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NITROGEN DEPLETION BY WEEDS FROM ORGANIC AND INORGANIC NITROGEN SOURCES IN WHEAT CROP

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ABSTRACT

A field experiment was carried out to examine nitrogen removal by weeds from nitrogen sources in wheat crop at the research farm of the University of Agriculture, Peshawar, Pakistan during year 2014-15. A randomized complete block design (RCBD) with three replications was used for the experiment. There were seven treatments consisting of control (no fertilizer), basal dose of P and K fertilizer, basal dose of N from Urea, basal dose of N from FYM, basal dose of N from PM, basal dose of N from compost of FYM and basal dose of N from compost of PM. Results exhibited that N application significantly increased weeds fresh and dry biomass, N concentration and uptake over control, while N application had no significant effect on plant moisture content. Nitrogen applied at the rate of 120 kg ha^{-1} from urea significantly increased weed fresh and dry biomass by a maximum of 40.3 and 30.9%, respectively. Nitrogen applied at the rate of 120 kg ha^{-1} from compost of PM increased N concentration and uptake by a maximum of 43.1 and 78.8%, respectively. Weeds removed a maximum of 23.4 kg N ha^{-1} from wheat crop where basal dose of N was applied from compost of PM. Thus, it is suggested that proper weed control is very much crucial for maintaining soil fertility and improving crop yield.

Key words: Nitrogen, organic sources, *Triticum aestivum,* weed biomass.

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INTRODUCTION

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Wheat is the most prominent food crop in many parts of the world in terms of crop areas and production. It accounted for 28% of the world's edible dry (DM) and up to 60% of the daily calorie intake for people in many developing countries (FAO, 2006). Despite being grown on larger area, average yield at farmers' fields is still lower than the potential yield (Manna *et al*., 2005). Under the ideal conditions it would be possible to obtain the wheat yield of 20 tons ha^{-1}, but unfortunately the average world yield is less than 2 tons ha^{-1} (Idris *et al*., 1984).

Balanced nitrogen fertilization is a crucial component that plays an important role in increasing the crop quality and its production because it is involved in synthesis protein, chlorophyll, nucleic acid metabolism and proper function of enzymes system. The efficiency of N fertilizer in Pakistan is very much low because more than 50% of the applied N-fertilizers are lost from soil (Ladha *et al*., 1998). Various factors are responsible for this low N efficiency, among them severe weed infestation, poor weed management practices and improper planting method are common problems. Weed infestation is important and usually ignored by the farming community. Weeds use soil fertility available moisture, nutrients and compete for space and light with crop plant, which results in yield reduction (Khan *et al.*, 2002). Many weeds are hosts of plant disease organisms or of insect pests. If left uncontrolled, weeds are capable of reducing yield by more than 80% (Karlen *et al.*, 2002).

There are controversial reports on wheat-weed competition for nutrients. Some researchers have found that weeds are more efficient than crop for nutrients uptake (Appleby *et al*., 1976). Crop weeds competition increases as soil fertility improves (Lintell *et al*., 1992). Thus, it is important to know about crop weed competition for nutrients to ensure balanced fertilization for increasing yield, hence, this study was initiated to know about nitrogen depletion by weeds from wheat crop for proper formulation of N dose to wheat crop under existing soil and climatic conditions.

MATERIALS AND METHODS

A field experiment was carried out at the research farm of the University of Agriculture Peshawar, Pakistan during winter season 2014-15, to examine the rate of nitrogen depleted by weeds from different N sources (organic and inorganic) in wheat crop. The experiment was laid out in randomized complete block design (RCBD) having seven treatments each replicated three times. The treatments consisted of T1: Control (no fertilizer), T2: Basal dose of P and K fertilizer, T3: Basal dose of N from Urea, T4: Basal dose of N from FYM, T5: Basal dose of N from PM, T6: Basal dose of N from compost of FYM and T7: Basal dose of N from compost of PM. Nitrogen was applied at the rate of 120 kg ha^{-1} as a basal dose as per proposed treatments from different N sources.FYM, PM, compost of FYM, compost of PM and urea were used as N sources in the experiment. The organic N sources were analysed for total N content, their respective quantity was calculated for 120 kg N ha^{-1}and applied to the plots one month before sowing to the experimental plots. Basal dose of P and K at the rate of 90 and 60 kg ha^{-1} was applied to all treatments except control while using SSP and SOP as a fertilizer source, respectively. Nitrogen concentrations in organic sources used was determined. Wheat veriety Siren was sown in plots of size 3x4 m^2 at the rate of 120 kg seeds ha^{-1} in 30cm apart rows. Normal recommended cultural practices were adopted throughout the growing season except weeding.

The soil of experimental site was sandy loam in texture, alkaline in reaction, non-saline, calcareous in nature, low in SOM content, AB-DTPA extractable P and total N.The total N concentration in nitrogen organic sources was 1.07, 1.42, 1.84 and 2.15% in FYM, compost of FYM, PM and compost of PM, respectively.

Data were recorded on weed fresh biomass was recorded by harvesting all the weeds from 1 m^2 area at two locations in each plot, weighed and their mean was worked out and converted to kg ha^{-1}. The weeds collected for fresh biomass were dried in oven at 105 ^{0}C for 24 hrs, weighed and converted into kg ha^{-1}. Nitrogen concentration in weeds harvested from each treatment plot was determined by as per procedure described by Bremner and Mulvaney (1982). Nitrogen uptake in weeds was taken as a product of dry biomass and concentration of samples obtained from respective plots. Data obtained was statistically analyzed by the procedure of Steel and Torrie (1980) using Statistix package 8.1.

RESULTS AND DISCUSSION

Weeds fresh biomass (kg ha^{-1})

Data collected on weeds fresh biomass are presented in (Table-1). Analysis of the data showed that N application from organic and inorganic sources significantly affected weeds fresh biomass. Higher weeds fresh biomass (4890 kg ha^{-1}) was calculated for those plots which received N at the rate of 120 kg ha^{-1} from inorganic source(urea), followed by N from compost of PM (4537 kg ha^{-1}) which was statistically at par to weed fresh biomass obtained from PM, compost of FYM, PM treated plots. Lower weed fresh biomass (3342 kg ha^{-1}) was obtained from control plots.The weeds fresh biomass in sole mineral nitrogen treated plots is higher than other treatment especially control when we look to the overall means of the treatments. The results suggested that fertilizer application benefited the mixed population of weeds and hence make the weed more competitive with the crop. All vegetative growth parameter showed enhancement due to nitrogen application resulting an increased shoot biomass (Akamine *et al*., 2007).

Weeds dry biomass (kg ha^{-1})

Results regarding plant characters are presented in Table-1. Analysis of the data for weeds dry biomass showed that N application from organic and inorganic sources significantly affected weeds dry biomass. Higher weeds dry biomass (3466 kg ha^{-1}) was recorded for those plots which received N at the rate of 120 kg ha^{-1} from inorganic source (urea), followed by N from compost of PM (3272 kg ha^{-1}) which was statistically at par with weed dry biomass obtained from PM, compost of FYM. Lower weed dry biomass (3342 kg ha^{-1}) was obtained from control plots which were similar to FYM treated plots on statistical basis. A comparatively higher dry weed biomass is seen in sole mineral nitrogen treated plots than other treatments when we look at the overall means of the treatments. This could be attributed to the fact that growth and development of weeds is accelerated by mineral nitrogen. Our result is similar with the findings of Akamine *et al*. (2007) who investigated that there is an increase in the vegetative growth following application of N alone or in combinations.

Table-1. Weeds fresh and dry biomass (kg ha^{-1}) as influenced by nitrogen sources

Treatments	Weeds fresh biomass (kg ha $^{-1}$)	Weeds dry biomass (kg ha $^{-1}$)
Control (No fertilizer)	3342e	2648c
Basal dose of P and K fertilizer	3841d	2949bc
Basal dose of N from Urea	4890a	3466a
Basal dose of N from FYM	4108cd	2967bc
Basal dose of N from PM	4319bc	3231ab
Basal dose of N from compost of FYM	4031cd	3007b
Basal dose of N from compost of PM	4537ab	3272ab
LSD(0.05)	354.2	349.1
CV	4.79	6.37

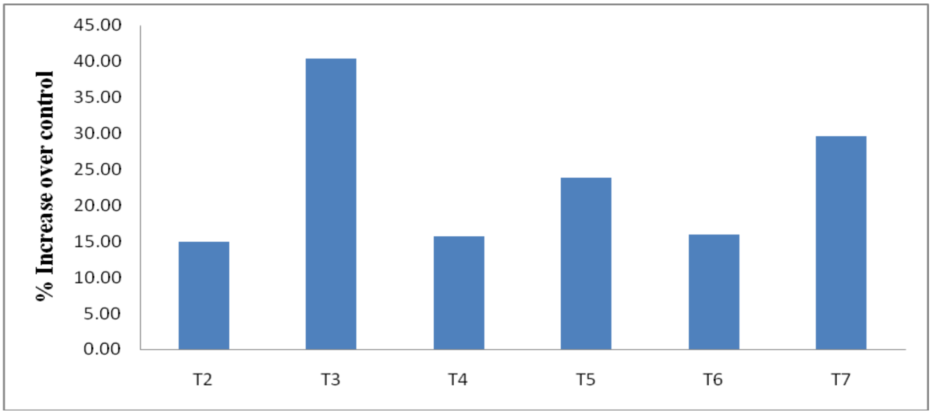

Figure 1. Percent increase over control in weeds fresh biomass

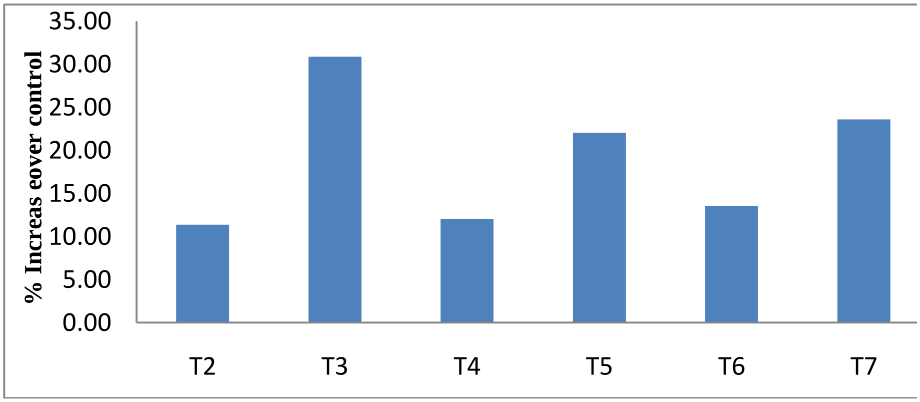

Figure 2. Percent increase over control in weeds dry biomass

Weeds nitrogen concentration (%)

Nitrogen concentration data are presented in Table-2. Statistical analysis of the data showed that N application from organic and inorganic sources significantly affected nitrogen concentration in weeds. Higher nitrogen concentration (0.71%) was obtained for those plots which received N at the rate of 120 kg ha^{-1} from organic source (compost of PM) was statistically similar in concentration (90.71%) with plots received N at the rate 120 kg ha^{-1} from compost of FYM followed by N from PM, FYM, Urea. Control plots result in lower N concentration (0.50%) followed by P and K treated plots. Weeds share the same resources e.g. water, minerals (especially nitrogen), and light etcwith the crop plants and reducing the nutrients concentration in the soil. Ourresults are similar with the findings of Hans *et al*. (2002), who suggested that many weeds are high N consumers, so limiting N for crop growth. Blackshaw *et al*. (2003) suggested that weed reduced the amount of N available to crops.

Weeds nitrogen uptake (kg ha^{-1})

Data regarding nitrogen uptake are presented in Table-2. Statistical analysis of the data showed that N application from organic and inorganic sources significantly affected nitrogen uptake by weeds. Higher nitrogen concentration (23.4%) was obtained for those plots which received N at the rate of 120 kg ha^{-1} from organic source (compost of PM) followed by compost of FYM, PM, Urea, FYM. Control plots result in lower N uptake (13.1%) followed by P and K treated plots (14.4). Nitrogen uptake was higher in organic fertilizer treated plots. This was likely due to the gradual N release from manure and compost. Similar results were obtained by Eghball *et al*. (2004). Mason (1987) reported that wheat N uptake was often reduced by competing weeds.

Table-2. Weeds Nitrogen concentration and uptake as influenced by nitrogen sources

Treatments	Nitrogen Concentration (%)	Nitrogen Uptake (kg ha^{-1})
Control (No fertilizer)	0.50d	13.1e
Basal dose of P and K fertilizer	0.49d	14.4de
Basal dose of N from Urea	0.54cd	18.7bc
Basal dose of N from FYM	0.59bc	17.6cd
Basal dose of N from PM	0.65ab	21.0abc
Basal dose of N from compost of FYM	0.71a	21.4ab
Basal dose of N from compost of PM	0.72a	23.4a
LSD (0.05)	0.065	3.47
CV	6.18	10.53

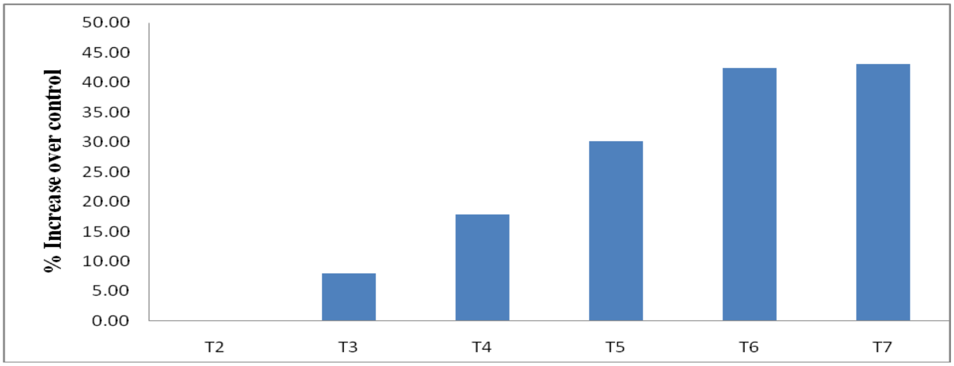

Figure 3. Percent increase over control in weeds N concentration

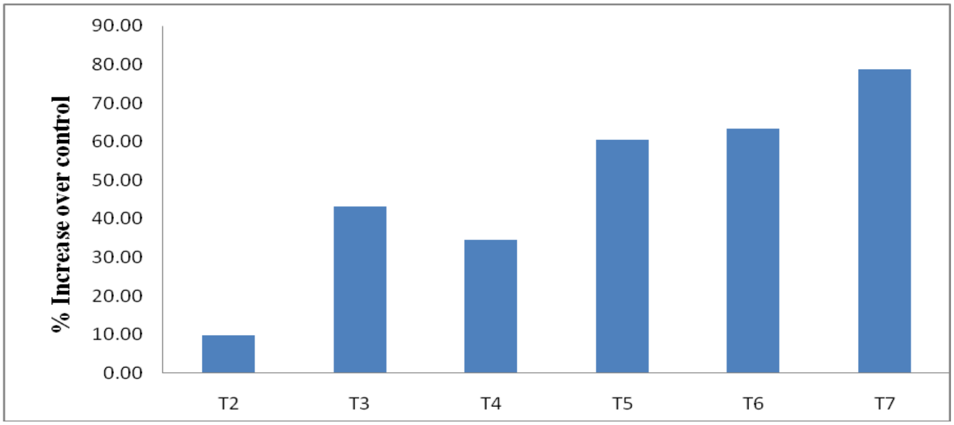

Figure 4. Percent increase over control in weeds N uptake

CONCLUSION

Results indicated that with application of nitrogen, weeds N content and biomass increased. Regardless of the N sources used weeds depleted significant amount of nitrogen from wheat crop, thus it is suggested that proper weeds control is very important for improved N use efficiency and crop yield.

REFERENCES CITED

Akamine, H., M.A. Hossain, Y. Ishimina, K. Yogi, K. Hokama, Y. Iraha and Y. Iniya. 2007. Effect of application of N, P and K alone or in combination on growth, yield curcumin content of turmeric (*Curcuma longa* L.). Plant Prod. Sci. 10(1): 151-154.

Appleby, A.P., P. D. Olson and D. R. Colbert. 1976. Winter wheat yield reduction from interference by Italian Ryegrass. Agron. J. 68(2): 463-466.

Blackshaw, R.E., R.N. Brandt, H.H. Janzen, T. Ents, C.A. Grant and D.A. Derksen. 2003. Differential response of weed species to added nitrogen. Weed Sci. 51: 532-539.

Bremner, J.M. and C.S. Mulvaney. 1982. Nitrogen total methods of soil analysis of chemical and microbiological properties. *In* A.L. Page, R.H. Miller and D.R. Keeney (eds). pp. 595-626, American Society of Agronomy, Madison, Wisconsin.

Eghball, B., D. Ginting and J.E. Gilley. 2004. Residual effects of manure and compost applications on corn production and soil properties. Agron. J. 96: 442–447.

FAO. 2006. The Statistics Division, United Nations, Rome, Italy.

Hans, S.R. and W.G. Johnson. 2002. Influence of shattercane (*Sorghum bicolor* L. Moench.) interference on corn (*Zea mays*

L.) yield and nitrogen accumulation. Weed Technol. 16: 787-791.

Idris, M., M.M. Iqbal, S.M. Shah, and W. Mohammad. 2001. Integrated use of organic and mineral nirtogen, and phosphorus on the yield, yield components, N and P uptake by wheat. Pak. J. Sci. 20: 77-80.

Karlen, L.D., D.D. Buhler, M.M. Ellasbury and S.S. Andrews. 2002. Soil, weed and insect management strategies for sustainable agriculture. J. Biol. Sci. 2(1): 58-62.

Khan, M.A., K.B. Marwat, G. Hassan and W.A. Shah. 2002. Effect of different Weed free periods on growth and yield of wheat. Pak. J. Agric. Agril. Engg. Vet. Sci.18 (1-2):30-33.

Ladha, J. K., A. T.Padre, G. C.Punzalan, E. Castillo, U.Singh and C. K.Reddy. 1998. Nondestructive estimation of shoot nitrogen in different rice genotypes. Agron. J. 90:33-40.

Lintell-smith , G., J. M. Baylis and A. R. Watkinson. 1992. The effect of reduced nitrogen and weeds competation on the yield of winter wheat. Aspects Appl. Biol. 30(2): 367-372.

Malik, M.A. 2007. Towards understanding agriculture, crops and crops of Pakistan, wheat. P. 632-540. Publishers Emporium, 22-Urdu Bazar, Lahore.

Manna, M.C., A. Swamp, R.H. Wanjari, H.N. Ravankar, B. Mishra, M.N. Saha, Y. V. Singh, D. K. Sahi and P. A. Sarap. 2005. Long term effect of fertilizer and manure application on soil organic carbon storage, soil quality and yield sustainability under sub-humid and semi-arid tropical India. Field Crops Res.93 (2-3): 264-280.

.Mason, M. 1987. Effect of agronomic practices on wheat protein levels. J. Agric. West. Aust. 28: 128–130.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of statistics. A biometrical approach. McGraw-Hill, New York.