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Effects of different levels of NPK on yield by wheat (*Triticum aestivum L.*)

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Abstract
A field experiment was carried out at the Sam Higginbottom Institute of agriculture, Technology and Science, Allahabad, during winter season in 27/11/2015 up to 26/03/2016 to investigate the effects of different levels of NPK on yield by wheat (*Triticum aestivum L.*).The treatments concluded: (T0: 0 -0 -0 NPK, T1: 30- 0-20 NPK, T2: 60 -0 -0 NPK, T3: 120 -0 -0 NPK, T4: 0 -15 -50 NPK, T5: 0 -30 -0 NPK, T6: 0 -60 -10 NPK, T7: 120 -60 -50 NPK T8: 60 -30 -25 NPK) kg ha^{-1} were tested in randomized block design (RBD) with three replications using a net plot size 2m× 2m. Fertilizer application significantly enhanced yield and other traits of wheat. Application of 120- 60- 50 NPK kg ha^{-1} to T7 recorded the maximum number of tillers /m^2, grain/ spike, grain yield, test weight and straw yield. The lowest values obtained from treatment T0: 0-0-0- NPK in during of research. It is concluded that highest grain yield of 6394.68 Kg ha^{-1} was recorded with the application of 175-150-125 NPK Kg ha^{-1}. The increase in yield was 60.5 % higher as compared to control (2539.03 Kg ha^{-1}), where no fertilizer was used.

Keywords: NPK fertilizers, RBD, yield, wheat

Introduction
Wheat (*Triticum aestivum L.*) is the staple food for more than 35% of world population. It is the leading source of vegetable protein in human food, having higher protein content than other major cereals. Safaa *et al*, (2013). Wheat is foremost among cereals and as a main source of carbohydrates and protein for both human beings and animals, contains starch (60-90%), protein (11-16.5%), fat (1.5-2%), inorganic ions (1.2-2%) and vitamins (B-complex and vitamin E), Ayala *et al*. (2011). Furthermore, wheat is considered the most important winter crop, because its grains are the main food for the urban and rural societies and its straw is a very important fodder for animal feed, especially during summer Youssef *et al*, (2013).
In india the total area under the wheat crop is about 29.8 million hectares in the country states. The production of wheat in the country has increased significantly from 75.81 million MT in 2006-07 to an all time record high of 94.88 million MT in 2011-12. The productivity of wheat was 2602 kg/ ha in 2004-05 has increased to 3140 kg/ ha in 2011-12. The major increase in the productivity of wheat has been observed in the states of Haryana, Punjab and Uttar Pradesh. Higher area coverage is reported from MP in recent years Christopher *et al.*(2006). Wheat is the main staple cereal and accounts for about 70% cropped area and cereal production each year and 70% of total cereal consumption. Wheat cultivation was estimated to cover 2,575,000 ha (1,426,000 ha rain-fed and 1,149,000 ha irrigated) during 2008/09 crop season, which recorded one of the highest production levels (5.064 million tonnes) in recent years. With an average yield of 2.5 t ha-1, the productivity of irrigated wheat is generally considered to be between 2 to 3 times that of rain-fed wheat. The average yields of 2 and 1 t ha-1 for irrigated and rainfed areas, respectively shows the need to improve productivity and narrow the wide yield gap by demonstrating best practices to farmers and encouraging their adoption in order to achieve higher crop yields. Kugbei *et al*, (2011).
more productive tillers (Wilhelm, 1998). more number of spikes per unit area, number of grains per spike, biological yield and grains yield Abdulsalam, (1997). Nitrogen fertilization increase wheat protein contents Robinson *et al*, (1979) Knowles *et al.* (1991). Soil phosphorus (P) deficiency is a major constraint to increased crop yields in many areas of the world Vance *et al.* (2003). Potassium is much of the earlier physiological work was conducted on plant parts, plant organelles or isolated membranes, with only a small portion carried out on whole intact plants or crop ecosystems William. (2008). Therefore, the present study was to determined the effects of different levels of NPK on yield by wheat (*Triticum aestivum L.*).

Materials and Methods
This experiment was conducted at crop research farm of soil Science, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Science, Allahabad during the years of 27 November 2015- 26 March 2016. The area is situated in the south of Allahabad on right hand of rivers Yamuna at Rewa Road at a distance of about 6 km Allahabad city. It is positioned 25^0 57' N Latitude 81^0 50' E longitude and the altitude of 98 meters above the near sea level. The experiment carried out in randomized block design with three replications and nine treatments combinations of three levels of nitrogen does, three levels of phosphorus and three levels potassium with replications. The total numbers of plots in the experimental design were 27. The treatments were randomly arranged in the experiment. The gross area 196.24 m2, the net cultivated area 108m2, the net plot area 2× $2m^2$, the treatments comprised of; (T0: 0 -0 -0 NPK, T1: 30- 0-20 NPK, T2: 60 -0 -0 NPK, T3: 120 -0 -0 NPK, T4: 0 -15 -50 NPK, T5: 0 -30 -0

NPK, T6: 0 -60 -10 NPK, T7: 120 -60 -50 NPK, T8: 60 -30 -25 NPK) kg ha^{-1} were tested in (RBD). Super Golden Wheat (*Triticum aestivum L.*) sowing was done in lines by hand on 27 November 2015, The seed were serum 120 kg ha^{-1} apart in plant to plant distance of 5 cm and row to row distance of 20 cm immediately after sowing the seeds areas coursed with soil. All phosphate and Potash was applied at the time of seed bed preparation and along with 1/3 dose of Nitrogen. The remaining equal splits of Nitrogen has done during top dressing with first and fourth irrigations or during flowering stage. The source of Nitrogen, Phosphorus and Potassium were Urea 46%, (SSP) Single Supper Phosphate, P_2O_5 (16-22) % and MOP (Muriate of potassium), K_2O (60-62) %, respectively.

The characters were done for achieving yield as followed
Number of grain per spike. The grains were counted from spike of selected plants.

Test weight (g): For test weight 1000 grains were counted and weighed. It was expressed in g

Grain yield (kg ha^{-1}): An area of one square meter of the experimental plot was harvested separately and the grain yield was determined. It was expressed in kg ha^{-1}.

Straw yield (kg ha^{-1}): Straw yield was determined by subtracting the grain yield from the biological (gain+ straw). It was expressed in kg ha^{-1}.
The data recorded during the course of investigation were subjected to statistical analysis as per method of" Analysis of variance". The significant and non-significant of the treatment effects were judged with the help of 'F' variance ratio test calculated with table value 'F' level of significance (Fisher, 1950).

Results and discussion:
Number of tillers (m^{-2}): Data on number of tillers m^{-2} is presented in Table (1) and figure (1), indicated that different levels of NPK were found to be highly significant. Highest number of tillers m^{-2} (353) was obtained where 120-60-50 NPK Kg ha^{-1} was applied. These results are statistically at fertilizer levels of 0-60-10, 120-0-0 NPK and 60-30-25 NPK (Kg ha^{-1}) by producing 300.00, 281and 273 tillers m^{-2}. Minimum number of tillers m^{-2} (161.67) was attained from control where didn't apply NPK. The different levels means indicated that there was progressive increase in number of tillers. The number of tillers m^{-2} started increasing where maximum dose of NPK (120-60-50) Kg ha^{-1} was applied. These results are in line with 5 who found significant differences of NPK on number of tillers. Similar results have recorded by Niamatullah *et al*. (2011) and Hussain *et al*. (2002).

Grain $spike^{-1}$: Data in table (1) and figure (2) shows that the plot treated with the treatment combinations T7 (N_{120} P_{60} K_{50}) Kg ha^{-1} recorded maximum number of grain per spike that is 84.33 in comparison to T8 (N_{60} P_{30} K_{25}) and T3 (N_{120} P_0 K_0) Kg ha^{-1} the number of grains per spike per plant where 76.00 and minimum number of grain per spike where observed in treatment combinations T0 (control) that is 52.00. The above findings showed that the optimum dose of nitrogen, phosphorus and potassium and their interaction increased the grain per spike significantly which inorganic fertilizer helped to increase the grain per spike and ultimately yield. Similar results have recorded by Malghani *at el*. (2010).

Grain yield: Data has given at Table (1) and in Fig (3) reveals that grain yield as influenced by various treatment combinations at 120 DAS when subjected to statistical analysis shows significant difference among the treatment. It is clear from the data that there was highly significant difference among treatments. The highest wheat grain yield (6394.68) Kg ha^{-1} was obtained where 120-60-50 Kg ha^{-1} NPK was applied. The lowest grain yield (2539.03) Kg ha^{-1} was obtained from control (without NPK fertilizer). However, there was increase in certain levels (120-60-50) Kg ha^{-1} due to application of nitrogen, P and K and their interactions. Similar results have recorded by Malghani *at el*. (2010).

1000- Grains Weight: Data has given at Table (1) and Fig (4) reveals that test weight of grains (1000- seeds/ g) of wheat as influenced by various treatment combinations at 120 DAS when subjected to statistical analysis shows significant difference among the treatment. Data shows that the plot treated with the treatment combinations T7 (N_{120} P_{60} K_{50}) Kg ha^{-1} recorded maximum test weight of grain that is 41.67 g in comparison to T6 (N_0 P_{60} K_{10}) and T8 ($N_{60}P_{30}K_{25}$) Kg ha^{-1} test weight of grain that is 40.87 and 40.47 (g) and minimum test weight of grain where observed in treatment combinations T0 (control) that is 33.27 g. The above findings showed that the optimum dose of nitrogen, phosphorus and potassium and their interaction increased the test weight of grain significantly which helped to increase the test weight of grain and yield. Similar results were recorded by Malghani *at el*. (2010) and Hussain *et al*. (2002).

Straw yield: Data has given at Table (1) and Fig (5) reveals that straw yield as influenced by various treatment combinations at 120 DAS when subjected to statistical analysis shows significant difference among of treatments. Data shows that the plot treated with the treatment combinations T7 (N_{120} P_{60} K_{50}) Kg ha^{-1} recorded maximum straw yield that is 10000 kg ha^{-1} in comparison to T3 (N_{120} P_0 K_0) and T8 ($N_{60}P_{30}K_{25}$) Kg ha^{-1} straw yield that were recorded (8666.67 and 8333.33) kg ha^{-1} and minimum straw yield where observed in the treatment combinations T0 (control) that is 5000.00 kg ha^{-1}. The above findings showed that the optimum dose of nitrogen, phosphorus and potassium and their interaction increased the straw yield significantly. The straw yield recoded in treatment combinations T7 (N_{120} P_{60} K_{50}) Kg ha^{-1} this was due to the much application of acidic and alkaline fertilizer to plant.

Conclusion
In generally all observations which concluded number of tillers (m^{-2}), grains $spike^{-1}$, grain yield, 1000- seeds weight and straw yield at 120 DAS treatment T0 recorded lowest that is control (without fertilizer) but the highest yield recorded in treatment combinations where optimum dose of inorganic fertilizer i.e. T7 (N_{120} P_{60} K_{50}) Kg ha^{-1}. Statistical data reveals that different levels of NPK fertilizers inoculation and interaction between them had a significant effect.

Table 1: Effects of different levels of NPK on yield by wheat (*Triticum easticum L.*)

Treatment	No of tillers m^{-2}	No of grains $spike^{-1}$	grain yield	test weight	straw yield
Combinations	120DAS	120DAS	120DAS	120DAS	120DAS
T0= 0 -0 -0 NPK	161.67	52	2539.03	33.27	5000
T1= 30- 0-20 NPK	267.67	59.33	4493.86	37.77	7700
T2= 60 -0 -0 NPK	256.67	72.67	4817.72	34	7500
T3= 120 -0 -0 NPK	281	76	5339.76	34.5	8666.67
T4= 0 -15 -50 NPK	203.33	63.33	3326.19	38.6	6533.33
T5= 0 -30 -0 NPK	245	65.67	4066.29	39.6	6600
T6= 0 -60 -10 NPK	300	75	4960.88	40.87	7000
T7= 120 -60 -50 NPK	353.33	84.33	6394.68	41.67	10000
T8= 60 -30 -25 NPK	273	76	5060.69	40.47	8333.33
F-test	**S**	**S**	**S**	**S**	**S**
S Ed (±)	**73.164**	**2.35**	**564.15**	**0.414**	**526.49**
C.D. at 0.05%	**34.513**	**4.983**	**1195.945**	**0.878**	**1116.108**

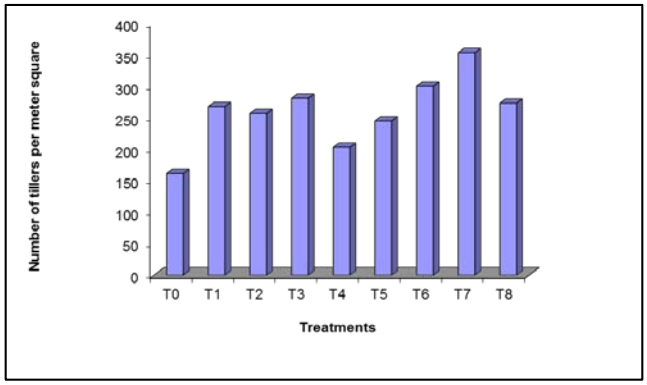

Fig 1: Effects of different levels of NPK on number of tillers/ m^2 by wheat (*Triticum aestivum L.*).

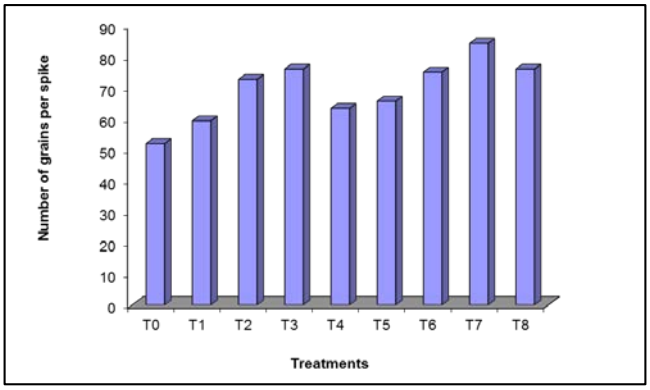

Fig 2: Effects of different levels of NPK on number of grains/ spike by wheat (*Triticum aestivum L.*).

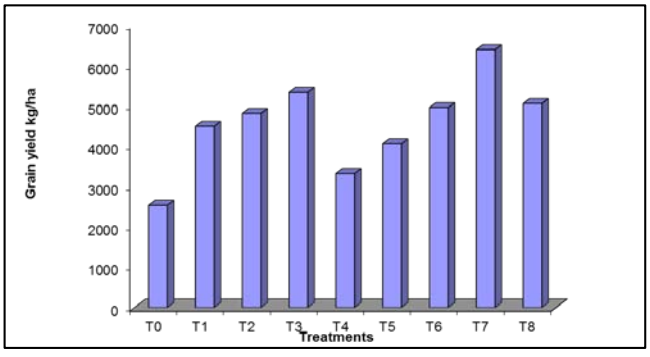

Fig 3: Effects of different levels of NPK on grain yield by wheat (*Triticum aestivum L.*).

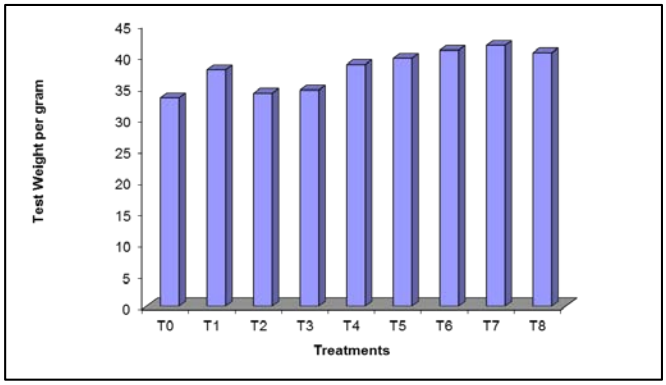

Fig 4: Effects of different levels of NPK on (1000- grains/g) by wheat (*Triticum aestivum L.*).

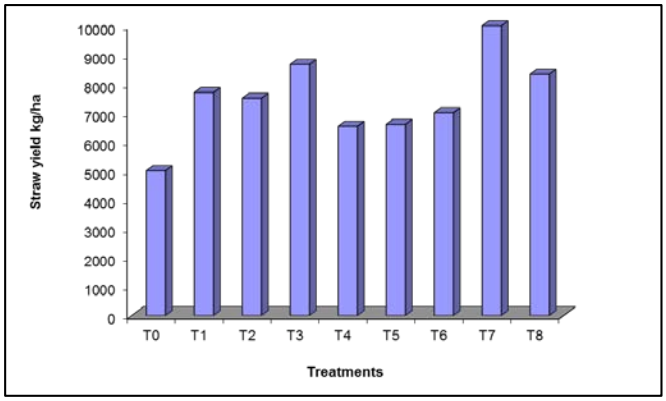

Fig 5: Effects of different levels of NPK on straw yield by wheat (*Triticum aestivum L.*).

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