Pak. j. life soc. Sci. (2011), 9(1): 63-66

Pakistan Journal of
Life and Social Sciences

Effect of Different Organic Matter on Growth and Yield of Wheat (*Triticum aestivum* L.)

Muhammad Tahir*, Muhammad Ayub, Hafiz Muhammad Rashad Javeed, Muhammad Naeem[1], Hasseb-ur-Rehman, Muhammad Waseem and Muqarrab Ali
Department of Agronomy, University of Agriculture, Faisalabad, Pakistan
[1] University College of Agriculture and Environmental Sciences, Islamia University, Bahawalpur, Pakistan

Abstract

A study was conducted at the Department of Agronomy, University of Agriculture, Faisalabad, Pakistan during rabie season 2007-08 to check the effect of different organic matters along with recommended dose of synthetic fertilizers on the growth and yield components of wheat (*Triticum aestivum* L.). The results of this experiment revealed that all the yield contributing factors such as number of spikelets per spike (18.4), number of grains per spike (48.8), 1000-grain weight (43.83g) and grain yield (4.14 t ha^{-1}) were significantly increased in T_3 [Humic acid 55% (dry basis) + K_2O 8% (dry basis)] as compared to all other treatments because it increased the availability of nutrients by aerating the soil, increasing the water holding capacity of soil and lowering down pH of soil which provides the favorable conditions for the growth and ultimately good crop harvest was achieved. Hence the results of this experiment indicate that organic matter along with recommended dose of synthetic fertilizers could be helpful in increasing the stagnant grain yield of wheat in our country.

Key words: *Triticum aestivum* L., organic matters, Nutrients, yield, Pakistan

Introduction

Wheat (*Tritium aestivum* L.) is one of the most important staple food crop among cereals, not only in Pakistan but also in many other Asian countries. Although, Pakistan is leading wheat producing country in the world, however potential yield of wheat can not be achieved (Shad et al*.,* 1999) due to many constraints such as water shortage, imbalanced nutrients, low soil fertility and inability of afford chemical fertilizers limits the crop yield. Nutrients are the major determinants of the productivity of any soil.

***Corresponding Author:** Muhammad Tahir
Department of Agronomy,
University of Agriculture, Faisalabad, Pakistan
Email: drtahirfsd@hotmail.com

No doubt, the chemical fertilizers are richer in their nutrient contents, less bulky, easier to transport and apply in the field, thus show quick response on crop in term of grain yield (Hussain et al., 1987). Due to larger consumption of chemical fertilizers, these are becoming expensive due to elimination of subsidy, more dependent on chemical fertilizers for higher grain yield, declining efficiency of fertilizers and mismanagement of fertilizers at farm level. The nitrogenous fertilizers are lost in the form of ammonia violation and excessive leaching in the form of nitrates and fixation of larger portion of phosphorus may affect the environment (Maynard, 1993).

Many scientists suggested that the use of organic matter along with chemical fertilizers can give the higher grains yield than obtained with synthetic chemical fertilizers alone (Sarwar et al*.,* 2007; Sarwar et al*.,* 2008). In Pakistan, soils are deficient in organic matter which is less than 5 % and it can be replenished by the application of organic matters and composts to the soil (Sarwar, 2005). Higher soil organic matter concentrations have been proved to enhance the yield and yield components of cereals (Sarwar, 2005) as well as soil aeration, soil density and maximizing water holding capacity of soil for seed germination and plant root development (Zia et al*.,* 1998).

The present study, therefore, was designed to check growth and yield of wheat as influenced by different organic matters under ecological conditions of Faisalabad.

Materials and Methods

The proposed research study was conducted at Agronomic Research Area, University of Agriculture, Faisalabad, during winter season 2007-08. Soil samples were drawn before sowing of crop to a depth of 15 cm and were subjected to physico-chemical analysis. The analysis report of soil samples was showed that soil was loam having pH 8.05, EC 1.48 dSm^{-1}, RSE 1.9 mel^{-1}, Organic matter 0.93 %, available-P 2.45 ppm, available-K 75 ppm and soil saturation 38 %. Meteorological data was obtained from meteorological station situated with in radius of

0.5 km of experimental site from Crop Physiology Department, University of Agriculture, Faisalabad, Pakistan and represented in Fig.1. The experiment was laid out in Randomized Complete Block Design (RCBD) having a net plot size 1.5 m × 5 m with three replications. The experiment comprised of six treatments; T_1= [control (only Basal dose of chemical fertilizers (Nitrogen + Phosphorous @ 108 + 57 kg ha^{-1})], T_2= [Humic acid 12.50 % + Fulvic acid 0.35 % @ 5 l ha^{-1} + basal dose of chemical fertilizers (Nitrogen + Phosphorous @ 108 + 57 kg ha^{-1}), T_3= [Humic acid 55 % (dry basis) + K_2O 8 % (dry basis) @ 10 kg ha^{-1} + basal dose of chemical fertilizers (Nitrogen + Phosphorous @ 108 + 57 kg ha^{-1}), T_4= [Humic acid 8.25 % + Fulvic acid 0.25 % @ 2.5 l ha^{-1} + basal dose of chemical fertilizers (Nitrogen + Phosphorous @ 108 + 57 kg ha^{-1})], T_5= [Humic acid 55 % + K_2O 8 % @ 10 kg ha^{-1} + basal dose of chemical fertilizers (Nitrogen + Phosphorous @ 108 + 57 kg ha^{-1})] and T_6= Fe 3 % + Zn 2 % + Ca 20 % + S 12 % + O.M 10 % @ 250 kg ha^{1} + basal dose of chemical fertilizers (Nitrogen + Phosphorous @ 108 + 57 kg ha^{-1}). First four organic matters were applied with 1st irrigation and last one was broadcasted before sowing.

Wheat cultivar Sahar-2006 was sown on 17 December, 2007, using seed rate of 125 kg ha^{-1} in 25 cm apart single rows. Nitrogen and Phosphorus were applied @ 108 and 57 kg ha^{-1} respectively. Whole of P and ½ N was side dressed at time of sowing and remaining ½ N was broadcasted with first irrigation and source of irrigation was canal water. The crop was harvest during the 3rd week of April, 2008 and individual sample was threshed manually. The data was collected and analyzed to Fischer's analysis of variance techniques and used the least significant difference test (LSD) at 5 % level of probability (Steel et al., 1997).

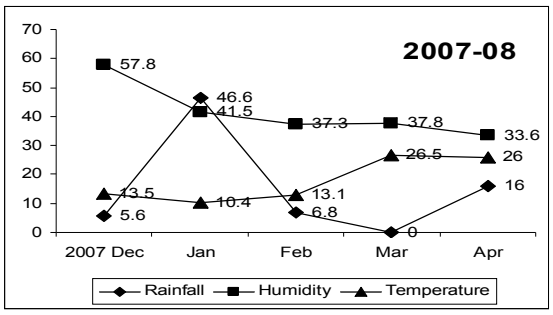

Figure 1 Meteorological Data

Results and Discussions

The data pertaining to effect of organic matters on the growth and yield of wheat (*Triticum aestivum* L.) was presented in the Table: 1 and 2. The yield components of wheat crop were significantly affected by the all treatments which were treated with organic matter over control. The response of organic matters on number of spikelets per spike was showed the significant difference among all treatments as compared to control. Number of fertile spikelets per spike is the major yield contributing factor to the total grain yield of the crop. The maximum number of fertile spikelets per spike (T3) was found with Humic acid 55% (dry basis) + K_2O 8% (dry basis) @ 10 kg ha^{-1} + recommended dose of synthetic fertilizers (increase the 27.7 % fertile spikelets per spike over control) and was followed by Humic acid 55% + K_2O 8% @ 10 kg ha^{-1} + recommended dose of synthetic fertilizers (26.43% more fertile spikelets per spike over control) which was statistically at par with the application of Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10% @ 250 kg ha^{-1} + recommended dose of synthetic fertilizers (produced 23.61% more fertile spikelets per spike than control). The minimum number of spikelets per spike (T_1) was obtained in control (13.13) where no organic matter was applied. These results are in close agreement with the results obtained by Sarwar, 2005. He stated that the numbers of fertile spikelets per spike are affected by the application of organic matters.

The results presented in Table: 1 showed that organic matter with recommended dose of synthetic fertilizers significantly increased number of grains per spike over control. The highest number of grains per spike (25.45 % more grains over control plots) was recorded from plot treated with Humic acid 55% (dry basis) + K_2O 8% (dry basis) @ 10 kg ha^{-1} + recommended dose of synthetic fertilizers (T_3) and it was followed by treatment with Humic acid 55% + K_20 8% @ 10 kg ha^{-1} + recommended dose of synthetic fertilizers which was non significantly differ with Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10% @ 250 kg ha^{-1} + recommended dose of synthetic fertilizers in T_5 and T_6 treatments respectively where 16.96 % and 14.32 % more number of grains per spike compared with control (T_1) which gave minimum number of grains per spike (38.9). These results are supported by Khan and Hussain (2001).

Apart from all other yield contributing factors, the ultimate final grain yield of cereal crops mainly depend upon the seed development and 1000-grain weight of that crop which were nourished under the available nutrients in the prevailing field conditions. The data indicated that the maximum 1000-weight (16.72 % more 1000-grain than control plots) was observed with Humic 55% acid (dry basis) + K_2O 8% (dry basis) @ 10 kg ha^{-1} + recommended dose of synthetic fertilizers (T_3) and was followed by T_5

Table 1 Growth and yield of wheat (*Triticum aestivum* L.) as influenced by various organic matter

Treatments	Number of spikelets spike^{-1}	Number of grains spike^{-1}	1000-grain weight (g)	Biological Yield (t ha^{-1})
T_1=[Control]*	13.13 e	38.9 d	37.55 e	7.77 e
T_2=[Humic acid 12.50 % + Fulvic acid 0.35%]**	14.4 d	41.3 d	39.05 d	8.03 cd
T_3=[Humic acid 55% (dry basis) + K_2O 8% (dry basis)]	18.4 a	48.8 a	43.83 a	8.70 a
T_4=[Humic acid 8.25% + Fulvic acid 0.24]	15.5 c	44.7 c	40.63 c	8.15 c
T_5=[Humic acid 55% + K_2O 8%]	16.6 b	46.4 b	42.27 b	8.52 ab
T_6=[Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10%]	16.23 b	45.4 b	40.97 c	8.26 bc

Table 2 Growth and yield of wheat (*Triticum aestivum* L.) as influenced by various organic matter

Treatments	Straw yield (t ha^{-1})	Grain yield (t ha^{-1})	Harvest index %	Value cost ratio	Benefit cost ratio
T_1=[Control]*	3.94 e	3.67 e	47.62 e	-	2.61 d
T_2=[Humic acid 12.50 % + Fulvic acid 0.35%]**	4.18 d	3.85 d	47.92cd	3.59 d	2.77 c
T_3=[Humic acid 55% (dry basis) + K_2O 8% (dry basis)]	4.75 a	4.14 a	46.48 a	4.37 a	2.82 a
T_4=[Humic acid 8.25% + Fulvic acid 0.24]	4.24 c	3.87 c	47.71 c	3.50 c	2.72 b
T_5=[Humic acid 55% + K_2O 8%]	4.56 b	4.02 b	48.09 ab	4.02 b	2.87 a
T_6=[Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10%]	4.32 c	3.95 b	47.96 bc	3.04 c	2.70 b

*only recommended dose of synthetic fertilizer ** Organic + recommended dose of synthetic fertilizer

which was treated with Humic acid 55% + K_2O 8% @ 10 kg ha^{-1} and was significantly differ with T_6 where Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10% @ 250 kg ha^{-1} were applied along with recommended dose of synthetic fertilizers which resulted in increase of 12.57 % and 9 % more 1000-grain yield than Control treatments. The minimum 1000-grain yield was recorded in control (T_1) (37.55 g) where only recommended dose of fertilizers was applied and no organic matter was applied. The comparison between treated plots (from T_2 to T_6) and untreated plots (T_1) showed significant difference towards 1000-grain yield. These results are strongly supported by Sarwar, 2005 and Bakash et al., 1999, who reported that grain yield was significantly increased by the application of organic matter along with fertilizers.

Biological yield indicate the total dry mater produced by the plants during its life cycle and showed the response of various treatments of organic matters on the growth and yield of wheat during study. It includes both spike yield and stalk yield of the wheat plant. The data regarding to this parameter revealed (Table: 1) the significant differences among all treatments on the biological yield of the wheat crop. The maximum biological yield (8.70 ha^{-1}) was in T_3 receiving 10 kg ha^{-1} of Humic acid 55% (dry basis) + K_2O 8% (dry basis) + recommended dose of synthetic fertilizers which increased 0.12 % biological yield over the control and it was statistically similar with treatments of 10 kg ha^{-1} of Humic acid 55% + K_2O 8% and @ 10 kg ha^{-1} which increased 0.096 % more biological yield as compared to control and Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10% (produced 0.06 % more biological yield over control) along with recommended dose of synthetic fertilizers. The significantly minimum biological yield (7.77 t ha^{-1}) was recorded in control (T_1) where no organic matter was applied. These results are in line with those reported by Sarwar, 2005 who concluded that the organic matter along with the recommended dose of synthetic fertilizers significantly affected the biological yield of the plant.

Data regarding to straw yield (Table: 2) revealed that 20.56 % more straw yield (4.75 t ha^{-1}) was observed with.10 kg ha^{-1} of Humic acid 55% (dry basis) + K_2O 8% (dry basis) + recommended dose of synthetic fertilizers (T_3) than those plots receiving the only recommended rate of chemical fertilizers (control) in T_1 (3.94 t ha^{-1}) and it was followed by T_5 (4.56 t ha^{-1}) which receive 10 kg ha^{-1} of Humic acid 55% + K_2O 8% along with recommended basal dose of synthetic fertilizers (15.74 %) which was significantly differ with Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10% showing 9.64 % more over control along with recommended dose of synthetic fertilizers . These results are supported by those of Sarwar et al. 2008, who reported that straw yield was significantly increased by the application of organic matters along with the application of fertilizers.

The grain yield is the final interaction of all yield contributing factors of wheat which resulted in the form of final yield. The increase in grain yield with different treatments ranged from 12.81 % to 4.90 % (Table: 2), in treatment (T_3) with 10 kg ha^{-1} of Humic acid 55% (dry basis) + K_2O 8% (dry basis) + recommended dose of synthetic fertilizers (12.81% increased gain yield over control). It was followed by 9.54 % (4.02 t ha^{-1}) and 7.63 % (3.95 t ha^{-1}) increase in grain yield in T_5 and T_6 treatments where 10 kg ha^{-1} of Humic acid 55% + K_2O 8% and @ 250 kg ha^{-1} of Fe 3% + Zn 2% + Ca 20% + S 12% + O.M 10% along with recommended dose of synthetic fertilizers were applied. The lowest grains yield (3.67 t ha^{-1}) was recorded in control (T_1) where no organic matter was applied, only basal recommended dose of chemical fertilizers was applied which may resulted in lowering the number of fertile spikelets per spike and ultimately significant difference recorded in the grain yield treated with organic matter and only with the application of synthetic chemical fertilizers. These results are in line with those reported by Díaz-Zorita et al. 1999, Parma and Sharma, 2002 and Sarwar et al. 2007. They concluded that grain yield was significantly affected by application of synthetic fertilizer along with organic matter than the sole application of synthetic fertilizers.

Value cost ratio tells us the value/cost of additional grain yield to the value/ cost of amount of organic matter applied. With this regard, the maximum value cost ratio was in Humic acids 55% (dry basis) + K_2O 8% (dry basis) treatment (T_3) and was followed by Humic acid 55% + K_2O 8% (T_5). So, on the basis of value cost ratio, we can suggest the treatment T_3 for it maximum V.C. ratio among all the organic treatments.

The benefit cost ratio indicated the ratio of gross income with the total expenditure. The maximum benefit cost ratio was obtained in treatment T_3 which received the Humic acids 55% (dry basis) + K_2O 8% (dry basis) treatment (2.87) and it was statistically at par with T_5 (2.82) where Humic acids 55% + K_2O 8% applied. The lowest cost benefit ratio was recorded in the control treatment (T_1) (2.61) where no organic matter was applied.

References

Bakash A, AH Gurmani, AU Bhatti and H Rehman, 1999. Effect of balanced application of N, P and K on the yield of wheat. Sarhad Journal of Agriculture, 15: 453-457.

Diaz-Zorita M, DE Buschiazoo and N Peinemann. 1999. Soil organic matter and wheat productivity in semiarid Argentine Pampas. Agronomy Journal, 91: 276-279.

Hussain A, M Rashid and M Yasin, 1987. Advantages of FYM and its better use. Zarat Nama Lahore. 33: 17-18.

Khan AM and I Hussain, 2001. Manuring effect on the potential grain yield of wheat in the light of Holy Quran. Journal of Biological Sciences, 1: 62-64.

Maynard AA, 1993. Nitrate leaching from compost amended soil. Compost Science and Ulitilisation, 1: 65-72.

Parma DK and V Sharma, 2002. Studies on long term application and manure on yield of maize-wheat rotation and soil properties under rainfed conditions in Western-Himalayas. Journal of Indian society of soil Science, 50: 311-312.

Sarwar G, 2005. Use of compost for crop production in Pakistan. Okologie abd Umweltsicherung, 26/2005. Universitat Kassel, Fachgebiet Landschaftsokologie and Naturschutz, Witzenhausen, Germany.

Sarwar G, N Hussain, H Schmeisky, S Sarwar, GN Hussain and S Muhammad. 2007. Use of compost an environment friendly technology for enhancing rice-wheat production in Pakistan. Pakistan Journal of Botany, 39: 1553-1558.

Sarwar G, N Hussain, H Schmeisky, S Muhammad, M Ibrahim and E Safdar. 2008. Improvement of soil physical and chemical properties with compost application in rice-wheat cropping system. Pakistan Journal of Botany, 40: 275-282.

Shad KK, AZ Khan, AR Baloch and P Shah, 1999. Effect of row spacing and herbicides application on some agronomic characteristics of wheat (*Triticun aestivum* L). Sarhad Journal of Agriculture, 15: 535-540.

Steel RD, JH Torrie and DA Dicky, 1997. Principles and procedures of statistics a biometrical approach 3rd Ed. McGraw hill Book International Co, Singapore, pp: 204-227.

Zia MS, MB Baig and MB Tahir, 1998. Soil environment issues and their impact on agricultural productivity of high potential areas of Pakistan. Science Vision, 4: 56-61.