared by using the least significant difference (LSD) test at 5% probability level.

RESULTS AND DISCUSSION

Present investigations were carried out to determine the influence of different organic manures on wheat growth and yield. Application of NPK @ 150+115+60 kg ha^{-1} showed maximum plant height (86.5 cm) due to instant availability of nutrients from inorganic fertilizer source and minimum plant height in control was due to less availability of nutrients. Other manures combination also had variable extent of increase in plant height as compared with control. Our result was confirmatory of the finding of Channabasanagowda *et al.* (2008) they also found same result. Production of fertile tillers was an important yield determining parameter. Data regarding number of

Table I: Chemical analysis of experimental soil and manures

Nitrogen (%)		Phosphorus	Potassium
Soil	0.03	6.9 mg/kg	225.0 mg/kg
FYM	0.87	0.26%	0.5%
P l	2.04	2.06%	1.67
PM	0.7	1.22%	0.7%
SS	3.5	2.00%	0.3%

Source: Animal nutrition Lab. University of Agriculture Faisalabad.
FYM= Farm yard manure, PL= Poultry litter, PM= Press mud and SS= Sewage sludge

Fig. 1: Effect of different organic manures on yield and its components in wheat

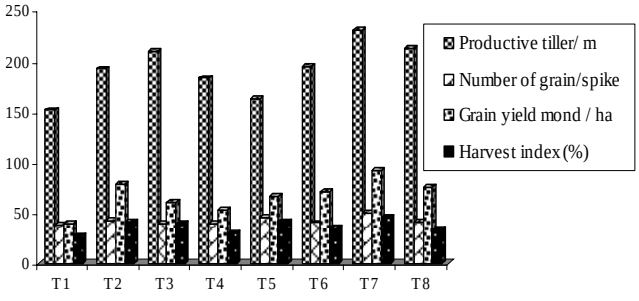

Table II: Effect of different organic manures on yield components of wheat

Treatment*	Plant height (cm)	Productive tillers (m^{-2})	Spike length (cm)	Number of spikelet per spike	Number of grain per spike	1000-grain weight (g)	Total biomass (t ha^{-1})	Grain yield t (t ha^{-1})	Harvest index (%)
Control	67.00 e	151.3 d	6.33 f	6.31 d	37.7 d	31.89 e	5.34 e	1.54 g	27.60 f
NPK recommended	86.50 a	192.3 bc	9.28 a	9.27 c	42.5 bc	37.92 a	7.96 b	3.14 b	40.12 b
GM+FYM+PL	80.50 bc	209.5 ab	7.40 de	11.81 b	39.00 d	34.06 d	6.39 d	2.38 ef	38.78 bc
GM+FYM+PM	82.75 b	183.3 bcd	7.03 e	12.5 b	38.7 d	33.87 d	7.27 c	2.10 f	29.59 ef
GM+FYM+ SS	76.75 d	162.3 cd	7.62 cd	14.3 a	44.7 b	36.39 b	6.46 d	2.65 de	41.37 ab
GM+PL+PM	79.50 cd	194.3 bc	7.12 e	12.4 b	39.7 cd	35.00cd	8.33 b	2.84 cd	34.60 cd
GM+PL+SS	82.75 b	230.8 a	8.22 b	14.9 a	49.25 a	38.63 a	8.13 b	3.65 a	44.77 a
*GM+PM+SS	80.50 bc	213.0 ab	7.89 bc	11.9 b	40.75cd	36.31bc	9.05 a	3.03 bc	33.41 de
LSD (5%)	2.97	32.71	0.40	0.75	3.37	1.35	0.60	0.29	4.26
CV (%)	2.54	11.58	3.59	4.39	5.52	3.11	5.63	7.36	8.00
EMS	4.09	494.7	0.075	0.26	5.25	1.17	0.17	0.039	8.42

Means not sharing the same letters in a column differ significantly at 5% probability

*Each treatment @ 10 t ha^{-1}, LSD=Least significant difference, CV= Coefficient of variance and EMS= Error mean squire

productive tillers per unit area given in Table II indicated that the combination of GM+PL+SS each @ 10 t ha^{-1} gave best results (213.0) and recorded 40.7% more productive tillers as compared to control however, it was statistically at par with treatment, where GM+FYM+PL each @ 10 t ha^{-1} were applied and minimum number of productive tillers was recorded in control. Maximum spike length (9.28 cm) was observed in the treatment where NPK was applied at recommended rates; it was followed by the GM+PL+SS each @ 10 t ha^{-1} while minimum spike length (6.3 cm) was recorded in control. Maximum number of spikelet per spike (14.9) was recorded in GM+PL+SS each @ 10 t ha^{-1} and it was 88.56% more from control and it was statistically not different from GM+FYM+ SS each @ 10 t ha^{-1}.

The GM+PL+SS each @ 10 t ha^{-1} which was combination of poultry litter and sewage-sludge after green manuring gave maximum number of grains per spike (49.25) that was 30.64% more from control and minimum grains per spike was recorded in control. These finding are confirmatory with those reported by Cherr *et al.* (2006). The weight of grain is an important yield component and made major contribution towards grain yield of wheat. The more 1000-grain weight of a crop depicts its efficacy to store more and more photosynthates in the seed. The 1000-grain weight is greatly influenced by ecological conditions and soil nutrients. Data (Table II) showed that maximum 1000-grain weight (38.63 g) was obtained in GM+ PL+SS each @ 10 t ha^{-1} and it was statistically at par inorganic NPK giving 12.11% and 11.90% more from control, respectively while minimum 1000-grain weight (31.89 g) was recorded in control. This result of present study supported the findings of Khattak *et al*. (1989). Maximum biological yield (9.05 t ha^{-1}) was produced with the application of GM+PM+SS each @ 10 t ha^{-1} it was followed by GM+PL+PM each @ 10 t ha^{-1}, GM+ PL+SS each @ 10 t ha^{-1} and then by Recommended inorganic NPK, while less biomass was recorded in control.

Wheat grain yield per hectare is the outcome of cumulative contribution of various yield components, which is affected by different growing conditions and crop management practices. The data pertaining to grain yield (Table II) was much affected by the application of different organic manures. Statistical analysis of the data revealed that different treatments had significant influence on the grain yield of the wheat crop probably due to different concentration of NPK in the organic manures (Table I); these results were clear in Fig. 1. Maximum grain yield (3.65 t ha^{-1}) was obtained from the combination GM+ PL+SS each @ 10 t ha^{-1}; it was 137% more from the control treatment. This might be attributed to more productive tillers, number of spikelets per spike, number of grains per spike and 1000-grain weight in this treatment, which was clear from Fig 1. Among different manures combination the combination of GM+FYM+PM each @ 10 t ha^{-1} gave relatively poor performance, because both manures had lesser NPK as compared to other organic manures (Table I). However, minimum yield (1.47 t ha^{-1}) was obtained from the control, where there was no application NPK or organic manure. Channabasanagowda *et al.* (2008) and Ghosh *et al.* (2004) used organic and inorganic source for NPK in wheat crop and their finding supported the above results.

The productive efficiency of a crop at variable agronomic practices could be also measured in terms of harvest index. Data regarding harvest index, presented in Table II indicated significant differences among treatments. Maximum harvest index (44.77 %) was observed in GM+ PL+SS each @ 10 t ha^{-1} and it was at par with GM+FYM+ SS each at 10 t ha^{-1} while minimum harvest index was recorded in control.

CONCLUSION

Our result showed that the combination of GM+PL+SS each @ 10 t ha^{-1} gave maximum productive tillers, number of grain per spike and 1000-grain weight as a result this combination gave highest grain yield. The performance of above combination was better at all growth stages of the crop due to frequently availability of nutrients to plant at all growth stages; as this combination had high quantity of NPK as compared to other groups of

manures. Thus, PL and SS each @ 10 t ha^{-1} followed by green manuring should be used as organic manure in wheat crop.

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