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EFFECT OF FOLIAR APPLICATION OF UREA ON DIFFERENT GROWTH STAGES OF WHEAT

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Abstract

The experiment was conducted at Student Farm, Department of Agronomy, Sindh Agriculture University, Tandojam during the year 2012-13, to evaluate the effect of foliar dose of urea on different growth stages of wheat variety TJ-83 with 3 replications, experimental design Randomized Block Design with two factors A foliar nitrogen concentration of urea with treatments control (non - treated plots), 0.5% and 1.0%however in factor B include two growth stages i.e. Tillering stage, Anthesis stage. Wheat variety TJ-83 was cultivated at net plot size 4x4= (16 m^2). The results revealed that germination (%) showed non-significant response to foliar nitrogen concentrations, growth

stages and their interaction whereas all other wheat traits significantly affected by different foliar fertilizers, growth stages and their interaction.The mean maximum plant height (cm), grains spike^{-1} and seed index (1000 grain weight g) were recorded at 0.5% urea nitrogen concentrations whereas other wheat traits tillers plant^{-1}, spike length (cm), spikelets spike^{-1} and grain yield kg ha^{-1} were found superior at 0.5% and 1.0% foliar nitrogen concentrations.Maximum mean for growth stages was observed at plant height (cm), tillers plan^{-1},spike length (cm), spikelets spike^{-1}, seed index (1000 grain weight g) and grain yield were recorded at tiilering stages whereas higher value of grains spike^{-1} was recorded at anthesis growth stage of wheat. The interactive results indicated that the maximum plant height (cm) was recorded at interaction of 1.0% foliar nitrogen concentration x tillering stage, however higher values of tillers plan^{-1}, spike length (cm) spikelets spike^{-1}, seed index (1000 grain weight g) and grain yield kg ha^{-1} were observed at interaction of 0.5% and 1.0% foliar nitrogen concentrations x tillering stages. Further results indicated that the foliar nitrogen concentrations, growth stages and their interaction showed enhanced values as compared to control plots where no any fertilizer was applied.

Keywords

Nitrogen, Concentrations, Growth, Wheat, Yield

1. Introduction

Wheat is cultivated in Pakistan as staple food crop. Nitrogenous fertilizers play a vital role in modern farm technology, however only 20-50% of the soil applied nitrogen is recovered by the annual crops (Bajwa, 1992).Nitrogen availability at critical stages is of paramount importance Foliar urea applications have increased grain yield, particularly when applied before flag leaf emergence and when N availability was limiting (Gooding and Davies, 1992). Applications of N near flowering increased post flowering N uptake, grain protein content, and grain protein concentration. Increases in grain N content were often larger when applications of N fertilizers to the soil were reduced, and when the urea solution was sprayed either at anthesis or during the following two weeks (Gooding and Davies, 1992; Iftikhar *et al.*, 2010; Babar *et al.*, 2011). Various studies have shown that a small amount of nutrients (nitrogen, potash, or phosphate) applied by foliar spraying increases significantly the yield of crops (Rauthan and Schnitzer.1981; Haq and Mallarino2000).A supplemental dose of 7 kg N ha^{-1} as urea spray significantly increased

maize grain yield (Singh *et al.,* 2003). Foliar application of nitrogen has more effect on yield and yield components of wheat because it is more effective and minimum losses involved in foliar spray. (Sud *et al.,* 1990). The efficiency of N assimilation through foliage, however, depends upon several factors including varieties or genotypes. The study under report was initiated to investigate the efficiency of foliar application of urea for yield and yield components of wheat when applied at different growth stages. Foliar spray of fertilizer did not only increase the crop yields but also reduced the quantities of fertilizer applied through soil. Foliar application can also reduce the lag time between application and uptake by the plant (Ahmad and Jabeen. 2005).

2. Material and Methods

The experiment was conducted at Student Farm, Department of Agronomy, Sindh Agriculture University, Tando Jam during the year 2012-13, to evaluate the effect of foliar dose of urea on different growth stages of wheat variety TJ-83 with 3 replications, experimental design Randomized Block Design with two factors A foliar nitrogen concentration of urea with treatments control (non treated plots), 0.5% and 1.0% however in factor B include two growth stages i.e Tillering stage, Anthesis stage with net plot size 4x4= (16 m^2). Wheat variety TJ-83 was cultivated in well prepared seed bed; recommended dose of NPK 120-60-60 was applied, total five irrigations given to crop. The 0.5 and 1.0 concentrations prepared from urea as percentage basis and mixing with calculated water quantity. Weeds control practices was done properly.

3. Results and Discussion

Table 1: *Germination% affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen concentrations	Growth stages		Mean for foliar nitrogen concentrations
	Tillering stage	Anthesis stage	
Control (non treated plots)	82.67	81.00	82.00
Foliar nitrogen 0.5%	83.00	83.33	83.00
Foliar nitrogen 1.0%	84.00	84.67	84.33
Mean for growth stages	82.56	83.67	

Foliar N Con.	Growth stages	Interaction
S.E±1.1722	0.9571	1.6578
LSD 5%	-------	-------- --------

The statistical analysis of germination% showed non-significant response to foliar nitrogen concentrations, growth stages and their interaction presented in table-1.The results revealed that mean minimum and maximum germination% range (82-84.33) for foliar nitrogen concentration at non treated control plots-1.0% was recorded. The mean minimum and maximum germination% (82.56 and 83.67) for growth stages was obtained at tillering stage and anthesis stages, The germination% minimum range of values were (81.00-84.68) observed at non treated control plots-1.5% foliar nitrogen concentration stillering stage and antheis both stages respectively.

Table 2: *Plant height (cm) affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen concentrations	Growth stages		Mean for foliar nitrogen concentra
	Tillering stage	Anthesis stage	
Control (non treated plots)	81.67 d	81.33 d	81.50 c
Foliar nitrogen 0.5%	86.67 b	85.33 c	86.00 b
Foliar nitrogen 1.0%	89.00 a	87.00 b	88.00 a
Mean for growth stages	85.78 a	84.56 b	

	Foliar N Con.	Growth stages	Interaction
S.E±	0.3801	0.3103	0.5375
LSD 5%	0.8468	0.6914	1.1976

The statistical analysis of plantheight (cm) showed significant response to foliar nitrogen concentrations, growth stages and their interaction presented in table-2.The results revealed that mean maximum plant height cm (88.00) for foliar nitrogen concentration were recorded at 1.0%; however minimum height (81.50) was obtained at non treated control plots respectively. The mean maximum height of plant cm (85.78) for growth stages was obtained at tillering stage, however the lower value (84.556) was recorded at anthesis stage of wheat crop.The plantheight cm (89.000) values for interaction showed highest as at 1.0% foliar nitrogen concentration x tillering stage whereas the lowest values (81.667 and 81.333) plant height were obtained at interaction of non treated control plots x tillering and anthesis stage of wheat crop. Plant height positively increased with foliar fertilization similarly the Alston (1979) who reported better vegetative growth of wheat with foliar application of N. Similarly, (Soylu et al., 2005;

Kenbaev and Sade (2002) and Arif *et al.*, (2006) reported significant increase in plant height of wheat crop with foliar application of different nutrients individually or in combination.

Table 3: *Tillers plant^{-1} affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen concentrations	Growth stages		Mean for foliar nitrogen concentration
	Tillering stage	Anthesis stage	
Control (non treated plots)	6.29 c	5.66 d	5.98 b
Foliar nitrogen 0.5%	7.87 a	6.63 b	7.24 a
Foliar nitrogen 1.0%	7.93 a	6.55 b	7.24 a
Mean for growth stages	7.36 a	6.28 b	

Foliar N Con.	Growth stages	Interaction
S.E±0.0342	0.0280	0.0484
LSD 5%	0.0763	0.0623 0.1079

The statistical analysis of tillers plant^{-1} showed significant response to foliar nitrogen concentration, growth stages and their interaction presented in table-3.The results revealed that mean maximum tillers (7.24) for nitrogen concentration were recorded at 0.5 and 1.0% foliar nitrogen and minimum tillers (5.98) were obtained at non treated control plots. The mean maximum tillers (7.36) for growth stages was obtained at tillering stage, however the lower value (6.28) was recorded at anthesis stage of wheat crop. The tillers plant^{-1} values for interaction showed highest as (7.85-7.93) at non treated control plots and 1.0% foliar nitrogen concentration x tillering stage whereas the lowest value (5.66) tillers plant^{-1} were obtained at interaction of non treated control plots x anthesis stage of wheat crop. Fertilization to wheat crop as different concentrations by foliar feeding significantly increase tillers plant^{-1} at different growth stages of plant these findings confirmed by Rajendran, (1991) who stated that the foliar spray of 3% DAP at flowering and then a fortnight later significantly increased the number of pods plant^{-1} of black and green gram. The nitrogen urea concentrations significantly increase the numbers of tiilers plan^{-1} similarly Dwivedi and Tiwari (1991) also reported that highest number of pods was obtained by 2 %urea than 2 % DAP in chickpea.

Table 4: *Grains spike^{-1} affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen concentrations	Growth stages		Mean for foliar nitrogen concentration
	Tillering stage	Anthesis stage	
Control (non treated plots)	41.89 d	42.91 d	42.40 c
Foliar nitrogen 0.5%	45.77 c	46.44 bc	46.11 b
Foliar nitrogen 1.0%	47.44 ab	48.48 a	47.96 a
Mean for growth stages	45.04 b	45.95 a	

	Foliar N Con.	Growth stages	Interaction
S.E±0.3905	0.3188	0.5522	
LSD 5%	0.87010.7104	1.2304	

The statistical analysis of grains spike^{-1} showed significant response to foliar nitrogen concentration, growth stages and their interaction presented in table -4.The results revealed that maximum mean grains spike^{-1} (47.96) for nitrogen concentration were recorded at 1.0 % foliar nitrogen and minimum grains spike^{-1} (42.40) were obtained in non treated control plots. The mean maximum grains spike^{-1} (45.95) for growth stages was obtained at anthesis stage; however the lower value (45.04) was recorded at tillering stage of wheat crop. The grains spike^{-1} values for interaction showed highest as (48.48) at 1.0% foliar nitrogen concentration x anthesis stage whereas the lowest grains spike^{-1} values (41.89 - 42.91) were obtained at interaction of non-treated control plots x anthesis stage of wheat crop.Foliar nitrogen concentrations increase grains per spike wheat similarly Defen *et al.,* (1999) stated that foliar application of nitrogen increased number of grains spike $^{-1}$ and grain weight. Same results also observed by Rogalski (1994).

Table 5: *Spikelength (cm) affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen concentrations	Growth stages		Mean for foliar nitrogen concentration
	Tillering stage	Anthesis stage	
Control (non treated plots)	10.58 c	8.03 d	9.31 b
Foliar nitrogen 0.5%	13.59 a	11.94 b	12.76 a
Foliar nitrogen 1.0%	13.88 a	12.10 b	12.99 a
Mean for growth stages	12.68 a	10.69 b	

	Foliar N Con.	Growth stages	Interaction
S.E±0.2596	0.2120	0.3672	
LSD 5%	0.5785	0.4723	0.8181

The statistical analysis of spike length cm showed significant response to foliar nitrogen concentration, growth stages and their interaction presented in table -5.The results revealed that maximum mean spike length cm (12.76 and 12.99) for nitrogen concentration were recorded at 0.5 and 1.0% foliar nitrogen and minimum spike length cm (9.31) was obtained at non treated control plots. The mean maximum spike length cm (12.68) value for growth stages was obtained at tillering stage; however the lower spike length (10.69) was recorded at antheis stage of wheat crop. The interaction results showed that the highest spike length (13.59 and 13.88) values were recorded at 0.5 and 1.0% foliar nitrogen concentration x tillering stage whereas the lowest spike length in cm was (8.03) obtained at interaction of non-treated control plots x anthesis stage of wheat crop. The length of spikes increases with the application of different concentrations of foliar nitrogen fertilizers this finding of researchers who stated that the applications of 1.5% urea and 0.5% DAP could increase the pod length of greengram (Patel and Patel, 1994). Application of foliar nitrogen concentrations showed positive response when applied at different growth stages similarly the findings of Pandian *et al*. (2001) also reported that application 2 % DAP spray twice registered higher green gram plant height (cm). The foliar feeding to crop showed positive response towards different growth stages of wheat crop.

Table 6: *Spikelets spike^{-1} affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen	Growth stages		Mean for foliar nitrogen concentration
	Tillering stage	Anthesis stage	
Control (non treated plots)	12.28 cd	10.82 d	11.55 b
Foliar nitrogen 0.5%	17.89 a	13.63 bc	15.76 a
Foliar nitrogen 1.0%	18.30 a	14.17 b	16.23 a
Mean for growth stages	16.16 a	12.87 b	

	Foliar N Con.	Growth stages	Interaction
S.E±0.4931	0.4026	0.6973	
LSD 5%	1.09870.8970		1.5537

The statistical analysis of spikelets spike^{-1} showed significant response to foliar nitrogen concentration, growth stages and their interaction presented in table -6. The results revealed that maximum mean spikelets spike^{-1} (15.76 and 16.23) for nitrogen concentration was recorded at 0.5 and 1.0% foliar nitrogen and minimum spikelets spike^{-1} (11.55) was obtained at non-treated

control plots. The mean maximum spikelets spike^{-1} (16.16) value for growth stages was obtained at tillering stage; however the lower spikelets spike^{-1} (12.87) was recorded at antheis stage of wheat crop. The interaction results showed that the highest spikelets spike^{-1} (17.89, 18.30) values were recorded at 0.5 and 1.0% foliar nitrogen concentration x tillering stage, whereas the lowest spikelets spike^{-1} was (10.82) obtained at interaction of non treated control plots x anthesis stage of wheat crop.

Table 7: *Seed index (1000 grain weight g) affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen	Growth stages		Mean for foliar nitrogen concentration
	Tillering stage	Anthesis stage	
Control (non treated plots)	31.90 d	30.52 e	31.21 c
Foliar nitrogen 0.5%	43.03 a	37.39 c	40.21 b
Foliar nitrogen 1.0%	43.78 a	38.60 b	41.19 a
Mean for growth stages	39.57 a	35.50 b	

	Foliar N Con.	Growth stages	Interaction
S.E±0.3648	0.2979	0.5159	
LSD 5%	0.8128	0.6637	1.1495

The statistical analysis of seed index (1000 grain weight g) showed significant response to foliar nitrogen concentration, growth stages and their interaction presented in table -7. The results revealed that maximum mean seed index (1000 grain weight g) 41.193 for nitrogen concentration were recorded at 1.0 % foliar nitrogen and minimum seed index (1000 grain weight g) 31.212 was obtained at non treated control plots. The mean maximum seed index (1000 grain weight g) 39.571 for growth stages was obtained at anthesis stage, however the lower value 35.504 was recorded at tillering stage of wheat crop. The seed index (1000 grain weight g) values for interaction showed highest as (43.027 and 43.783) at 0.5 and 1.0% foliar nitrogen concentration x tillering stage whereas the lowest seed index (1000 grain weight g) value (30.520) was obtained at interaction of non treated control plots x anthesis stage of wheat crop. Rajendran, 1991 who stated that the foliar spray at flowering later significantly increased 100 grain weight of black gram and green gram. Seed index increase with increasing foliar feeding of nutrients to crop. These results are in line with Soylu et al., (2005) and Guenis *et al.*, (2003) who reported significant increase in thousand grains weight with foliar application of nutrients. Application of

foliar fertilizers on different growth stages showed positive response. Similar results also confirmed by Ganapathy *et al.* also apply foliar fertilizer on green gram at different growth stages.

Table 8: *Grain yield kg ha^{-1} affected by different foliar nitrogen concentrations applied at growth stages of wheat*

Foliar nitrogen	Growth stages		Mean for foliar nitrogen concentration
	Tillering stage	Anthesis stage	
Control (non treated plots)	3626.7 c	3184.3 d	3405.5 b
Foliar nitrogen 0.5%	4343.0 a	3904.0 bc	4123.5 a
Foliar nitrogen 1.0%	4437.3 a	4018.0 b	4227.7 a
Mean for growth stages	4135.7 a	3702.1 b	

	Foliar N Con.	Growth stages	Interaction
S.E±98.237	80.210	138.93	
LSD 5%	218.89	178.72	309.55

The statistical analysis of grain yield kg ha^{-1} showed significant response to foliar nitrogen concentration, growth stages and their interaction presented in table-8.The results revealed that maximum mean grain yield kg ha^{-1} (4123.5 and 4227.7) for nitrogen concentration were recorded at 0.5 and 1.0% foliar nitrogen and minimum grain yield kg ha^{-1} (3405.5) was obtained at non treated control plots. The mean maximum grain yield (4135.7) value for growth stages was obtained at tillering stage; however the lower (3702.1) grain yield kg ha^{-1} was recorded at antheis stage of wheat crop. The interaction results showed that the highest grain yield kg ha^{-1}(4343.0 and 4437.3) values were recorded at 0.5 and 1.0% foliar nitrogen concentration x tillering stage, whereas the lowest (3184.3) grain yield kg ha^{-1} was obtained at interaction of non treated control plots x anthesis stage of wheat crop. Grain yield significantly increase with the application of foliar nitrogen concentrations at different growth stages of wheat crop similarly the researcher Rajendran, 1991 who stated that the foliar spray of 3 per cent DAP at different stages of crop significantly increased the number of pods plant^{-1}, 100 grain weight and ultimately grain yield in black gram and green gram and another researcher also confirmed that the Pujari *et al.* (1998) studied the foliar application of urea reported significant increase in seed yield of pigeon pea. The growth stages also significantly influenced by different foliar application concentration. Similar results also confirmed by Ganapathy *et al.* also apply foliar fertilizer on green gram at different growth stages.

4. Conclusion

It is concluded from the results that the application of urea foliar nitrogen concentrations 1.0% found superior for wheat yield and yield components traits among control non foliar treated plot and 0.5% foliar concentration, tillering stage proved best and the better interaction of 0.5 and 1.0% foliar nitrogen concentrations x tillering stage.

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