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RESPONSE OF WHEAT PLANTS TO FOLLIAR APPLICATION OF UREA AT DIFFERENT GROWTH STAGES

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Abstract

From a pilot experiment at Shandwil Agricultural Research Station, the concentration of urea at 6% as foliar application was found the most favourable for wheat plants since it gave the highest yield of grain and straw without having foliar chlorosis or necrosis.

To investigate the effect of foliar application of urea (6%) at different growth stages of wheat in comparing with soil application (75kg N/fed), two field trials were carried out at the same location in 1989/90 and 1990/91 growing seasons. It was observed that grain and straw yields of plants received 25 kg N/fed., as soil application followed by three sprays at crown, tillering and booting stages were increased over the soil application (75 kg N/fed). N-, P- and K-uptake by wheat plants as well as grain protein content of the plants received three sprays were nearly the same as those received 75 kg N/fed. as soil appliation .

It can be concluded that addition of 25 kgfed. before sawing followed by 3 sprays of urea (6%) could save 25 kg N /fed.

INTRODUCTION

The Government pays a great attention to increase the production of field crops as a way to increase the national income and to narrow the gap between what is produced and what is needed Increasing the field crops by new scientific concepts is considered a must at the present time . It is known that wheat responds to nitrogen much more than any single nutrient element . Availability of nitrogen for wheat

plants during various stages of its growth is an important factor influencing the yield and quality of grain. Foliar application of N has attracted considerable attention in recent years. In a comprehensive review, Reeves (1954) reported that an increase in 1000 -kernel weight and gluten content occurred due to N spray. Increases in protein yield / acre due to N sprays ranged from 24 to 60 % and P content in wheat grains was increased on account of spraying urea (Sadaphal and Das 1966). One spray of urea at flowering stage increased wheat protein content by 4.4% and much greater increases in protein content were obtained when more than one spray was made. Although both foliar and soil applications of urea significantly increased straw and grain yield , protein content of grains , as well as NP content of straw and grains, yet the effect of soil application was better than that of the foliar application at heading stage when the concentration ranged from 2.5 to 10% (Abd El-Reheem *et al.*, 1988).

The aim of this investigation is to study the response of wheat plants to foliar application of urea at different stages of growth.

MATERIALS AND METHODS

Three field experiments were conducted at Shandawil Agricultural Research Station, Upper Egypt, during 1988/89, 1989/90 and 1990/91 seasons. The first was a pilot experiment to obtain the optimum concentration of urea applied as foliar application on wheat plants variety Creen. Plants received two sprays of urea solution at the concentration of 2,4,6 and 8% after 45 and 75 days from sowing in comparison with 75 kg N/fed. as soil application in three equal portions, applied before sowing , before the first irrigation and before the second irrigation.

The other two experiments were carried out to study the effect of spraying urea at the concentration of 6% (the optimum concentration obtained from the first trial) on yield , grain protein content and NPK uptake by the plants. the urea fertilizer treamtnes were applied as follows:

No.	Treatment
1	Soil application of urea (46.5%) at the rate of 75 kg N /feddan.
2	One spray of urea (6%) at crown stage (5.5 kg N / fed.).
3	One spray of urea (6%) at tillering stage (8.3 kg N/fed).

4 One spray of urea (6%) at booting stage (11.0 kg N/fed.).
5 Two sprays of urea (6%) at crown and tillering stages (13.8 kg N/fed.).
6 Two sprays of urea (6%) at crown and booting stages (16.5 kg N/fed.).
7 Two sprays of urea (6%) at tillering and booting stages (19.3 kg N/fed.).
8 Three sprays of urea (6%) at crown, tillering and bottong stages (24.8 kg N/fed.)

The sprayed voulumes were 200,300 and 500 L/fed. at crown , tillering and boating stages, respectively. The sprayed plots received 25 kg N/fed. as soil application before sowing .

Basic applcation of 15 kg P_2O_5 and 24 kg k_2O / fed.were applied before sowing to each plot of the experiments. Treatments wre arranged in a complete randomized block design with four replications with plot size of 10.5m^2. Chemical properties of the experimental soil were performed and indicated in Table 1.

Table 1. Chemical analyses of the experimental sites.

Analysis	1988 / 89	1989/90	1990/91
Available N (ppm) (1% K-sulphate ext.).	9.300	56.10	28.90
Available P (ppm) (Olsen et al)	5.00	12.10	18.00
Available K (ppm) Amm. acetate ext.).	273.000	359.00	554.00
Ec mmohs/ cm/25°C (1:5)	0.900	1.011	0.85
pH (1:2.5)	7.700	7.40	7.70
Soil texture:	Loam in top soil and sandy Loam to loam in sub soil		

Straw and grain yields were recorded at maturity . N, P and K contents of straw and grains were determined as described by Jackson (1968) . Total N of grains was multiplied by 6.25 to obtain protein content. Data were statistically analyzed according to Snedecor and Cochran (1966).

RESULTS AND DISCUSSION

I. The pilot experiment

This experiment was conducted to obtain the optimum concentration of urea used as a foliar spray on wheat plants. It was found that grain and straw yields were increased by increasing urea concentration (2-8%) , but foliar chlorosis followed by necrosis was observed due to th foliar spray of urea at the concentration of 8% . So foliar application of 6% urea was applied for the other experiments, However , the best treatment was that of the soil receiving treatment (75 kg N/ fed.) as shown in Table 2.

Table 2. Effect of urea treatments on grain and strqw yield of wheat during 1988/ 1989 season

Analysis	Control	Soil application (75 kg N/ fed.)	Foliar application				LSD at 5%
			2%	4%	6%	8%	
Grain yield (Ardab/fed.)	2.22	9.59	3.65	3.40	5.56	5.68	0.67
Straw yield (ton /fed.)	0.90	4.45	1.35	1.90	1.95	2.40	0.73

2 . Grain and straw yeilds

It was observed (Tables 3 and 4) that spraying wheat plants with urea 6% at the three stages (crown, tillering and booting)gave the highest yield of grain and straw compared with other treatments . The increase was significant in the first season compared with soil application. It was also noticed that spraying urea at early stage (crown stage) of wheat growth is more effective on wheat growth and yield than at the latter stages. On the other hand, spraying wheat plants at tillering or booting stage reduced both grain and straw yields. This might be due to the low level of nitrogen added to wheat plants. Similar results were also reported by Abd El-

Reheem *et al.* (1988).

3. Grain protein content.

Data in Tables 2 and 3 , revealed that plants received three sprays of urea (6%) at different growth stages gave nearly the same grain protein content as that of soil application, while foliar application of urea as one or two sprays recorded less grain protein content . Abd El-Reheem *et al.* (1988) showed that the highest protein yield was recorded with soil application of urea which is superior to the foliar application.

4 . Nitrogen

The obtained results in Tables 2 and 3 show that wheat plants having three sprays of urea solution (6%) at different gorwth stages recorded similar result of nitrogen percentage and nitrogen uptake as those of soil application. Meanwhile, one or two sprays coused less nitrogen uptake by wheat plants than soil application, such a result may be attributed to the low dose of added nitrogen. In this respect, soil application of urea recorded higher N- uptake than foliar application (Abd El-Reheem *et al.* 1988).

5 . Phosphorus

Phosphorus content of wheat plants and P- uptake were decreased by foliar application of urea at low level of N application compared with soil application during the first season, while three sprays gave less decrease in both characters, In the second season, although P content of wheat plants was not significantly affected by foliar application of urea. P- uptake was increased by 17.8 % due to three sprays of urea solution (6%) over soil treatment.

6 . Potassium

As shown in the same Tables , potassium content of wheat grains was not significantly affected by foliar application of urea, but straw content of K wa generally decreased by foliar spray of urea and three sprays gave the less decrease , in both seasons.

Finally, it could be concluded that addition of 25 kg N/fed. before sowing followed by foliar application of urea (6%) at crown, tillering and booting stages can be used for wheat plants and thus about 25 kg N could be saved.

Table 3. Effect of foliar application of urea at different growth stages of wheat on yield , NPK upake and grain protein (1989/1990 season)

Treat-ment No.	N applied kg/ .fed.	Yield / fed		Grain protein (%)	N%		N uptake (kg/ fed)	P%		P uptake (kg/ fed)	K%		K uptake (kg/ fed)
		Gain (ardab)	Straw (ton)		Gain	Straw		Gain	Straw		Gain	Straw	
					Soil application								
1	75.0	16.20	4.90	10.54	1.69	0.46	63.61	0.42	0.10	15.11	0.41	1.58	87.38
					Foliar application								
2	30.5	16.03	4.73	8.75	1.40	0.35	50.22	0.43	0.08	14.12	0.47	1.24	69.95
3	33.3	15.87	4.33	8.36	1.34	0.33	46.19	0.41	0.06	12.36	0.40	1.24	63.21
4	36.0	15.80	4.57	8.36	1.34	0.41	50.50	0.42	0.05	12.24	0.41	1.45	75.98
5	38.8	16.97	4.83	10.06	1.61	0.40	60.30	0.39	0.06	12.82	0.39	1.38	76.58
6	41.5	17.13	4.93	10.86	1.74	0.35	61.96	0.36	0.07	12.70	0.38	1.24	70.90
7	44.3	16.10	4.37	9.44	1.51	0.31	50.01	0.36	0.06	11.32	0.40	1.47	73.90
8	49.8	17.33	5.67	11.19	1.79	0.33	65.24	0.41	0.07	14.63	0.42	1.50	95.97
LSD 5%		0.69	0.48	0.79	0.38	0.10	--	0.04	0.01	--	NS	0.07	--

Table 4. Effect of foliar application of urea at different growth stages of wheat on yield , NPK upake and grain protein (1990/1991 season)

Treatment No.	N applied kg/ .fed.	Yield / fed		Grain protein (%)	N%		N uptake (kg/ fed)	P%		P uptake (kg/ fed)	K%		K uptake (kg/ fed)
		Gain (ardab)	Straw (ton)		Gain	Straw		Gain	Straw		Gain	Straw	
					Soil application								
1	75.0	19.40	4.78	9.69	1.55	0.23	56.10	0.33	0.05	11.99	0.44	2.26	120.83
					Foliar application								
2	30.5	18.03	4.13	8.54	1.37	0.24	46.96	0.36	0.05	11.80	0.42	1.86	88.18
3	33.3	17.43	3.83	7.92	1.27	0.24	42.74	0.38	0.05	11.85	0.45	1.88	83.77
4	36.0	16.63	3.75	7.81	1.25	0.21	39.06	0.40	0.06	12.23	0.44	1.85	76.60
5	38.8	19.69	4.40	8.65	1.38	0.20	49.56	0.38	0.05	13.42	0.42	2.07	103.48
6	41.5	19.80	4.45	8.44	1.35	0.23	50.33	0.34	0.06	12.77	0.41	1.85	94.50
7	44.3	18.50	4.33	8.75	1.40	0.20	47.51	0.35	0.06	12.31	0.42	1.78	88.73
8	49.8	20.10	4.68	9.60	1.45	0.27	56.35	0.36	0.07	14.31	0.43	2.03	107.97
LSD 5%		1.10	0.94	0.99	0.16	0.03	--	NS	NS	--	NS	0.30	--

REFERENCES

1 . Abd El-Reheem, M.A., Y.H. Mohamed, Yehia Nour El-Din, and M. Abd El-Naim. 1988. Effect of foliar and soil applications of urea on chemical composition of wheat plants. Agric. Res. Rev. 66 (4) : 701 - 708.

2 . Finney , K.F., J.W. Meyer, F. W. Simth and R.C. Fryer. 1957. Effect of foliar spraying of pawnel wheat with urea solutions on yield, protein, and protein quality. Agron. J. 39 : 341 - 347.

3 . Jackson, M. L. 1968. Soil Chemical analysis . Prentice Hall., Inc. Engle Wood Cliffs. New Jersey.

4 . Jaranov, S.N., M.M. Romonenkova, and T.V. San'Ko. 1967. Effect of levels of mineral nutrition on yield and nitrogen uptake by barley plants. Vestsi Adadmeii Navuk, USSR Sel' Skagaspadara Ckykh Navuk No. 2,pp. 38 - 42.

5 . Revees, J.T. 1954. Some effect of spraying wheat with urea. J. Aust . Int. Sci., 20:41 - 45.

6 . Sadaphal, M.N. and N.B. Das. 1966. Effect of spraying urea on winter wheat (Triticum aestivum). Agron. J., 59: 137 - 141

7 . Snedecor, G.W. and W.G. Cochran. 1966. Statistical methods, 6th ed. Iowa State Univ. Press., Ames.

إستجابة نباتات القمح للرش باليوريا عند مراحل النمو المختلفة

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اقيمت تجربة حقلية استكشافية في موسم ١٩٨٨/١٩٨٩ لدراسة تأثير الرش باليوريا بتركيزات مختلفه (٢-٨٪) علي محصول القمح وإختيار التركيز الأمثل ثم دراسة تأثير الرش بهذا التركيز عتد مراحل النمو المختلفة لنباتات القمح في تجربتين حقليتين خلال موسمي ١٩٨٩/١٩٩٠ ، ١٩٩٠/١٩٩١ مع اضافة ٢٥ كجم آزوت للفدان قبل الزراعة ومقارنه ذلك بالاضافة الارضية (٧٥ كجم آزوت /ف).

وقد وجد من التجربة الاستكشافية ان الرش بمحلول اليوريا بتركيز ٦٪ هو افضل التركيزات حيث أعطي زيادة معنوية في محصول القش والحبوب عن معاملة الكنترول ولم تحدث حروق لأوراق النبات الا ان الاضافة الارضية كانت أفضل من اضافة اليوريا رشا.

كما وجد أن الرش بحلول اليوريا ٦٪ ثلاث مرات عند مراحل النمو المختلفة للقمح (التفريع – الاستطالة – الحمل) قد أعطي زيادة في محصول القش والحبوب عن المعاملة الأرضية. وجد أيضا أن محتوى القش والحبوب من الآزوت والفوسفور والبوتاسيوم بالاضافة الي نسبه البروتين بالحبوب للنباتات التي اخذت ثلاث رشات بمحلول اليوريا (٦٪) عند مراحل النمو المختلفه كان يماثل تقريبا تلك النباتات التي عوملت أرضيا.

ويمكن الخلاصه الي أن اضافه ٢٥ كجم نيتروجين للتربه قبل الزراعه مع رش القمح ٣ مرات بمحلول اليوريا (٣٪) يمكن أن يوفر ٢٥ كجم نيتروجين .