EFFECT OF BALANCED FERTILIZER FOR ENHANCEING WHEAT GROWTH AND YIELD

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ABSTRACT: *A field trial was conducted on wheat variety Imdad-2005 to optimize NP rates for achieving maximum grain yield under cropping system of wheat-cotton. Seven different fertilizer doses includes, 0:80, 60:80, 120:0, 120:40, 120:80, 120:120 and 180:80 kg NP/ha were tested in a 03 replicated Randomized Complete Block Design. The results revealed that NP doses had significant ($p<0.05$) influence on all the growth and yield constituents of wheat. The maximum 78.0 cm height of plant, 412.0 tillers m^{-2}, 11.2 cm spike length, 21.2 spikelets/spike, 43.0 grains/spike, 18.0 grams grain weight/plant, 10373 kg biological yield and 4820 kg grain yield/ha were recorded at 180:80 kg NP/ha followed by followed by 120:120 kg NP/ha which positioned 2nd with 77.3 cm plant height, 411.3 tillers m^2, 11.2 cm spike length, 21.3 spikelets/spike, 42.9 grains/spike, 17.7 grams grain weight/plant, 10366 kg/ha biological yield and 4811 kg/ha grain yield. While, 120:80 kg NP/ha ranked 3rd and resulted 76.0 cm plant height, 410.7 tillers m^{-2}, 11.2 cm spike length, 21.2 spikelets/spike, 42.1 grains/spike, 17.3 grams grain weight/plant, 10354 kg biological yield and 4807 kg grain yield/ha. The crop received NP fertilizers at the rates of 120:40, 60:80, 120:0 and 0:80 kg/ha gave 4th, 5th, 6th and 7th number results in case of ranking by comparison with other treatments for almost all the vegetative and reproductive components of wheat. The absence of either N or of P equally showed adverse effects on the grain yield and its components. However, increasing NP levels improved the grain yield gradually, but application of NP beyond 120:80 kg/ha was non-beneficial economically as the distinctions in the figures of all the traits studied between NP levels like, 180:80, 120:120 and 120:80 kg/ha were non-significant ($p>0.05$) factually. Hence, 120:80 kg NP/ha declared as an ideal level.*

Keywords: Wheat, Nitrogen, Phosphorus, Growth, Yield

INTRODUCTION

Among cereals, wheat (*Triticum aestivum* L.) is the leading food grain of the poaceae family (sub-family pooideae) and cultivated almost in all parts of the world [1]. World trade in wheat is greater than for all other crops combined [2]. Globally, it is the major important source of vegetable protein in human food which have higher protein content compare to other cereals [3]. As stable food crop, it is widely cultivated. The wheat grain production of world was estimated about 651 mt that enlist it the third most-produced cereal after maize (844 mt) and rice (672 mt). This shows an increasing trend in production of wheat, but slight decrease in the production of maize and rice over preceding year [4]. Increasing cultivation of wheat is good sign, but Improvement in wheat yield is necessary for world food requirement, maximum wheat crop yield is associated with balanced nutrient application. It is essential and their imbalanced use reduces yields, particularly in case of NP fertilizers. Crop nutrients use efficiency should be enhanced for well results and fertilizers applied to plants by different methods, like soil or foliar application. Basically, green leaves are factories in plants where the photosynthesis processes produce the energy that is utilized by the plants for growth and development. For efficient nutrient management, all various sources of nutrients may be applied to correct nutritional insufficiencies in plants caused by inadequate supply of nutrients to roots from the soil [5]. N is being an essential element that strongly stimulates growth, expansion of the crop canopy and its interception to solar radiation [6]. Atmosphere contains huge N, thus crops are greatly surrounded from N and an estimate every acre of crop land is covered by N in thousands of kilograms, but this N_2 (toxic structure) form of nitrogen is directly unavailable to the plant for their growth, development and reproduction [7]. After N the secondly p is an essential macro nutrient, plays several biochemical and physiological function of plant. It is noted from researches that P has role in capture and convert of the energy of sun into useable compounds, thus P is necessary vigor and plant's overall health [8].

transformations and mobility in the soil-plant system are controlled by a combination of biological, chemical and physical processes [5]. The phosphorus is applied in various forms such as Di-Ammonium phosphate, Nitrophos, single superphosphate, rock phosphate and phosphocompost etc. The source and time of nutrient additions can have a variable effect on crop yields. It is evident from the reports that wheat plants fertilized with NP and SSP gave higher yields than DAP that might include MAP [9]. Many nutrient interactions are time dependent. Basal application of phosphatic fertilizers is the most common and preferable practice of farmers in Sindh. Once they missed its application at sowing they regret to apply it at later stages [10]. Kapoor and Goyal [11] applied 30 and 60 mg P_20_5 kg/soil, Nitrogen @ 60 mg kg^{-1} soil in two equal split doses at the time of sowing and 30 days after sowing of wheat. The studies carried out earlier indicated that application of NPK at the ratio of 150:100:50 kg/ha gave highest 4293 kg/ha grain yield of wheat [12]. Singh *and his team* [13] were used 120:60:40 kg NPK/ha and found a significant increase in term of grain and straw yield as well as improvement in protein content of wheat. Ziadi and his co-researchers [14] reported that application of NP fertilizers at the optimum rates resulted in heavier grains, more grain numbers and higher seed index values in wheat varieties. Ashraf and his co-authors [15] reported that N as urea and P as single super phosphate resulted better length of spike, spikelets/spike, grains/spike, seed index values and yield of wheat/ha. Niamatullah and co-workers [16] recommended 80 kg N and 40 kg P for economical wheat production in D.I.Khan region of Punjab. Tababtabaei and Ranjbar [17] suggested N up-to 160 kg N/ha and elaborated that more160 kg N/ha rate led to a partial increasing in grain protein. Baloch [18] indicated that N at the rate of 168 and P at the rate of 84 kg/ha proved to be

optimum levels for obtaining economically higher grain yields in wheat Baloch [18] indicated that 168:84 NP kg/ha proved as an optimum level for obtaining economically high wheat grain yields. In the light of the perspectives stated above, the present study was conducted on wheat variety Imdad-2005 to optimize NP rates for achieving maximum grain yield under cropping system of wheat-cotton.

MATERIALS AND METHODS

The experiment was conducted at Wheat Research Institute, Sakrand (WRI) during rabi season 2012-13. The field was laid out in three replicated randomized complete block design (RCBD) having plot size for each treatment was 5 m x 2 m (10 m^2). The N and P fertilizer regimes were seven includes T_1 = 0:80 kg NP/ha, T_2 = 60:80 kg NP/ha, T_3 = 120:0 kg NP/ha, T_4 = 120:40 NP kg/ha, T_5 = 120:80 kg NP/ha, T_6 = 120:120 kg NP/ha, T_7 = 180:80 kg NP/ha. The field was well leveled and it was prepared by applying of 02 dry plow, When field came in suitable conditions after the soaking dose then crosswise cultivator was used and soil plowed followed by the tillage implement rotavator, thus a well seed bed prepared of the experimental field. The seed rate was 125 kg/ha recommended, sown with single row hand drill in first week of month November 2012. 22.5 row to row distances maintained and at 21 days after sowing the 1st irrigation was applied at crown root initiation and subsequently all irrigations were applied at recommended interval to crop maturity. Total phosphorus (P) and 1/3rd nitrogen (N) in the form of Urea and DAP fertilizer were applied at sowing time and other remaining 1/3rd of nitrogen was applied at first irrigation. In experimental field the weeds like narrow and broad leaved were suppressed by using of recommended dose of Bactril-M and Puma Super post-emergence herbicides and handweeding throughout crop period. When crop matured then data were collected from randomly selected five plants in each treatment of replications for different parameters such as plant height cm, tillers m^{-2}, spike length cm, spikelets/spike, grains/spike, grain weight g/plant, biological yield kg/ha and grain yield kg/ha. The cutting was done with sickle and threshing was carried out with hands and straw were separated from the grains. All collected data then statistically analyzed at MSTAT-C (Russel and Eisensmith, 1983). For means superiority, the DMR test was applied where necessary required.

RESULTS AND DISCUSSION

The present study showed that 180:80 kg NP/ha fertilizer resulted increased 78.0 cm height of plant, 412.0 tillers m^{-2}, 11.2 cm spike length, 21.2 spikelets/spike, 43.0 grains/spike, 18.0 g grain weight/plant, 10373 kg/ha biological yield and 4820 kg grain yield/ha, followed by 120:120 kg NP/ha treatment which positioned second with 77.3 cm plant height, 411.3 tillers m^{-2}, 11.2 cm spike length, 21.3 spikelets/spike, 42.9 g grains/spike, 17.7 grain weight/plant, 10366 kg/ha biological yield and 4811 kg grain yield/ha. Similarly, the crop received 120:80 NP kg/ha ranked 3rd and resulted in 76.0 cm plant height, 410.7 tillers m^2, 11.2 cm spike length, 21.2 spikelets/spike, 42.1 grains/spike, 17.3 grain weight/plant, 10354 kg/ha biological yield and 4807 kg grain yield/ha. While, NP fertilizers at the rates of 120:40, 60:80, 120:0 and 0:80 kg/ha gave 4th, 5th, 6th and 7th, number performance for almost all the vegetative and reproductive components of Imdad-2005 wheat variety. It is noted that absence of either N and or P equally showed adverse affect on the wheat grain yield and its constituents. However, grain yield and vegetative growth is gradually improved toward increasing of NP doses, but application of N and P fertilizers more than 120:80 kg/ha was determined non-beneficial economically as the distinctions in the figures of all the traits studied between NP levels like, 180:80, 120:120 and 120:80 kg/ha were non-significant ($p>0.05$) factually. Hence, 120:80 kg NP/ha declared as an ideal level for wheat variety Imdad-2005 under cropping system of wheat-cotton. These results are fully supported by Soonder [19] observed that wheat crop has positive response to various NP fertilizer rates and its combinations and Stanislawska [20] found that 100 kg N + 60 kg P were the optimum rates for achieving higher wheat yields. Biswas and Bendi [21] researcher said that the increased yield of crop production can be sustained with the proper amount application of N and P under an intensive cropping system. Kumar and Kumar [22] recommended 120:60 kg NP/ha dose of fertilizer for obtaining maximum grain yield, nutrient uptake, spike number and grains/spike etc. Black [23] studied on the effect of NP fertilizers and applied different doses on wheat crop and observed that wheat grain yield increased from 1984-2706 kg/ha when N at the level of 90 kg/ha were applied. Sial and his co-scientists [24] pointed out that the use of mineral fertilizers is beneficial for increasing the soil fertilizer status and crop productivity. Negi and Chaudhary [25] suggested application of NPK 120:60:30 kg/ha in the form of P_2O_5 and K_2O than at lower 100:50:25 and 80:40:20 kg NP/ha level. Laopiro's team [26] recommended 140 kg/ha N for higher grain yield in wheat; while Cheema and his co-researchers [12] showed that more grain yield of wheat 4293 kg/ha was recorded with an application of 150:100:50 kg NPK/ha. Kratochvil [27] found 80:120 kg N/ha fertilization in wheat for higher yields. Singh and his tream [13] suggested N upto 180 kg/ha along with P at 120 kg/ha respectively for achieving higher yields in different wheat varieties. Hussain's team [28] recommended dose of 200 kg N/ha compared to 150 kg N/ha dose for better grain yield. Kumar [29] reported that 200 kg N/ha produced superior growth and yield characteristics such as taller plant height, more leaves/plant and tillers, increased ear length and weight, dry weight, grains/ear, spikelets/ear and maximum biological yield/ha because N has beneficial effect on certain chemical and physiological function of plant. Baloch [18] reported that NP at the dose of 168:840 kg/ha was an adequate level for SKD-1 wheat variety to obtain economically high grain yields. Khalid and his co-authors [30] reported that greater NP fertilizer application gave more yield, while excessive dose of N cause lodging and delay maturity of wheat. Kratochvil [27] elaborated that under a particular weather condition, the optimum N dose is best done for greater production. Wrong application of N to wheat at vegetative stages causes significant minimization in yield and its weight of kernel. About 80:120 kg N/ha declined nitrate (NO^{3-}) leaching losses without adversely reduction in yield. Habash and his co-scientists [31] observed that accumulated N of the root and shoot before flowering come due to remobilization process and contributes in grain N an estimate 60 to 95%. However, after anthesis N incorporates immediately and demonstrated no any effect on the lodging in wheat. 0 to 90% of N from the vegetative parts accounts in

total panicle N. Ashraf and his co-authors [15] found that N as urea and P as single super phosphate resulted in increased values for spikelets/spike, spike length, seed index, grains/spike and yield/ha. Niamatullah's scientists group [16] recommended 80 kg N and 40 kg P for economical wheat production in D.I.Khan region of Punjab. Tababtabaei and Ranjbar [17] suggested 160 kg N/ha, increasing of N level >160 kg/ha led to a imperfect increase of grain protein. Baloch [18] indicated that N at the rate of 168 and 84 kg P/ha proved an optimum levels for economic grain yields in SKD-1 wheat variety. The comparative analysis of results of the present study and findings of the past researchers showed complete agreement that different wheat varieties respond to NP fertilizers variably depends upon the soil and environmental conditions and genetic makeup of parental material of certain varietie

Table 1. Growth and yield contributing components of wheat variety Imdad-2005 as affected by various nitrogen and phosphorus doses

Treatments	Plant height (cm)	Tillers (m^{-2})	Spike length (cm)	Spikelets/spike
N-P: 0-80 kg/ha	58.7 c	202.7 e	6.4 d	12.8 e
N-P: 60-80 kg/ha	71.7 b	319.7 c	10.1 b	18.3 c
N-P: 120-0 kg/ha	72.7 b	238.0 d	7.8 c	15.0 d
N-P: 120-40 kg/ha	74.7 b	388.7 b	10.0 b	19.5 b
N-P: 120-80 kg/ha	76.0 a	410.6 a	11.2 a	21.2 a
N-P: 120-120 kg/ha	77.3 a	411.3 a	11.2 a	21.3 a
N-P: 180-80 kg/ha	78.0 a	412.0 a	11.2 a	21.2 a
S.E ±	1.1236	6.0749	0.3128	0.4324
$LSD_{0.05}$	3.8056	13.236	0.6815	0.9421

Mean values sharing same letters do not differ significantly at 0.05 probability level

Table 2. Yield and yield contributing components of wheat variety Imdad-2005 as affected by various nitrogen and phosphorus doses

Treatments	Grains/spike	Grain weight/plant (g)	Biological yield (kg/ha)	Grain yield (kg/ha)
N-P: 0-80 kg/ha	27.3 f	9.4 d	6500 d	2753 d
N-P: 60-80 kg/ha	36.3 d	15.5 b	7666 c	4137 b
N-P: 120-0 kg/ha	32.0 e	12.3 c	9456 b	3311 c
N-P: 120-40 kg/ha	40.3 c	16.6 b	9482 b	4260 b
N-P: 120-80 kg/ha	42.1 a	17.3 a	10354 a	4807 a
N-P: 120-120 kg/ha	42.9 a	17.7 a	10366 a	4811 a
N-P: 180-80 kg/ha	43.0 a	18.0 a	10373 a	4820 a
S.E ±	0.9568	0.5266	406.63	89.440
$LSD_{0.05}$	2.0847	1.1473	885.97	194.87

Mean values sharing same letters do not differ significantly at 0.05 probability level

CONCLUSIONS

The results concluded that increasing nitrogen and phosphorus levels improved the grain yield gradually, but application of nitrogen and phosphorus beyond 120-80 kg/ha was found uneconomical, because the differences between nitrogen and phosphorus levels of 180:80, 120:120 and 120:80 kg/ha were non-significant (p>0.05) statistically. Hence, suitable dose of nitrogen and phosphorus for wheat variety Imdad-2005 was 120-80 kg/ha.

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