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Effect of nitrogen and foliar spray of nutrient mixture on yield attributes and yield of wheat (*Triticum aestivum* L.)

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Abstract
A field experiment was conducted to study the "Response of wheat (Triticum aestivum L) to different levels of Nitrogen (N) and foliar spray of nutrient mixture under Gharuan conditions of Punjab (India)" during Rabi 2020-2021 at Agriculture Farm of Chandigarh University. The soil of the experimental field was sandy loam to clay neutral in reaction and having neutral pH and medium range of organic carbon, low in available nitrogen, phosphorus and potassium. The experiment was laid out in split plot design with four levels of nitrogen(30,60,90,120 kg N ha^{-1}) in main plots and four Foliar spray of nutrient mixture(F_1 = 2% DAP + 1% KCL, F_2= 2% DAP+ 1% KCL+ Nutrient mixture,F_3= 2% DAP + 1% KCL+100ppm Salicylic acid, F_4= 2% DAP +1% KCL+ 100ppm maleic hydrazide, nutrient mixture prepared by 0.5% MgSO4, 0.25% ZnSO4 and 0.1% Boric acid) in sub plots. The results showed that, highest yield, yield attributing characters and growth attributes viz. plant height, dry weight $plant^{-1}$, number of tillers $plant^{-1}$, LAI, 1000-grain weight, fertile spikelets/ear, Ear length as well as number of spikes $plant^{-1}$ were recorded with the application of 120 kg Nha-1 and foliar spray of 2% DAP + 1% KCl + nutrient mixture (F2) whereas lowest value of yield and growth attributes was recorded with application of 30 kg Nha-1 and foliar spray of 2% DAP + 1% KCl + 100 ppm maleic hydrazide (F4). Besides, foliar spray of 2% DAP + 1% KCl + 100 ppm salicylic acid 100 ppm (F3) and 2% DAP + 1% KCl (F1) also recorded significantly higher values of these growth characters over F4 treatments.

Keywords: nitrogen, nutrient mixture, foliar spray, yield, yield attributes

Introduction

Wheat (*Triticum aestivum* L.*)* belongs to family Gramineae. It is second most important cereal crop worldwide staple food. Grown all over the world, wheat covers more of the earth's surface than any other cereal crop. However, although it takes more land space than other cereals, based on a three year average it is only the third-largest cereal crop, behind maize and rice. The domestication of grains and the development of agricultural lifestyles led to significant changes in people's lives, encouraging permanent settlements, the development of civilization, and trade. Wheat cultivated over an area of about 29.14 million hectares (ministry of Agriculture and farmer welfare) with a record production of about 763.06 million tonnes of grain. Respectively (Anonymous, 2007). In terms of area and production it is second to Rice. Wheat is grown in more than hundred countries, with a total harvested area of approximately 84.4 million acres. In India area under wheat cultivation is about 30 million hectares with annual production of about 99.70 million tonnes with an average productivity of 3371 kg/ha (According to ministry of agriculture).India is largest producer of wheat, and grown in almost half of the states, major wheat producing states in India are UP, Punjab,Madhya Pradesh, HR and Rajasthan. In Punjab an area under wheat is about 35.20 lakh hectare (2019-20) with production of 18.62 lakh tonnes and average yield of 51.88 quintals per hectare. Nitrogen is one of the most essential plant Nutrient. It plays very important role in plant metabolism.

The most important role of N in the plant is its presences in the structure of protein, nitrogen is also found in chlorophyll, the green colouring of matter of leaves and involves in photosynthesis. Plants grown with an adequate supply of nitrogen make rapid growth of plant. When soil available nitrogen is low, yield and protein content will be low. As more nitrogen becomes available, yield and protein rise concurrently. Urea is generally being applied as basal and as top dressing at critical growth stages of the crop and under ideal conditions, the percent recovery of nitrogen is not more than 40%, meaning a loss of 60% of applied nitrogen in the form of urea. The favorable balance of macro and micronutrients is required for high yields. However, Genetic imbalance may be due to a lack of good judgment as well the free use of high nutrients and the existence of low levels of micronutrients. Zinc is known to be involved in the syn concept of Indole-3-acetic acid thus being indirectly involved stem elasticity, while manganese plays an active role plays a role in water depletion in the simple response of photosynthesis. Boron's functions in cell wall formation; sugar transport, flower storage and pollination thus improving grain production (Henry and Cathey, 2009).

Maleic hydrazide, a well-known growth inhibitor, has been found to be involved in improving growth at very low altitudes (Henry and Cathey, 2009).Similarly salicylic acid improves transportation and transport of ions, brings about a change in the structure of chloroplast as well involvement in growth and development, photosynthesis and breathing (Hayat et al., 2005).

Since the shortage of micronutrients viz., zinc boron and manganese are very common be careful the wheat so that their foliar spray in the mixture is mixed improve wheat yield.

Material and Methods

A field experiment was conducted to study the "Response of wheat (*Triticum aestivum* L) to different levels of Nitrogen (N) and foliar spray of nutrient mixture under Gharuan conditions of Punjab (India)" during Rabi 2020-2021 at Agriculture Farm of Chandigarh University. The soil of the experimental field was sandy loam to clay neutral in reaction and having neutral pH and medium range of organic carbon, low in available nitrogen, phosphorus and potassium. The experiment was laid out in split plot design with four levels of nitrogen(30,60,90,120 kg N ha^{-1}) in main plots and four Foliar spray of nutrient mixture(F_1 = 2% DAP + 1% KCL, F_2= 2% DAP+ 1% KCL+ Nutrient mixture,F_3= 2% DAP + 1% KCL+100ppm Salicylic acid, F_4= 2% DAP +1% KCL+ 100ppm maleic hydrazide, (nutrient mixture prepared by 0.5% MgSO4, 0.25% ZnSO4 and 0.1% Boric acid) in sub plots replicated thrice. DAP = Di-ammonium phosphate and MOP= Murate of potash). Same dose for P and K at 60 and 40 kg P2O5 no K20 / ha, respectively at half the N rate as per treatment it is used as a basal during sowing while the remaining half capacity is left N is used in equal divisions twice, each in 30 DAS and the inclination phase as per treatment. N, P and K were applied using urea, DAP and MOP. Foliar use of mixtures of various elements was fully utilized vegetable growth in each structure as per treatment. Plant height as well the number of tillers plant-1 was recorded at 30, 60, 90, and 120 DAS from ten randomly marked plants from two previous rows of each time plot and later estimated. 1 dry plant cut off by collecting plant samples from a line height of 50 cm (25 cm from each last row) for each building in 30, 60, 90, and 120 DAS. After sun exposure for 2 to 3 days, plant samples will be dried in the oven at 60 to 65 ° C for 48 h at a constant weight. Similarly, the number of plant-1 spikes are recorded on ten plants marked periodically from two rows of edges of each building one day before harvesting again estimated the number of plant-1 spikes Information obtained in relation to of the various views were mathematically analyzed in this way described by Cochran and Cox (1963).

Results and Discussion

Yield attributes

The result shows that, The heighest number of effective tillers m^2 (418.2) was recordrd with the application of 120 kg of N ha^{-1} and it was significantly higher than all the other treatments.this might due to proper supply of Nitrogen and in required amount. 30 kg N ha^{-1} resulted in lower effective tillers m^2 (251.2) then the heigher level of Nitrogen (120 kg ha^{-1}) but it was satistically at par with the lower level of nitrogen dose (90 kg ha^{-1}). The higher level of nitrogen gave significantly hogher effective tillers m^2 then tha lower level of nitrogen (30 kg N ha^{-1}).Regarding the foliar spray of nutrient mixture, The effective tillers m^2 were significantly higher (313.5) in F2 (2% DAP+ 1% KCL+ Nutrient mixture) and F1(2% DAP + 1% KCL) gave significantly lower effective tillers m^2(249.3) than F2, but it was stastically at par with F4 treatment shows in table no. 1. Ear length was significantly more with (9.98 cm) with the recommended dose of nitrogen (N_{120}Kg ha^{-1}) than all other treatments. Higher level of nitrogen (N_{120}Kg ha^{-1}) gave significantly more ear length (9.98 cm) than the lower level of nitrogen dose (N_{30} Kg ha^{-1}), but it is statistically at par with the medium level of nitrogen dose (N_{60} Kg ha^{-1}).

Among the nutrient spray, The higher ear length was recorded with F2 (9.32), (% DAP+ 1% KCL+ Nutrient mixture.) which is statistically at par with F3 (9.28), (2% DAP + 1% KCL+100ppm Salicylic acid). ear length was significantly more with (9.98 cm) with the recommended dose of nitrogen (N_{120}Kg ha^{-1}) than all other treatments. Higher level of nitrogen(N_{120}Kg ha^{-1}) gave significantly more ear length (9.98 cm) than the lower level of nitrogen dose (N_{30} Kg ha^{-1}), but it is statistically at par with the medium level of nitrogen dose (N_{60} Kg ha^{-1}).Among the nutrient spray, The higher ear length was recorded with F2 (9.32), (% DAP+ 1% KCL+ Nutrient mixture.) which is statistically at par with F3 (9.28), (2% DAP + 1% KCL+100ppm Salicylic acid). The maximum number of grains ear^{-1} was recorded with N_{120} kg ha^{-1} (45.6) which was significantly higher than lower level N_{30} Kg ha^{-1} (39.9) and medium level of nitrogen N_{60} Kg ha^{-1} (42.4) and N_{90} Kg ha^{-1} (44.3). Nutrient spray F2 (% DAP+ 1% KCL+ Nutrient mixture) gave maximum number of grains ear^{-1} (43.6) which was statistically at par with F3 (41.3) (2% DAP + 1% KCL+100ppm Salicylic acid) The nutrient spray F1 (38.9) (2% DAP + 1% KCL) gave significantly lower number of grains ear^{-1} than all other treatments nutrient treatments. number of tillers that form inflorescence and the number of spikelets formed on each spike (Reddy and Reddi 2008).

Fertile spikes plant/Ear were significantly more over application of 30 kg Nha^{-1} due to the application of 120 kg Nha-1 but the Fertile spikes plant/Ear did not vary significantly among 120, 90, and 60 Kg Nha^{-1} application. Among different N levels, maximum number of fertile spikes plant/Ear (15) were recorded with application of 120 kg Nha-1, followed by application of 90 kg Nha^{-1} (14), 60 kg Nha^{-1} (12) and the least number of spikes Ear was observed with the application of 30 kg Nha^{-1}(10). The higher N nutrition to the crop reflected in increased number of Fertile spikes ear. Earlier Singh et al. (1995) also reported the significant improvement in the effective tillers $plant^{-1}$ with N application up to 120 kgN ha^{-1}. Significant increase in spikelets/Ear was observed with application of foliar spray of 2% DAP + 1% KCl + nutrient mixture (F2) over 2% DAP +1% KCL+ 100ppm maleic hydrazide (F4) but the spikelets per ear did not vary significantly amongst F2, F3 (2% DAP + 1% KCl + 100 ppm Salicylic acid) and F1 (2% DAP + 1% KCl) treatments (Table 2). Earlier, Mohamed (1994) also reported the improvement in the number of fertile spikelets in wheat with foliar spray of Zinc, Iron and other micronutrients.

The 1000-grain weight was higher in N 120kg ha^{-1} (41.9) than other treatments. The 1000-grain weight significantly lower in N 30 kg ha^{-1} (39.8) than medium levels of nitrogen N 60 kg ha^{-1} which is statistically at par with N 90 kg ha^{-1}. Nutrient spray, F2 (2% DAP+ 1% KCL+ Nutrient mixture) resulted in significantly higher 1000-grain weight (41.8 g) than the other two treatments. F1 gave significantly lower 1000-grain weight (39.9 g) than F3 and F4.

Table 1: Yield attributes of wheat as affected by different doses of nitrogen and foliar spray of nutrient mixture.

Treatment	Effective tillers (m^2)	Ear length (cm)	Number of grains ear^{-1}	Fertile spikelets/ Ear	1000-grain weight gram

Nitrogen levels (Kg ha^{-1})

Table 2

N_{30}	**251.2**	**8.96**	**39.9**	**10**	**39.8**
N_{60}	275.6	8.98	42.4	12	40.4
N_{90}	312.4	9.34	44.3	14	40.6
N_{120}	418.2	9.98	45.6	15	41.9
SEm±	34.21	0.17	1.24	1.23	0.15
CD (p=0.05)	112.24	0.57	3.75	3.64	0.46

Foliar spray of nutrient mixture

Table 3

F1	249.3	89.5	38.9	09	39.9
F2	313.5	9.32	43.6	14	41.8
F3	274.2	9.28	41.3	12	40.8
F4	279.8	8.97	39.4	11	40.6
SEm±	13.21	0.21	0.79	1.19	0.07
CD (p=0.05)	39.69	0.63	2.41	3.62	0.023

F_1 = 2% DAP + 1% KCL, N_1= 30 Kg ha^{-1}, F_2= 2% DAP+ 1% KCL+ Nutrient mixture,N_2=60 Kg ha^{-1},F_3= 2% DAP + 1% KCL+100ppm Salicylic acid, N_3=90 Kg ha^{-1}, F_4= 2% DAP +1% KCL+ 100ppm maleic hydrazide, N_4= 120 Kg ha^{-1}, nutrient mixture prepared by 0.5% MgSO4, 0.25% ZnSO4 and 0.1% Boric acid.

Yield

Grain increased significantly with N application at 120 kg N ha^{-1} 90, 60, and 30 kg Nha^{-1}. Akthar (2001), Naeem (2001) and increased significantly with the application of N and foliar spray of nutrient mixture, grain increased significantly with N application at 120 kg N ha^{-1} 90, 60, and 30 kg Nha^{-1} N120 level marked grains yield superiority of 46.8 qha^{-1}over N90, N60 and N30 levels, respectively. Increased yields of grain and grass by the use of N have also been Jatoi (2003). Low yields of grain and grass obtained at 30 Kg Nha-1 can be caused by malnutrition due to insufficient N-availability. The maximum yield of 46.2 grain only 1 was obtained through the use of F2 treatment followed by the recording of F3 treatment of 45.3 only 1 grains and, the lowest yield of 43.1 only 1 was recorded with F1 drugs. F2 treatment marked a peak yield of 46.2, in addition to F3, F1 and F4, respectively. A higher grain yield compared to F3 treatment F1 and F4 treatment. The low yields obtained by F1. Drugs or at low concentrations may be due to the fact that, Maleic hydrazide may limit the growth and development of the plant due to its inhibitory effect (Henry and Cathey, 2009).

The nitrogen dose N 120kg ha^{-1} increased the straw yield (75.9 q ha^{-1}) significantly than all the other treatments. The straw yield is higher than the medium level of nitrogen doses N 90 kg ha^{-1}, 60 kg ha^{-1}, 30 kg ha^{-1}. N 30 kg ha^{-1} gave significantly lower straw yield (69.2 qha^{-1}) than N 90 kg ha^{-1} but it is statistically at par with the lower level of nitrogen (N 60 kg ha^{-1}).The nutrient spray, in straw yield were mainly due to their genetic characteristics. The straw yield with treatment F2 (2% DAP+ 1% KCL+ Nutrient mixture) was significantly higher (74.9 q ha^{-1}) Than the other treatments. The straw yield yield of F4 (73.6 qha^{-1}) (2% DAP + 1% KCl + 100 ppm Salicylic acid) statistically at par with F3 (72.2 q ha^{-1}).

Table 4: Effect of different levels of nitrogen and foliar spray of nutrient mixture on yield of wheat.

Treatment	Grain yield (q ha^{-1})	Straw Yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)

Nitrogen levels (Kg ha^{-1})

Table 5

N_{30}	41.6	69.2	110.8	37.5
N_{60}	44.3	72.5	116.8	37.9
N_{90}	44.4	73.2	118.6	38.2
N_{120}	46.8	75.9	122.7	38.1
SEm±		1.23	1.45	2.93
CD (p=0.05)	NS	3.61	4.35	8.71

Foliar spray of nutrient mixture

Table 6

F1	**43.2**	**68.4**	**116.6**	**38.2**
F2	46.2	74.9	121.1	38.1
F3	45.3	72.2	117.5	38.4
F4	45.6	73.6	119.2	38.7
SEm±		1.10	1.26	2.63
CD (p=0.05)	NS	3.30	3.81	8.23

F_1 = 2% DAP + 1% KCL, N_1= 30 Kg ha^{-1}, F_2= 2% DAP+ 1% KCL+ Nutrient mixture,N_2=60 Kg ha^{-1},F_3= 2% DAP + 1% KCL+100ppm Salicylic acid, N_3=90 Kg ha^{-1}, F_4= 2% DAP +1% KCL+ 100ppm maleic hydrazide, N_4= 120 Kg ha^{-1}, nutrient mixture prepared by 0.5% MgSO4, 0.25% ZnSO4 and 0.1% Boric acid.

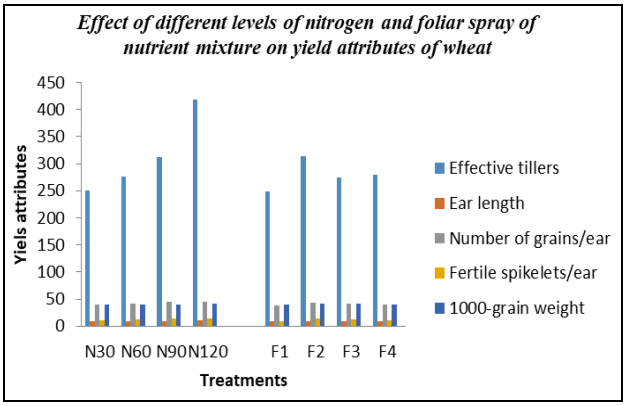

Fig 1: Effect of different levels of nitrogen and foliar spray of nutrient mixture on yield attributes of wheat.

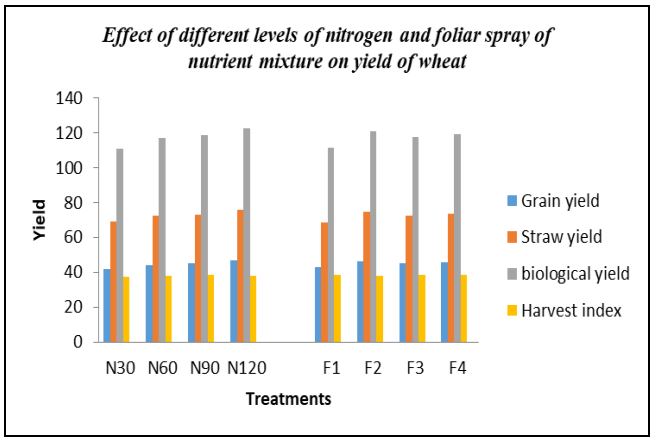

Fig 2: Effect of different levels of nitrogen and foliar spray of nutrient mixture on yield of wheat.

Conclusion

Both the crop yield and the different yield attributing characters characters viz, effective tilers, ear length, number of grains/ear, fertile spikelets/ear and 1000-grain weight. were significantly large with the application of 120 kg Nha-

1 and at least with application of 30 kg N ha $^{-1}$Foliar spray 2% DAP+ 1% KCl + nutrient mixture (F2) at most increase yields and growth qualities viz: occasional crop height, dry plant^{-1}, number of tillers plant^{-1} with number of plant spikes-1 over 2% DAP + 1% KCl + 100 ppm maleic hydrazide (F4). Foliar spray 2% DAP + 1% KCl + 100 ppm salicylic acid 100 ppm (F3) and 2% DAP + 1% KCl (F1) also recorded the highest values of growth spurts in addition to F4 treatment. The effect of the interaction between N and foliar spray of a mixture of nutrients has been found to be important in grain show. The treatment combination is N120 × 2% DAP + 1% KCl + 100 ppm nutrient blend (F2) produce very high amounts of these characters.

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