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METHANOL AND GLYCINE EFFECTS ON WHEAT PRODUCTION AND NUTRIENTS UPTAKE UNDER EGYPTIAN CONDITIONS .

EL-Agrodi, M. W. M ; G. Labeeb and A . S . Abd El-Hameed
Soils Dept .Fac. Of Agri .Mansoura Univ .

ABSTRACT

A pot experiment was conducted at soils department , faculty of agriculture farm, Mansoura university, during 2004/2005 growing season to fined out the effect of methanol application on wheat plant under Egyptian conditions. The foliar spray of methanol concentration (0 ,5 ,10 ,15 , 20 , 25 and 30 % v/v)with or without glycine (0.0 and 0.2 % w/v)were started at 30 days old of plants and weakly repeated for four times.

The obtained results can be summarized in:

Methanol concentration significantly affected plant dry weight at elongation stage ,where the highest mean (3.034 g/plant) was assigned with 30% v/v compared with 0.0% methanol treatment mean(24.11 % increase).

Flag leaf area was affected by methanol –glycine interaction . The highest mean (23.42 cm^2) was obtained at the treatment of 30% v/v of methanol with 0.2 w/v of glycine .

5 ,10 ,15 , 20 ,25 ,and 30 % v/v methanol application as spray led to increase grain yield of wheat by 8.6 ,13.4 ,16.0 ,17.9 , 14.3 , and 25.7 % ,respectively, compared with control(0.0% methanol).

The treatment of 5% methanol increased straw yield (5.87 % increase) , where the other methanol concentration treatments ,10 ,15 ,20 ,25 , and 30 % decreased straw yield by 1.97 ,1.181 ,2.11 ,1.131 , and 3.97 %, respectively .

30% methanol led to increase the harvest index by 17.71 % compared with 0.0 methanol treatment .

Glycine addition under any methanol concentration except for 0.0 increased the harvest index .The highest value (44.3%) was noticed with the treatment of 20 % v/v methanol + 0.2 % m/v glycine .

Methanol application with concentration of 5 , 10 ,15 ,20 , 25 , and 30 % v/v increased grains nitrogen uptake by 14.3 ,19.2 , 25.9 ,13.5 , 24.3 , and 34.5 % compared with control (0.0 % v/v methanol treatment) .

Methanol application led to increase nitrogen uptake by grains with a higher rate compared with its effects on nitrogen uptake by straw ,so glycine addition increased grains nitrogen portion from 57.8 % to 67.2 % .

Methanol application led to increase nitrogen uptake by grains with a higher rate compared with its effects on nitrogen uptake by straw ,so glycine addition increased grains nitrogen portion from 57.8 % to 67.2 % .

Glycine decreased nitrogen uptake by straw by 14.27 % compared with untreated treatment .

Up to 20 % v/v of methanol , glycine addition increased phosphorus uptake by grains, where above that level (20 %methanol) glycine addition decreased phosphorus uptake by grains and the sharp decrease was noticed at 30 % methanol treatment (29.55%decrease) .

The whole mean of phosphorus uptake by grains in relation to that uptake by straw is 3.19 fold . all used concentration of methanol increased phosphorus uptake by grains on the account of phosphorus uptake by straw except 30 % methanol . So ,glycine enhance phosphorus translocation from straw to grains.

Potassium uptake by grains was significantly increased with methanol additions , where the highest increase were found with 20 and 30% methanol treatments (12.8 and 14.2 % increase ,respectively). Glycine addition led to higher increase in potassium uptake by grains ,40.7 % increase .

INTRODUCTION

Recent studies suggested methanol as a plant growth enhancer and the published results showed dramatic increases in growth parameter and yield component of C3 plant such as wheat, water melon, barley, cabbage, tomato , cotton ,strawberry and eggplant. on the other hand some studied stated that methanol application failed to stimulate C3 and C4 plants growth such as corn, sorghum and etc. Polien (1993) found that application of diluted methanol to roses ,cotton ,wheat and tomatoes increased growth and yield . It is thought that dilute solutions may help to reduce drought stress by stimulating photosynthetic activity. Barnes and Houghton (1994) stated that spraying Cotton plants with 20% methanol (20 gallons/acre) at first square, first bloom, and weekly after first bloom tended to increase plant height, boll number and fruiting sits but lint yield was adversely affected. Karczmarczyk *et al* (1995)outlined that sprayed winter rape seedling with 20% methanol was increased Biomass of leaves by about 90% compared with controls. Nitrate reductase and alkaline phosphatase activities were found to be increased by methanol, Idso *et al* (1995) stated that foliar applications of 40% aqueous methanol led to sunlit leaves of sour orange trees that had been grown continuously in clear-plastic-wall open-top enclosures maintained out-of-doors at Phoenix, Arizona. No unambiguous effects of the methanol applications were detected in net photosynthesis measurements made on foliage . Dami *et al.*(1996) outlined that the Sublethal methanol doses, based on visual observations, were 90% for leaves and 100% for trunks. They also outlined that methanol treatment had no significant effect on photosynthesis, transpiration and stomatal resistance activity was decreased and peroxidase activity was unchanged. In Field experiments and greenhouse at Finland, barley, oats, wheat, peas and rape were treated with different concentrations of methanol or ethanol at different growth stages Rajala *et al.*(1998) found that alcohols did not affect growth or yield of the above crop studied. Patil *et al.*(1999), in a field trial, found that kernel size, kernel protein and yield of groundnuts were significantly increased due to foliar spray of 5-30% methanol. They also found that three foliar sprays of 20% methanol, applied at 30, 45 and 65 days after sowing, gave the highest plant growth, yield and quality of groundnut.

The ever increasing pressure of population has challenged the Egyptian government to increase production per unit area especially from wheat to minimize the consumption production gap, which accounted by 45% .

This work aimed to asses the effects of both methanol concentration and its application time on wheat plant under Egyptian conditions.

MATERIALS AND METHODS

A pot experiment was conducted at soils department, faculty of agriculture, Mansoura university, during 2004/2005 growing season. The objectives of this study were to choice the proper methanol concentration for application to wheat plant under Egyptian conditions for maximizing the net return of wheat grains.

Plastic pots, 25 cm in diameter and 17 cm in height, were used. Clay loamy soil was collected from Mansoura university farm, air dried, roughly ground and mixed. 7.56 kg of air dried soil, corresponding to 7.00 kg oven dried soil was put in each pot.

Experimental soil was clay loam in texture, having pH value of 7.48 (soil paste), EC value of 2 dSm^{-1} (soil paste extract)and total carbonate as calcium carbonate amounted by 3.0%. The amount of available nutrient were 34.72 ,386.00, and 18.35 ppm of nitrogen, potassium, and phosphorus, respectively .

All pots were sown in 23/12/2004 with 20 grain. After 21 days from sowing, plants were thinned (8 plants per pot) then 2.0 g super phosphate (15.5% P2O5), 1.5g potassium sulphate (48% K2O) and 1.25 g urea (46% N) were added. Immediately, after fertilizer addition, soil water content for each pot was adjusted to be 100% of field capacity by weighing and water addition . At the end of tillering stage (45 days old) the second dose of urea –N was added to each pot (1.25g urea /pot).

Forty two pots were arranged in a strip plot in a complete randomize block design with three replicates to assess seven (0.0 ,5 ,10 ,15 ,20 ,25 , and 30%) levels of methanol concentration combined with two levels of glycine (0.0 and 0.2% w/v) which known as a meliorating agent to the corression effect of higher methanol concentration.

Foliar sprayed of methanol concentration with or without glycine were started with 30 days old of plants and weakly repeated for four times. In the first and second application 15 ml/pot of each concentration was sprayed with a small atomizer , where, 30 ml/pot was used in 3rd and 4 th application time.

Vegetative plant samples (2 plants) were taken at elongation stage (60 days old). Flag Leaf area was determined at heading stage (80 days old) as described by Palanis Wamy and Gomez (1974).

Harvesting was made manually, whenever plants are completely yellowish in colour ,(152 days old). Ten days latter of harvesting , the yield of each pot was weighed , grain separated and , weighed,straw yields was recorded and the harvest index {100 grain yield /(grain yield + straw yield)} was computed. 100 grains weight was also estimated .

Vegetative, grains, straw samples were oven dried (70 C°), ground, wet ashed, N, P, and K were determined in digestion product and the elemental concentrations were calculated based on oven dry matter (105 C°) as described by Cottenie *et al* (1982) .

The collected data were subjected to the statistical analysis, ,using the analysis of variance (ANOVA) and L.S.D to compare between means .

RESULTS AND DISCUSSION

Data of Table 1 illustrate the effect of methanol , glycine and their interaction on plant dry weight at elongation stage . Methanol concentration significantly affected plant dry weight at this stage, where the highest mean (3.034 g/plant) was assigned with 30% v/v compared to 0.0% methanol treatments mean. This treatment caused an increase amounted by 24.11 % in plant dry weight at this stage. These results are in agreement with that of Abdel Al (1998) who stated that methanol application (10 ,20 , and 30 %) significantly increased dry weight of cotton growth parts.

Table 1 : Methanol, Glycine and their interaction effects on wheat vegetative parameters and spikelets number/ spike .

M concentration / G. treatment	0%	5%	10%	15%	20%	25%	30%	mean	LSD at 5%
Elongation sample dry weight (g/ plant)									
-G	2.623	3.308	2.922	3.032	2.988	2.980	2.873	**2.960**	0.07 **
+G	2.268	2.145	2.595	2.745	2.460	2.718	3.195	**2.589**	
mean	**2.446**	**2.727**	**2.759**	**2.888**	**2.724**	**2.849**	**3.034**		
LSD at 5% 0.1391 **									
M *G LSD at 5% 0.1968 **									
Flag leaf area (cm^2)									
-G	18.97	21.88	19.99	20.46	19.73	18.20	19.06	**19.75**	NS
+G	17.81	18.76	18.88	18.34	19.62	18.14	23.42	**19.28**	
mean	**18.39**	**20.32**	**19.43**	**19.40**	**19.68**	**18.17**	**21.24**		
LSD at 5% NS									
M *G LSD at 5% 3.020 *									
Plant height (cm)									
-G	75.0	76.3	75.3	75.3	77.3	76.3	74.0	**75.6**	NS
+G	73.0	75.0	77.3	76.0	77.6	78.6	73.0	**75.8**	
mean	**74.0**	**75.6**	**76.3**	**75.6**	**77.5**	**77.5**	**73.5**		
LSD at 5% 2.393 *									
M *G interaction NS									
Spiklets number/ spike									
-G	38.64	39.08	38.79	39.66	40.10	38.29	38.88	**39.06**	NS
+G	39.16	39.16	39.83	38.80	39.70	39.70	38.73	**39.30**	
mean	**38.90**	**39.12**	**39.30**	**39.23**	**39.90**	**38.99**	**38.80**		
NS									
M *G interaction NS									

- G : without glycine **+ G : with glycine** **M: Methanol**

As it is shown in Table 1 glycine addition seemed to reduce plant dry weight (12.5% decrease). These results are in contradictory with that of (Nonomura and Benson.(1992b). They stated that glycine increased the rate of methanol metabolism , then increased plant dry matter production .

Methanol-glycine treatment means show that glycine addition reduced the positive effect of methanol at the lowest concentrations used (from 0.0 to 25 % v/v), otherwise at the highest one (30%) it caused 11.21% increase in this trait

Data of Table1 show flag leaf area as affected by methanol concentration, glycine addition and their interaction, where a significant effect was only detected due to methanol–glycine interaction. The highest mean (23.42 cm^2) was obtained with the treatment of 30% v/v of methanol + 0.2 w/v of glycine. The lowest value was recorded from 0.0% methanol + 0.2 %w/v glycine treatment . These results are in agreement with that of Faver *et al.* (1996). They outlined that applying aqueous solutions of methanol (10, 20 and 30% v/v) to adequately watered and fertilized cotton plant did not increase leaf area.

Data of Table 1 reveal that methanol concentration significantly affected plant height at heading stage. Methanol concentration of 20 and 25 % v/v recorded the highest and the same mean value of plant height (77.5 cm). These results are in agreement with that of Madhaiyan *et al* (2006). They stated that 30% methanol significantly increased cotton plant height . Glycine under the studied conditions did not prove any significant effect on plant height of wheat at heading stage .

Methanol-glycine interaction didn't exhibit any significant effect on plant height at heading stage.

Data of Table 1 illustrate methanol concentration ,glycine and methanol–glycine interaction on number of spiklets per spike, where, insignificant effect was found due to studied factors application .

Data of Table 2 show the effect of studied factors levels and their interaction on yield of grains and straw as well as the harvest index values . Data of the Table and Fig 1 reveal that methanol concentration significantly affected wheat grains yield, where 5, 10, 15, 20, 25 and 30 % v/v methanol treatments increased grains yield of wheat by 8.6, 13.4, 16.0, 17.9, 14.3 and 25.7%, respectively. Nonomura and Benson.(1992a) outlined that foliar sprays of aqueous (10-50%) methanol resulted in C3 yield increase up to 100% when maintained under direct sunlight in desert agriculture.

Highly positive effect (23.27 % increase) was found due to glycine application on grain yield, where the mean of treatments which not included glycine was 18.74 g/pot and the mean of treatments included glycine was 23.38 g/pot. Methanol–glycine interaction proved a highly significant effect on grain yield, where 15 % methanol + 0.2 % w/v glycine maximized grain yield to a higher degree (25.83 g/pot) followed by 20% methanol + 0.2 % w/v glycine treatment (24.69 g/pot). These results are in agreement with that of Zbiec *et al* (2003), who studied the effect of methanol solution (10, 20, 30 and 40% with florovit 0.4% and glycine 0.2%) and supplemental irrigation on the performance of tomato, bean, sugar beet and winter rape. They found that the studied plants which treated with 30% methanol solution yielded 12-30% higher than control.

Straw yield was significantly affected by methanol, glycine and methanol –glycine interaction as it is found in Table 2 and Fig 2. Data also reveal that 5% methanol treatment increased straw yield by 5.87 %, where the other methanol concentration treatments, 10, 15, 20, 25 and 30 % decreased straw yield by 1.97 ,1.181 ,2.11 ,1.131 and 3.97 %, respectively . These results confirmed that of Salunkhe, *et al* (1998) . They found that foliar application of methanol (up to 30%) increased wheat straw yield, where the highest value was obtained with 20% methanol at 21 and 61 days after sowing . Glycine addition slightly increased straw yield (1.3% increase) .

Table 2 : Methanol, Glycine and their interaction effects on yield parameter of wheat plant .

M treatment / G treatment	0%	5%	10%	15%	20%	25%	30%	mean	LSD at 5%
				grain yield dry weight (g /pot)					
-G	18.30	18.11	17.44	17.16	18.98	18.23	22.96	18.74	0.046 **
+G	18.74	22.13	24.58	25.83	24.69	24.11	23.60	23.38	
Mean	18.52	20.12	21.01	21.49	21.83	21.17	23.28		
			LSD at 5%		0.0911 **				
			M *G LSD at 5%		0.1288 **				
				straw yield dry weight (g /pot)					
-G	36.91	39.52	35.83	36.13	37.3	37.86	35.55	37.01	0.229 *
+G	38.06	39.86	37.76	37.5	36.10	36.14	36.45	37.48	
Mean	37.49	39.69	36.75	36.81	36.70	37.00	36.00		
			LSD at 5%		0.4405 **				
			M *G LSD at 5%		0.6230 **				
				Harvest index					
-G	33.1	31.4	35.7	32.2	33.7	32.5	39.2	33.9	1.800 * *
+G	33.0	35.7	39.4	40.7	44.3	40	39.3	38.9	
mean	33.0	33.6	37.6	36.4	39.0	36.2	39.2		
			LSD at 5%		3.001 * *				
			M *G LSD at 5%		4.300 * *				
				100grains weight (g)					
-G	3.803	4.426	4.300	4.543	4.173	4.303	3.890	4.205	NS
+G	3.826	3.983	3.883	4.233	4.053	3.836	4.013	3.975	
Mean	3.815	4.205	4.091	4.388	4.113	4.070	3.951		
			LSD at 5%		0.3547 *				
			M *G LSD at 5%		0.5016 *				

- G : without glycine   + G : with glycine   M: Methanol

The treatment of 5% methanol + 0.2 % w/v glycine yielded the highest value of straw yield (39.86 g/pot).

The harvest index as affected by methanol, glycine and their interaction are shown in able 2 and fig 3. Data reveal that 0.0 % methanol treatment recorded the lowest value (33.1%) compared with the other methanol treatment means. 30% methanol led to increase the harvest index by 18.78 % compared with 0.0 methanol treatment. These results are in agreement with that of Dwivedi *et al.*(2001). In a field experiment to asses various methanol concentrations (0, 1, 2, 5, 10, 15, 20, 25, and 30%) sprayed at branch initiation (30 days after sowing) of soybean, they stated that methanol improved the partitioning efficiency towards economic sink by registering high harvest index.

Glycine addition under any methanol concentration except for 0.0 increased harvest index value. The mean of glycine treatments amounted by 1.148 fold of that obtained with treatments without glycine .

As it is found in Table 2 and Fig 3 methanol–glycine interaction significantly affected the harvest index, where the highest value (44.3%) was noticed with the treatment of 20 % v/v methanol + 0.2 % w/v glycine and the lowest value was (33%) obtained with the treatment of 0.0 % methanol + 0.2 % w/v glycine .

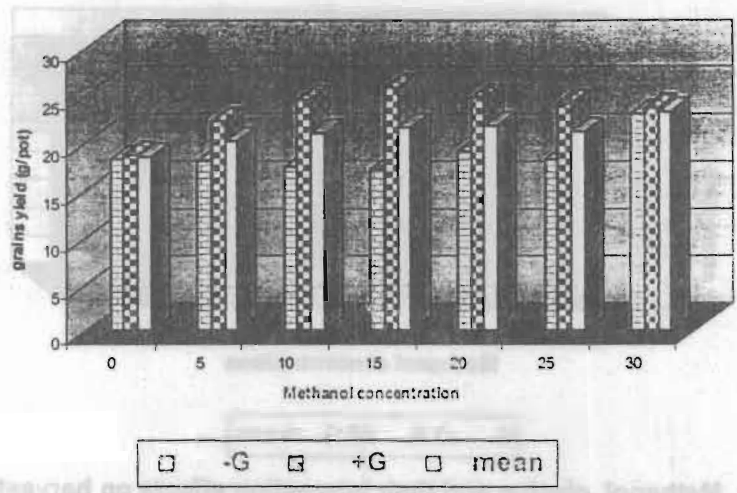

Fig (1) : - Methanol, glycine and their interaction effects on grain yield

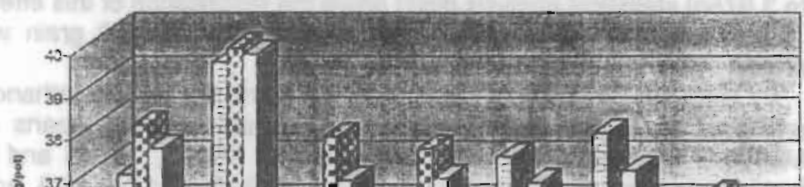

Fig (2) : - Methanol ,glycine and their interaction effects on straw yield

Data of Table 2 show methanol, glycine and methanol–glycine interaction effects on 100 grain weight. Methanol concentration significantly affected 100 grain weight, but no constant trend was found. The lowest mean (3.815g) was recorded with 0.0 % methanol treatment and the highest mean (4.388g) was obtained with 15 % v/v of methanol. These results are in contradictory trend with that obtained by Ekiz *et al.* (1996). They found that methanol solutions (20% v/v) at the early shooting, late shooting and heading stages, and at combinations of these stages did not significantly influence the 100 grains weigh , suggesting that methanol does not have the potential to increase yield in wheat under central Anatolia conditions in Turkey

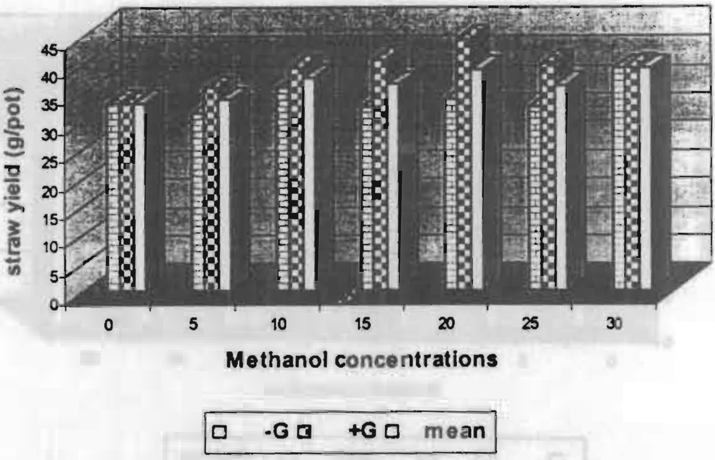

Fig 3 : Methanol ,glycine and their interaction effects on harvest index

In spite of decreasing 100 grain weight with glycine addition (from 4.205 to 3.975g) statistical analysis didn't prove the significance of this effects .

Methanol–glycine interaction significantly affected 100 grain weight, as shown in Table 2.

Data of Table 3 illustrate the significant effects of methanol, glycine and their interaction on nitrogen uptake by different plant parts of wheat. Methanol application with concentration of 5, 10, 15, 20, 25 and 30 % v/v increased grains nitrogen uptake by 14.3, 19.2, 25.9, 13.5, 24.3, and 34.5 % compared with control (0.0 % v/v methanol treatment) .

Glycine application across methanol concentration treatments increased the grains nitrogen uptake from 487.1 mg/pot to 630.7 mg/pot (29.44% increase) .

The lowest nitrogen uptake by grains (461.3 mg/pot) was assigned with the treatment of 0.0 methanol + 0.0 glycine and the highest one was assigned with the treatment of 15 % v/v methanol + 0.2 w/v glycine .

Methanol concentration significantly affected nitrogen uptake by straw, where 9.6, 12.7, 11.0, 17.8, 17.5 and 11.5 % increase were found due to 5, 10, 15, 20, 25 and 30% v/v methanol application compared with control treatment (0.0 %methanol). As it is found in that Table glycine addition decreased nitrogen uptake by straw by 14.27 % compared with untreated treatments. The previous discussion outlined that methanol application led to increase nitrogen uptake by grains with a higher rate compared with its effects on nitrogen uptake by straw, so glycine increased nitrogen uptake by grains on the account of nitrogen uptake by straw. Methanol–glycine interaction significantly affected nitrogen uptake by straw, where the lowest and the highest values were obtained with the treatments of 0.0% methanol + 0.0% glycine and 20 % methanol + 0.0 % glycine, respectively .

Methanol, glycine and methanol–glycine interaction effects on total nitrogen uptake comes as a result of these factors effects on nitrogen uptake by grains and straw. In general, methanol application increased total nitrogen uptake,i.e. 30 % methanol increased total nitrogen uptake from 760.5 mg /pot to 954.93 mg /pot (25.6% increase)as shown in Fig 4. These results confirmed that of Patil *et al.*(1999). They found that N uptake of groundnuts was significantly increased due to foliar spray of 5-30% methanol, whereas, glycine addition increased this trait by 9.5 % ,only. Total nitrogen uptake was significantly affected too by methanol-glycine interaction, where 15% v/v methanol + 0.2 % w/v glycine recorded the highest value (1040.4 mg /pot) .

Table 3 : Methanol , glycine and their interaction effects on nitrogen uptake by wheat plants .

M treatment / G treatment	0%	5%	10%	15%	20%	25%	30%	mean	LSD at 5%
	nitrogen uptake by grains (mg /pot)								
-G	461.3	472.1	440.3	450.6	474.1	505.3	606.3	487.1	3.336 * *
+G	468.6	591.3	667.9	720.2	670.2	650.3	644.6	630.5	
mean	465.0	531.7	554.1	585.4	572.15	577.8	625.4		
	LSD at 5% 7.8836 * *								
	M *G LSD at 5% 11.1491 * *								
	nitrogen uptake by straw (mg /pot)								
-G	281.9	385.1	350.3	335.7	395.4	371.9	361.4	354.5	3.005 **
+G	306.9	262.7	315.4	320.2	300.8	322.0	297.5	303.9	
mean	295.41	323.9	332.8	327.9	348.1	347	329.4		
	LSD at 5% 4.4119 * *								
	M *G LSD at 5% 6.2393 * *								
	Total nitrogen uptake (mg /pot)								
-G	743.26	857.33	790.66	786.46	869.56	877.23	967.7	841.74	5.154 * *
+G	777.73	854.06	983.4	1040.4	971.0	972.43	942.16	934.45	
mean	760.50	855.7	887.03	913.43	920.2	924.83	954.93		
	LSD at 5% 9.7704 * *								
	M *G LSD at 5% 13.817 * *								
	Grains nitrogen uptake x100 / total nitrogen uptake								
-G	62.0	55.0	55.6	57.3	54.5	57.6	62.6	57.8	0.340 * *
+G	60.2	69.2	67.9	69.2	69.0	66.8	68.4	67.2	
mean	61.1	62.1	61.8	63.2	61.8	62.2	65.5		
	LSD at 5% 4.20 * *								
	M *G LSD at 5% 0.60 * *								

- G : without glycine + G : with glycine M: Methanol

As shown from Table 4, phosphorus uptake by grains was significantly affected by methanol treatment, where, phosphorus uptake by grains was increased from 96.10 mg /pot to 111.76, 118.96 ,114.89 ,116.07, 127.66 and 135.45 mg / pot, whenever methanol concentration was increased from 0.0 to 5, 10, 15, 20, 25 and 30 %v/v, respectively. These results are in agreement with that of Ombase *et al.* (2003). They found that foliar application of methanol at different concentrations(10, 20 and 30%), at 30, 30+45, 45+60 and 30+45+60 days after sowing, increased phosphorus uptake by groundnut plant .

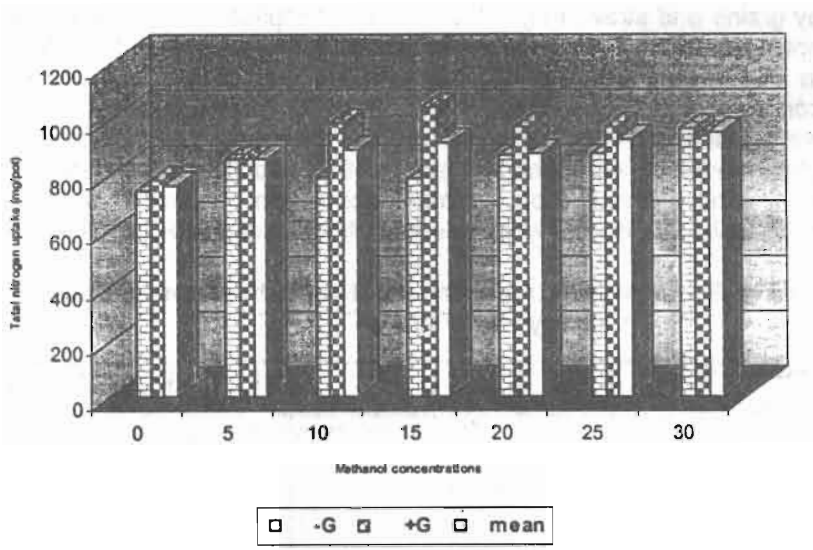

Fig (4) : - methanol, glycine and their interaction effects on total nitrogen uptake (mg/pot) .

No significant difference was found due to glycine application, where the mean of treatments which contained glycine was 116.28 mg/pot and the mean of treatments which didn't contain glycine was 118 .25 mg/pot .

Methanol–glycine interaction significantly affected phosphorus uptake by grains, where, the lowest value (91.54 mg/pot) was obtained with treatment of 0.0 %methanol +0.0 % glycine and the highest (158.93 mg/pot) one was noticed at the treatment of 30 % methanol + 0.0 % glycine. It is worthy to note that up to 20 % v/v of methanol, glycine addition increased phosphorus uptake by grains, where above that level (20 %methanol) glycine addition decreased phosphorus uptake by grains and the sharp decrease was noticed at 30 % methanol treatment (29.55% decrease).

Data of Table 4 reveal that the studied treatments significantly affected phosphorus uptake by straw, where, methanol concentration of 30 % v/v assigned the highest value of phosphorus uptake by straw 48.86 mg/pot.

Glycine addition at 0.2 % w/v decreased phosphorus uptake by straw from 41.76 to 30,67 mg /pot (26.6 % decrease) compared with 0.0 % glycine addition.

Methanol, glycine and their interaction effects on total phosphorus uptake are Tabulated in Table 4 which outlined the significant effect of each on this trait. Methanol treatments of 5, 10, 15, 20, 25 and 30 % v/v increased total phosphorus uptake by 10.6, 22.4, 18.98, 13.6, 29.4 and 42.8 %, respectively . On the other hand glycine addition tended to decease total phosphorus uptake by wheat plant from 160.03 mg /pot to 148.92 mg /pot (6.9 % decrease).

Methanol–glycine interaction affected total phosphorus uptake by wheat plant as it is shown in Fig 5, where, 30 %v/v of methanol + 0.0 % glycine recorded the highest mean (214.43 mg/pot) .

Table 4: Methanol, Glycine and their interaction effects on phosphorus uptake by wheat plant .

M treatment / G treatment	0%	5%	10%	15%	20%	25%	30%	mean	LSD at 5%
phosphorus uptake by grains (mg /pot)									
-G	91.54	114.16	108.49	110.50	112.44	131.70	158.93	118.25	NS
+G	100.67	109.36	129.44	119.22	119.70	123.60	111.96	116.28	
mean	96.10	111.76	118.96	114.89	116.07	127.66	135.45		
LSD at 5% 6.0803 * *									
M *G LSD at 5% 8.5989 * *									
phosphorus uptake by straw (mg /pot)									
-G	33.21	35.24	32.73	43.59	35.89	56.20	55.50	41.76	0.9186 * *
+G	32.71	26.83	31.51	33.78	25.20	22.43	42.23	30.67	
mean	32.96	31.04	32.12	38.69	30.55	39.31	48.86		
LSD at 5% 0.7606 * *									
M *G LSD at 5% 1.0757 * *									
Total phosphorus uptake (mg /pot)									
-G	124.75	149.40	141.22	154.15	148.33	187.93	214.43	160.03	2.9975 * *
+G	133.39	136.19	174.75	153.00	144.91	146.03	154.20	148.92	
mean	129.07	142.79	157.98	153.57	146.62	166.98	184.31		
LSD at 5% 6.2204 * *									
M *G LSD at 5% 8.79698 * *									
Grains phosphorus uptake x 100 / total phosphorus uptake									
-G	73.37	76.40	76.80	71.70	75.80	70.10	74.10	74.03	0.061 * *
+G	75.47	80.29	74.07	77.92	82.61	84.60	72.50	78.21	
mean	74.42	78.34	75.43	74.81	79.20	77.35	73.30		
LSD at 5% 0.0092 * *									
M *G LSD at 5% 0.0131 * *									

- G : without glycine   + G : with glycine   M: Methanol

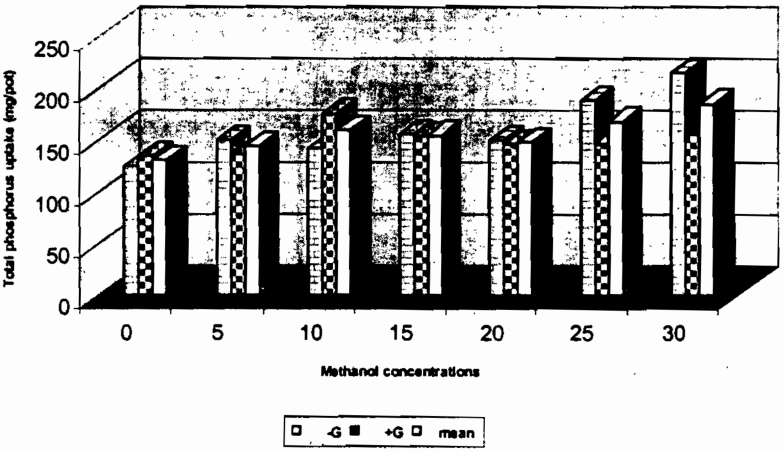

Fig (5) : - Methanol ,glycine and their interaction effects on total phosphorus uptake (mg/pot)

As it is found in Table 4 the whole mean of phosphorus uptake by grains in relation to that uptake by straw is 3.17 fold. All used methanol concentration increased phosphorus uptake by grains on the account of phosphorus uptake by straw except 30 % methanol . So, glycine enhanced phosphorus translocation from straw to grains, where total phosphorus uptake by grains was increased from 74.03 to 78.21 % of total phosphorus uptake .

The treatments of 20 % methanol + 0.2 % glycine and 25 % methanol + 0.2 % glycine recorded the highest means (82.61 and 84.60%, respectively) of grains phosphorus uptake in relation to the whole phosphorus uptake .

Data of Tabel 5 illustrate potassium distribution between wheat plant parts as affected by the studied treatments. Potassium uptake by grains was significantly increased with methanol additions, where the highest increase (12.8 and 14.2 %, respectively) were found with 20 and 30% methanol addition. Glycine addition led to higher increase (40.7 %) in potassium uptake by grains. Methanol–glycine interaction significantly affected potassium uptake by grains, where the highest value (182.25mg/pot) was obtained with 20 % methanol + 0.2 %w/v glycine .

Data of Table 5 show a significant effect of methanol, glycine and methanol–glycine interaction on potassium uptake by straw, in spite of the little differences which were found between methanol treatment means, glycine treatment means and methanol–glycine treatment means. As it is shown from the table glycine exhibited a good effect with the higher used methanol concentration only, where glycine addition increased potassium uptake of straw by 12.3% .

Methanol, glycine and methanol–glycine interaction effects on total potassium uptake(Fig 6), approximately similar to their effects on potassium uptake by straw, where potassium uptake by straw was amounted by 85.62 % of total potassium uptake. These results are in agreement with the results of Ombase *et al.* (2003), they outlined that foliar sprayed of methanol increased potassium uptake by groundnut .

Data of Table 5 reveal that methanol addition increased potassium in grains compared to potassium in straw. 20% and 30% methanol assigned the same and highest value (15.1 %) .

Glycine additions progressively increased the grains share of potassium, where this trait was increased from 12.6 to16.1 % (27.8 % increase) as a results of glycine additions .

The highest grains share of potassium (18 %) wasnoticed under the treatment of 20 % v/v of methanol + 0.2 w/v of glycine .

Table 5 : Methanol, Glycine and their interaction effects on potassium uptake of wheat plant .

M treatment / G treatment	0%	5%	10%	15%	20%	25%	30%	mean	LSD at 5%
	potassium uptake in grains (mg /pot)								
-G	153.5	138.2	134.0	134.9	145.8	143.5	169.9	145.7	2.9676 * *
+G	199.9	204.5	210.2	211.3	218.7	191.6	199.3	205.1	
mean	161.6	171.4	172.1	173.1	182.2	167.6	184.6		
LSD at 5% 6.3110 * *									
M *G LSD at 5% 8.9252 * *									
	potassium uptake in straw (mg /pot)								
-G	993.4	1099.9	960.6	1028.3	1044.7	1052.8	936.2	1016.5	10.607 * *
+G	1072.8	993.8	1088.3	1057.1	999.2	1070.2	1051.3	1047.5	
mean	1033.1	1046.9	1024.4	1042.7	1021.9	1061.5	993.7		
LSD at 5% 10.4009 * *									
M *G LSD at 5% 14.7092 * *									
	Total potassium uptake (mg /pot)								
-G	1146.9	1238.2	1094.6	1163.3	1190.5	1196.3	1106.1	1162.3	8.7274 * *
+G	1242.6	1198.4	1298.5	1268.4	1217.9	1261.8	1250.6	1248.3	
mean	1194.7	1218.3	1196.6	1215.9	1204.2	1229.1	1178.4		
LSD at 5% 11.5646 * *									
M *G LSD at 5% 16.3548 * *									
	grains potassium uptake x 100 / total potassium uptake								
-G	13.4	11.1	12.2	11.6	12.2	12.0	15.4	12.6	0.0027 * *
+G	13.6	17.1	16.1	16.6	17.9	15.2	0.159	16.1	
mean	135	141	142	141	15.1	13.6	15.1		
LSD at 5% 0.0048 * *									
M *G LSD at 5% 0.0068 * *									

- G : without glycine + G : with glycine M: Methanol

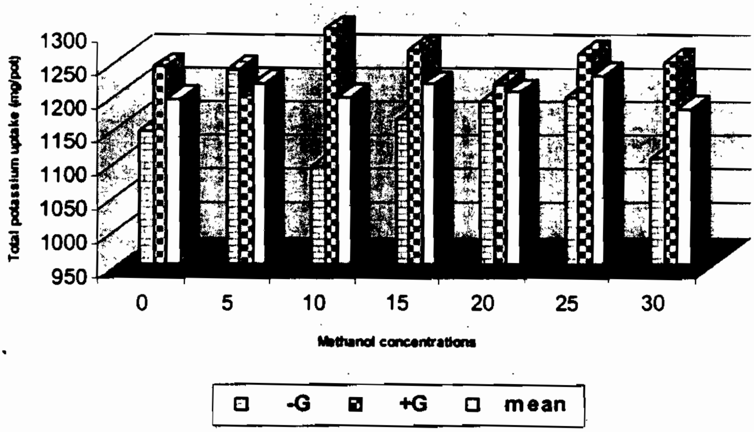

Fig 6 : Methanol, Glycine and their interaction effects on total potassium uptake (mg/pot).

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تأثير الميثانول والجليسين علي إنتاجية القمح و إمتصاصه للعناصر الغذائية تحت الظروف المصرية

محمد وجدي محمد العجرودي – جمعة لبيب أحمد – أحمد صلاح عبد الحميد
قسم الأراضي- كلية الزراعة – جامعة المنصورة

أقيمت تجربة أصص خلال موسم نمو 2004 – 2005 بالمزرعة البحثية لكلية الزراعة – جامعة المنصورة وتناولت الدراسة تأثير الرش بالميثانول (0، 5، 10، 15، 20، 25، 30 % ح/ح) و الجليسين (صفر ، 0.2 % و/ح) أربعة مرات أسبوعيا بدايتها بعد 30 يوم من الزراعة علي إنتاجية القمح وإمتصاصه للعناصر الغذائية تحت الظروف المصرية .

وقد أوضحت النتائج ما يلي:

- أثرت تركيزات الميثانول علي وزن النبات الجاف في مرحلة الاستطالة وحقق الرش بالميثانول بتركيز 30% أعلي قيمة (3.034 جم/ نبات) بزيادة تقدر بـ 24.11% مقارنة برش الميثانول بتركيز صفر%.
- تأثرت مساحة ورقة العلم معنويا بالتفاعل بين تركيز الميثانول والجليسين وحققت المعاملة التي تتضمن 30% ميثانول + 0.2% جليسين أعلي قيمة (23.42 سم2).
- زاد محصول الحبوب بما يعادل 8.6، 13.4، 16.0، 17.9، 14.3، 25.7% عند الرش بالميثانول بتركيز 5، 10، 15، 20، 25، 30 % علي التوالي.
- أدي استخدام الميثانول بتركيز 5% إلي زيادة في محصول القش تعادل 5.87% مقارنة بالكنترول بينما أدي استخدام باقي التركيزات (10، 15، 20، 25، 30 %) إلي نقص محصول القش بما يعادل 1.97، 1.18، 2.11، 1.13، 3.97% علي التوالي.
- رش الميثانول بتركيز 30% أدي إلي زيادة دليل الحصاد بما يعادل 17.71% مقارنة بالكنترول.
- إضافة الجليسين مع أي تركيز من تركيزات الميثانول المستخدمة عدا الصفر أدي إلي زيادة دليل الحصاد وأعلي قيمة له (44.3%) تم الحصول عليها عند إضافة الجليسين بتركيز 0.2 % إلي الميثانول بتركيز 20%.
- استخدام الميثانول بتركيزات 5 ، 10، 15، 20، 25، 30 % أدي إلي زيادة استخدام النيتروجين الممتص بواسطة الحبوب بمقدار 14.3، 19.2، 25.9، 13.5، 24.3، 34.5 علي التوالي مقارنة بالكنترول.
- استخدام الميثانول أدي إلي زيادة النيتروجين الممتص في الحبوب بمعدل أعلي منه القش وأدت إضافة الجليسين إلي زيادة نصيب الحبوب من النيتروجين الممتص من 57.8 إلي 67.2%.
- أدت إضافة الجليسين إلي نقص النيتروجين الممتص بواسطة القش بما يعادل 14.27% مقارنة بعدم إضافته.
- زيادة تركيز الميثانول المستخدم حتى 20% في وجود الجليسين أدت لزيادة الفوسفور الممتص بواسطة الحبوب وتركيزات الميثانول الأعلى من ذلك في وجود الجليسين تؤدي إلي نقصه ولقد لوحظ نقص حاد مع التركيز الأعلى من الميثانول 30%.
- المتوسط العام للفوسفور الممتص بالحبوب يعادل 3.19 ضعف الممتص في القش وكل التركيزات المستخدمة من الميثانول أدت إلي زيادة الممتص من الفوسفور في الحبوب علي حساب الممتص منه في القش عدا التركيز الأعلى منه (30%) وبالتالي فإن الجليسين يشجع انتقال الفوسفور من القش للحبوب.
- أدت إضافة الميثانول إلي زيادة معنوية في البوتاسيوم الممتص بواسطة الحبوب وأعلي زيادة لوحظت مع 20%، 30% بينما أدت إضافة الجليسين إلي زيادة فائقة تقدر بـ 40.7% في البوتاسيوم الممتص بالحبوب.