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Effect of Some Organic Compounds on Wheat Plant Production and Some Nutrient Uptake .

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ABSTRACT

Two field experiments were carried out during the winter seasons of 2012/2013 and 2013/2014 to investigate the effect of some organic compounds (methanol, Ethanol, ethephon and salicylic acid) as a foliar application on wheat plant. The treatments were arranged in a complete randomized block design with three replicates. All treatments were added three times at 30, 45 and 60 days after sowing. Plant height, leaf area, 100 grain weight, grain yield (kg fed^{-1}), straw yield (kg fed^{-1}), biological yield, harvest index, N, K, P content and uptake were determined. The obtained results revealed that all used treatments significantly affected the above parameters.The results also show that the treatments of ethephon reduce plant height compared with control treatment, while the treatments of 10% methanol, 100 ppm and 200 ppm salicylic acid significantly increased plant height. The treatments of 10 % ethanol, 100 ppm and 200 ppm salicylic acid significantly enhanced the weight of 100 grains compared with control in both season. The highest grain yield values (2091.26 and 2300.39 kg fed^{-1}) were found with the treatment of 200 ppm salicylic in both seasons. While,the best flag leaf area and straw yield values in both seasons were recorded with 10% methanol. On the other hand,the highest nitrogen percent and protein content in grain was recorded with 0.25g/Lethephon. Data also shows thatall used treatments significantly increased the nitrogen, potassium and phosphorus uptake by grains (kg fed^{-1})and the best results were found with the treatment of 200 ppm salicylic acid.Finally, the results suggested that foliar application of 200 ppmsalicylic acidenhanced wheat plant production and nutrients uptake.

Keywords: wheat, methanol, ethephon, salicylic acid, nutrient uptake

INTRODUCTION

Wheat (*Triticam aestivum L.*) is considered one of the most important cereal crops in the world as well as in Egypt. Increasing production of wheat plant per unit area is a native goal to meet the consistent demands from this crop, especially with increasing population and limitation of water resources and water quantity in Egypt. Recently, many studies suggested that there are some organic compounds such as methanol, ethanol, ethephon and salicylic acid led to increase wheat production. In contrast, other studies stated that these complexes had no effects on plants.

Nonomura and Benson (1992) studied methanol effects on C_3 and C_4 species under different environment condition. They stated that foliar sprayed of aqueous 10-50% methanol increased plant turgidity. Treated plants with methanol supplemented nutrient showed up to 100% increase in yields when maintained under direct sunlight in desert agriculture. Zbiec et al.(2003) at Poland to survey the impact of methanol arrangement (10, 20, 30 and 40 % with florvit 0.4 % and glycine 0.2 %) and supplemental water system on the execution of tomato, cucumber, bean, sugarbeet and winter rape. They outlined that methanol decidedly influenced photosynthesis and increment nitrate reductase and antacid phosphatase exercises by 50 and 32%, separately, contrasted with the control. They additionally expressedthat methanol has increased drought resistance, carbon assimilation and biomass production. Pasari and Yakchali (2015) found that methanol has a significant effect on yield and yield components. Methanol spraying with a concentration of 30% was more effective than other treatments on yield and yield components, as it increased the number of pods, number of seeds per pod and 100 seed weight. On the other hand, foliar application of ethrel (ethephon) at the rate of 200 ppm at flower initiation stage increased the uptake of N, P and K in soybean plants (Singh*et al.,* 1987).Ethephon had affected emphatically on cultivar N utilize effectiveness and specifically on the N uptake efficiency in winter wheat(Van Sanford *et al.,* 1989).Taylor *et al*.(1991) stated that ethephon reduced plant height in all of the cultivars and reducing plant lodging. During the first 3 year under relatively dry conditions, grain yield was reduced and straw yield increased in 2 out of the 3 yr. The yield component consistently affected by ethephon was the number of seed spike. Shekoofa and Emam (2008) showed that ethephon at 0.28 $kgha^{-1}$increased wheat grain yield (8.2 t ha^{-1}) compared with control (7.2 t ha^{-1}) treatm ents. Salicylic acid (SA) is viewed as a phenolic compound normally created by the plants and expanded development as a growth regulator (Arberg, 1981). Gunes, *et al.*(2005) found that SA treatments stimulated N accumulation in plants, P, K, Mg and Mn concentrations of SA received plants were increased in the stress conditions. These results suggest that SA regulates the response of plants to the environmental stresses and could be used as a plant growth regulator to improve plant growth and stimulate mineral nutrient concentrations under stress conditions. Ibrahim, et al. (2014)studied three levels of salicylic acid (0, 50, 100 ppm) effects on yield and yield components of wheat (Sakha 93). Increasing salicylic acid rates resulted in a significant increase innumber of grain/spike, plant height (cm), 1000 grain weight (g),number of spikes/m^2, grain yield ($gplot^{-1}$), straw yield ($gplot^{-1}$), and biological yield ($gplot^{-1}$), in addition to grain weight/spike (g).While, Vazirimehr and Rigi. (2014) pointed out that the positive effect of salicylic acid could be attributed to an increased CO_2 assimilation, photosynthetic rate and alsoto increased mineral uptake by the stressed plant. They found, also that salicylic acid decreased the Na uptake by plants and increased the uptake of N, P, K, Ca, Mg and the other minerals as compared to control treatment. The aim of the study is to investigate the effect of some organic compounds (methanol, ethanol, ethephon, and salicylic) as a foliar application on wheat plant grown in sandy soilin Egypt.

MATERIALS AND METHODS

Two field studies were conducted during 2012/2013 and 2013/2014 to declare the effect of some different organic compound on wheat plant growth. The soil at the location of the study is a loamy sand in textureand come the chemical and physical properties of the experimental soil are listed in Table (1).

Table 1.Chemical and physical properties of the experimental soil.

Soil properties							
Clay	**Silt**	**Fine sand**	**Coarse sand**	**Texture**	**$CaCO_3$ %**	**pH (soil paste)**	**EC(dSm^{-1})(soil paste)**
10.45 %	15.65 %	61.35%	12.55 %	loamySand	0.50	7.85	3.5
Soluble cation mq/L				Soluble anions mq/L			
Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}
10.2	14.1	1.3	10.00	0.00	10.75	15.75	7.85
Saturation percent (%)		Available nutrient($mgkg^{-1}$) Nitrogen		Potassium		Phosphorus	
37.6		20.20		160.00		5.62	

The used treatments in the experiments, including: methanol at a concentration of 10 and 20% (v/v) , ethanol at a concentration of 10 and 20%(v/v), ethephon at a concentration of 0.25 and 0.5g/L, salicylic acidat aconcentration of 100 and 200 ppm and control treatment. The treatments were arranged in a complete randomized block design and each treatment was replicated three times.

Plot area was 2m * 2m.The experiment was carried out on wheat variety, Sakha 93 cultivar, which was sown on both seasons on 16th November.The usual and common agronomical practices were adopted as recommended by the Ministry of Agriculture and soil reclamation –Egypt. Each plot was seeded with 120 g (approximately 120 kg fad^{-1}). All treatments were added three times at 30, 45 and 60 days from sowing. Plant height in each experiment was measured atthe harvesting stage (ten plants average). The flag Leaf area was calculated using the following equation of Palanis Wamy and Gomez (1974).

Where leaf area = Flag Leaf length * the maximum width of leaf * 0.75.

Harvesting was manually done when the plants are completely yellowish in color (172 days). 10 days latter harvesting, the yield of each plot was weighed, grain separation, grain weighted and straw yields were computed. 1000 grain weight was determined.

Particle size distribution was determined using the international piptte method as described by Haluschak, P. (2006).PH value of soil was determined in soil paste using a Beckman pH meter (Carter and Gregorich (2007)). Ec determined by electrical conductivity meter in soil past extract as described by Carter and Gregorich (2007). Soluble ions in soil extract were determined acoording tothe method of (Jakson, 1967).Soluble Sodium and Potassium in soil extract were determined by a flame photometer (AOAC International (2012).

Available nitrogen in soil was extracted by using 2.0 N KCL according to van Reeuwijk (2002) and determined by using half automatic kjldal apparatus whileavailable phosphorus in the soil was extracted by using 0.5 N $NaHCO_3$ - 8.5 pH according to van Reeuwijk (2002). Available potassium in soil was extracted by using 1.0 N (CH_3) $COONH_3$ according to Hesse (1971) and determined by using a flame photometer.

Grains and straw samples were oven dried (70 Cº) until constant weight. The oven dry material of plant samples were ground and wet digested by a sulfuric – percloric acid mixture as described by Cottenie et al. (1982) .

Nitrogen, phosphorus and potassiumwere measured in the digesting extract according the methods of ((AOAC International (2012).Protein Concentration (%) was calculated as % protein = % N * 6.25. Total uptake of N, P, K was calculated separately by the following formula: Nutrient uptake in kg fed^{-1} in grain or straw= Nutrient % in grain or straw*dry matter of grain or straw in kg fed^{-1} ÷100(Sharma, et al.2012)

Statistical analysis

All data were statistically analyzed according to the technique of analysis, variance (ANOVA) and the least significant difference (LSD) method was used to compare the difference between the means of treatment values to methods described by Gomez and Gomez (1984). All statisticalanalyses were performed usingan analysis, variance technique by means of CoSTATE computer software.

RESULTS AND DISCUSSION

Data presented in table (2) show that plant height significantly affected by all used treatment where, it ranged between 74.1 cm and 99 cm in the first season and 67.3 cm and 90.2cm in the second season. The treatments of ethephon reduce the plant height compared with the control treatment, while the treatments of 10% methanol, 10% ethanol, 100 ppm salicylic acid and 200 ppm salicylic acid significantly increased wheat plant height.The highest plant height values were recorded with 200 ppm salicylic acid treatment with no significant effect comparing with 100 ppm salicylic acid treatment. This increase in plant height may be due to the effect of auxins and the cytokinins which found in salicylic acid (Shakirova etal.2003). These results are in agreement with Ibrahim,et al.(2014).The lowest values of plant height were found with the treatments of 0.25 and 0.5 g/L ethephon. This maybe due to theinhibitory action of auxin transport and cell expansion.These results are in agreement with Taylor et al.(1991)who found that that ethephon reduced plant height in all of the cultivars and reducing lodging

Table 2. Effect of different treatments onmeans values of wheat plant height (cm), flag leaf area(cm^2) and 100 grain weight (g).

Treatment	Plant height(cm)		Leaf area (cm^2)		1000 grains weight (g)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	92.4	84.0	26.15	28.77	43.1	45.3
10% methanol	97.9	89.0	33.58	36.93	41.5	45.6
20 % methanol	93.1	84.6	23.40	25.74	43.2	45.4
10 % ethanol	95.7	87.1	28.55	31.41	45.9	48.3
20 % ethanol	92.4	84.1	22.95	25.25	43.1	45.3
0.25 g/L ethephon	75.2	68.3	26.10	28.71	38.1	40.0
0.5 g/L ethephon	74.1	67.3	27.13	29.84	37.9	39.9
100 ppm salicylic acid	97.9	89.1	25.20	27.72	44.6	46.8
200 ppm salicylic acid	99	90.2	24.30	26.73	43.8	46.5
LSD at 5 %	2.59**	2.35**	3.17**	3.48**	0.48**	0.48**

Flag leaf area (cm^2) data presented in Table (2) illustrate that all treatments significantly affected leaf area (cm^2) where, it increased by the treatment of 10 % methanol compared with control. The treatment of 10 % methanol gave the highest flag leaf area (33.58 and 36.93 cm^2) in both seasons. This result may be due to that methanol affected photosynthesis and increase carbon assimilation at the low concentration of methanol.

These results are in contrast with AbdeL-Hameed (2008)who found that application of methanol at the rate of 10, 20 and 30% methanol significantly reduce plant leaf area. In contrast, the treatment of 20 % ethanol significantly decreased the leaf area cm^2 compared with control treatment.These results are in accordance with AbdeL-Hameed (2008).

Data also shows that weight of 1000 grains significantly affected by all treatments compared with control treatment where, the treatment of 10 % ethanol, 100 ppm and 200 ppm salicylic acid significantly enhanced the weight of 1000 grainsas compared with control in both season. While the treatments of 0.25and 0.5g/L ethephon significantly reduced in both season.These results are in agreement with Ibrahim,et al.(2014). The highest weight of 1000 grain value was recorded with 10 % ethanol while the lowest one was realized for the treatment of 0.25g /Lethephon.

Data presented in Table (3) illustrate that grain yield of wheat plant has significantly increased by all treatments in both seasons as compared with the control treatment except the treatment of 0.5g /L ethephon which,was significantly decreased grain yield in both seasons. These results may be regarded to that ethephon led to increase the vegetative growth, late maturation, affected the transition from vegetative to reproductive growth and reduce the weight of 1000 grains. The highest grain yield values (2093.26 and 2300.39 kg fed-1) were found with the treatment of 200 ppm salicylic in both seasons. Thisresult may be due to the role played bysalicylic acid for increasing CO_2 assimilation, photosynthetic rate and increased mineral uptake (Vazirimehr and Rigi. (2014). These results in accordance with Nonomura and Benson (1992), Ibrahim,*et al.*(2014)and Pasari and Yakchali (2015).

The obtained data also showed that straw yield was significantly affected by all treatments where, it increased with all treatment compared with control in both seasons. The best straw yield values (3632.16 and 4358.59 kg fed-1) in both seasons were recorded with 10% methanol. These results may be regarded to the role played by methanol for increasing plant leaf area and plant height, which are correlated with straw yield. These results are in agreement with Nonomura and Benson (1992), Pasari and Yakchali(2015).On the other hand the lowest values (2081 and 2498.23 kg fed-1) were found with control treatment in both seasons.. In spite of 0.5g /L ethephon decreased the grain yield, it significantly increased straw yield as compared with control treatment. These results may be regarded to the ethephon effect which led to increase vegetative growth and the number of branches on contrast withgrain yield.

Table 3. Effect of different treatments on means values of wheat Grain yield and Straw yield (kg fed^{-1}.).

Treatment	Grains yield (kg fed^{-1}.)		Straw yield (kg fed^{-1}.)		Grains yield dry weight (kg fed^{-1}.)		Straw yield dry weight (kg fed^{-1}.)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	1057.06	1162.76	2081.86	2498.23	995.54	1095.08	1890.02	2268.03
10 % methanol	1359.46	1495.40	3632.16	4358.59	1275.05	1402.55	3271.92	3926.30
20 % methanol	1451.52	1596.67	2550.91	3061.09	1364.08	1500.49	2317.74	2781.29
10 % ethanol	1757.62	1933.38	3060.85	3673.02	1648.49	1813.34	2794.02	3352.83
20 % ethanol	1913.41	2104.75	3031.39	3637.67	1799.50	1979.45	2734.92	3281.91
0.25 g/L ethephon	1357.44	1493.18	3166.80	3800.16	1276.51	1404.16	2871.34	3445.61
0.5 g/L ethephon	944.16	1038.58	3476.59	4171.91	884.04	972.45	3120.82	3744.98
100 ppm salicylic acid	1800.29	1980.32	3271.97	3926.36	1699.19	1869.11	2951.71	3542.05
200 ppm salicylic acid	2093.26	2300.39	3525.65	4230.78	1976.64	2172.23	3180.56	3816.67
LSD at 5%	29.16**	32.09**	28.23**	33.88**	22.80**	22.70**	23.42**	31.13**

Data in table (3) show that grains yield dry weight and straw yield dry weight significantly increased by all used treatments except the treatment of 0.5 g/l ethephon which decrease the grains yield dry weight in both seasons comparing with the control treatment. The grains yield dry weight and straw yield dry weight take the same trend of grains yield and straw yield in both seasons.

The biological yield (kg fed^{-1}) in both seasons significantly increased by all used treatments compared with control treatment. The higher concentration of methanol and ethephon increased the biological yield, but this increment was less than the lowest concentration. On contrast the higher concentration of ethanol and salicylic acid increased the biological yield and this increment was higher than at the lowest concentration. The best biological yield values (5619.9 and 6531.17 kg $fed.^{-1}$) in both seasons were recorded with 200 ppm salicylic acid. This result due to high grain and straw yield of wheat plant with the salicylic acid treatments. These results may be regarded to with Ibrahim,et al.(2014).On the other hand; control treatment gave the lowest biological yield in both seasons.

Table. 4. Effect of different treatments onmeans values of wheat Biological yield (kgfed^{-1}.)and harvest index.

Treatments	Biological yield (kg/fed.)		Harvest index	
	1st season	2nd season	1st season	2nd season
Control	3138.9	3660.99	0.34	0.32
10 % methanol	4991.6	5853.99	0.27	0.26
20 % methanol	4002.4	4657.77	0.36	0.34
10 % ethanol	4818.5	5606.40	0.36	0.34
20 % ethanol	4944.8	5742.42	0.39	0.37
0.25 g/L ethephon	4524.2	5293.34	0.30	0.28
0.5 g/L ethephon	4420.8	5210.49	0.21	0.20
100 ppm salicylic acid	5072.3	5906.68	0.35	0.34
200 ppm salicylic acid	5616.9	6531.17	0.37	0.35
LSD at 5 %	41.59 **	47.80 **	0.007	0.007

Data presented in Table (4) show that all used treatment significantly affected the harvest index. The treatments of 20 % ethanol, 100 ppm and 200 ppm salicylic acid significantly increased harvest index compared with control, while the treatments of 10% methanol, 0.25g/Lethephon and 0.5g /L ethephon significantly reduced harvest index compared with control treatment. This may be attributed to the high grainyield compared with straw yield in these treatments in spite of the increment of straw yield. The treatment of 20 % ethanol gave the best harvest index (0.39 and 0.37) in both seasons while the lowest value was recorded with 0.5g /L ethephon.

The percentage of nitrogen in wheat plant was shown in Table (5). In general, the nitrogen percentage in grain significantly increased with all used treatments compared with control. It ranged from 1.84 to 2.29% in the 1st seasons,the highest nitrogen values in grain (2.29%) was recorded with 0.25g /Lethephon without any significant with 0.5g /Lethephon and 200 ppm salicylic acid. These results may be regarded to ethephon effects where it reduced the wheat yield, which reflects on high concentration of nitrogen in grain. Data also shows that the higher concentration of methanol, ethanol and salicylic acid increased the nitrogen percentage in grain compared with the less concentration by 5%, 3.8% and 12.9 % respectively. The second season took the same trend, but the nitrogen percentage was less than the first season.These results may be due to the dilution effect, where the yield in the second season was higher than the first season. In contrast,the lowest concentration of ethephon increased the nitrogen percent in grain than the higher concentration.This result is in agreeing with Singh *et al.* (1987).

Straw nitrogen percentage significantly increased with all used treatments compared with control treatment as shown in Table (5). In general, in the two seasons, nitrogen percentage in wheat straw took the same trend, where, the highest values (1.12 and 1.07%) were recorded with 0.5g /L % ethephon.The percentage of nitrogen in the straw at the second season was less than the first; this result may be regarded to the yield increment in the second season compared with the first one.

Table 5. Effect of different treatments onmeans values ofnitrogen content (%) and protein percentage of wheat plant (%).

Treatment	N % in grain		N %in straw		Protein% in grain		Protein% in straw	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	1.84	1.74	0.81	0.77	11.46	10.89	5.08	4.81
10 % methanol	2.00	1.90	0.88	0.83	12.50	11.88	5.51	5.23
20 % methanol	2.10	2.00	0.87	0.83	13.13	12.48	5.44	5.16
10 % ethanol	2.06	1.96	0.90	0.86	12.86	12.23	5.64	5.36
20 % ethanol	2.14	2.03	0.97	0.92	13.39	12.73	6.04	5.74
0.25 g/L ethephon	2.29	2.18	1.10	1.05	14.31	13.60	6.91	6.58
0.5 g/L ethephon	2.27	2.15	1.12	1.07	14.18	13.46	7.00	6.66
100 ppm salicylic acid	2.01	1.91	0.90	0.86	11.81	11.23	5.25	4.99
200 ppm salicylic acid	2.27	2.16	0.86	0.82	14.19	13.49	5.38	5.10
LSD at 5%	0.059**	0.06**	0.11**	0.1**	0.63**	0.61**	0.48**	0.49**

The protein percent in grain was shown in table (5), protein percent in grain increased significantly with all used treatments compared with control treatment. It increased by 9.07, 14.57, 12.21, 16.84, 24.86, 23.73, 3 and 23.82%, respectively, with the treatments of 10% methanol, 20% methanol, 10 % ethanol , 20% ethanol ,

0.25g /L ethephon , 0.5g /Lethephon, 100 ppm and 200 ppm salicylic acid compared with control treatment in the first season. The percent of protein in grain at the second season took the same trend and the highest values were found with the treatment of 0.25g/L ethephon. This results are in accordance with Sekhon, and Singh, (1994) who found that ethephon treatments has been increased protein content and efficient incorporation of amino acids into proteins in wheat.

Straw wheat protein percentage as shown in table (5) significantly increased with all treatment in both seasons and it decreased at the second season compared with the other one.The highest straw wheat protein percent values were found with the treatment of 0.25g /L and 0.5g /Lethephon. This result may be due toethephon effects, which it led to late maturation, increase branching and high nitrogen percent intreatedplant.

The potassium percentage in grainas shown in table (6) was significantly affected by all treatments where, it increased by all used treatments compared with control treatments. The treatment of 100 ppm recorded the highest increased in the potassium percentage in grain compared with control treatment. These may cause to salicylic acid effects which it encouraged plant growth and nutrient uptake as a plant hormone(Hayat *et al.* 2007). These results in agreement withGunes, *et al.* (2005). The results in the second season take the same trend and potassium percent was higher in the second season than the first.

Data presented in Table (6) show that the potassium percent in straw significantly affected with all used treatments, it significantly decreasedwith the treatment of 20% methanol, 0.25g/L ethephon, 0.5g/L ethephon, 100ppm and 200ppm salicylic acid comparing with the control treatment. These results may be regarded to high straw yield by these treatments and the dilution effect as a result to this increment in straw yield.

Table 6. Effect of different treatments on means values of potassium and phosphorus percent (%) in grains and straw of wheat plant.

Treatment	K % in grain		K % in straw		P % ingrain		P % in straw	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	3.51	3.86	3.75	4.13	0.231	0.215	0.027	0.025
10 % methanol	3.72	4.09	3.71	4.08	0.178	0.165	0.017	0.016
20 % methanol	3.57	3.93	3.50	3.85	0.201	0.187	0.025	0.023
10 % ethanol	3.44	3.79	3.67	4.03	0.153	0.142	0.060	0.055
20 % ethanol	3.53	3.88	3.88	4.26	0.170	0.158	0.063	0.059
0.25 g/L ethephon	3.86	4.25	3.29	3.62	0.257	0.239	0.068	0.063
0.5 g/L ethephon	3.84	4.22	3.46	3.81	0.348	0.324	0.112	0.104
100 ppm salicylic acid	4.00	4.40	3.50	3.85	0.266	0.247	0.120	0.111
200 ppm salicylic acid	3.49	3.84	3.04	3.35	0.263	0.245	0.095	0.091
LSD at 5 %	0.07**	0.08**	0.09**	0.11**	0.015**	0.014**	0.014**	0.013**

The percentage of phosphorus in grain and straw of wheat plant are presented in Table (6). Data shows that the phosphorus percent in grains significantly decreased with the treatments of 10% and 20% methanol, 10% and 20% ethanol compared with control treatment. While the treatments of 0.25g /Lethephon, 0.5g /Lethephon, 100 ppm salicylic acid and 200 ppm salicylic acid increased the phosphorus percent in grains by 11.25%, 50.64%, 15.15% and 13.85% respectively.The highest phosphorus percent values (0.348% and 0.324%) were recorded with 0.5g /Lethephon while the lowest values (0.153% and 0.142%) were found with the treatment of 10% ethanol. These results may be related to ethephon effectson grain yield,which led to reduce it as soon as nutrient absorption increased. The same trend was found in the second season and the phosphorus percent on the season was less than the first season.These may regarded to the increment of the yield in second season compared with another season and dilution effects.

The percentage of phosphorus in straw significantly affected by all used treatments. It increased with all treatment except methanol treatments. The highest values (0.120 and 0.111%) were found with the treatment of 100 ppm salicylic acid. This may be regarded to effects of salicylic acid on encouraging growth(Vazirimehr and Rigi. 2014).The lowest values (0.017 and 0.016%) were recorded with 10 % methanol treatment.

Data presented in Table (7) declare nutrient uptake by grain and straw of wheat plant. Nitrogen uptake in grains significantly increased with all used treatments compared with control treatment in both seasons. The treatment of 200 ppm salicylic acid recorded the best nitrogen uptake values in grain (44.87 and 46.92kgfed^{-1}.) in the first and second season. These results may be due to salicylic acid effects on stimulating growth and increased the nutrient absorption or may due to higher yield and nitrogen percent obtained by salicylic acid treatment. These results are in agreement with Vazirimehr and Rigi. (2014)

Nitrogen uptake by straw yield also significantly increased by the all used treatment compared with control treatment. The treatment of 0.5g /L ethephon gave the highest values of nitrogen uptake by straw. These results may be related to the ethephon effect on wheat plant which it led to increased vegetative growth by increased branches or the increment on the nitrogen percent in wheat straw.

Data in table (7) show that potassium uptake values by grains and straw significantly increased by all used treatments.The treatment of 100 and 200 ppm

salicylic acid as a foliar spray gave the highest potassium uptake values in grains. These results may be regarded to the salicylic acid effects on encouraging growth and increase yield, which reflected on nutrient uptake increment. These results are in agreement with Gunes, *et al. (*2005).

Table 7. Effect of different treatments onmeans values of nitrogen and potassium uptake by grains and straw of wheat plant (kgfed^{-1}.).

Treatment	N uptake by grain		N uptake by straw		K uptake by grain		K uptake by straw	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	18.32	19.05	15.31	17.46	34.94	42.27	70.88	93.67
10 % methanol	25.50	26.65	28.79	32.59	47.43	57.36	121.39	160.19
20 % methanol	28.65	30.01	20.16	23.08	48.70	58.97	81.12	107.08
10 % ethanol	33.96	35.54	25.15	28.83	56.71	68.73	102.54	135.12
20 % ethanol	38.51	40.18	26.53	30.19	63.52	76.80	106.12	139.81
0.25 g/L ethephon	29.23	30.61	31.58	36.18	49.27	59.68	94.47	124.73
0.5 g/L ethephon	20.07	20.91	34.95	40.07	33.95	41.04	107.98	142.68
100 ppm salicylic acid	34.15	35.70	26.57	30.46	67.97	82.24	103.31	136.37
200 ppm salicylic acid	44.87	46.92	27.35	31.30	68.98	83.41	96.69	127.86
LSD at 5 %	2.59**	2.72**	4.05**	4.67**	1.48**	1.84**	3.35**	4.43**

While the highest potassium uptake values by straw was recorded with the treatment of 10% methanol at the two seasons. These results may be due to its methanol effects on increasing plant high, flag leaf area and straw yield which reflected in potassium uptake. These results are in agreement with Nonomura and Benson (1992).The same trend was found in the second season, but the values were higher than the first one because the yield was higher in the second season than the first.

Data in Table (8) show that phosphorus uptake by grains and straw of wheatplant signific antlyaffectedby foliar application of all used treatments compared with the control treatment.All used treatments increased phosphorus uptake by grains except the treatments of 10 % methanol had no significant effects compared with control in both seasons. The highest phosphorus uptake values by grain were found with the treatment of 200 ppm salicylic acid then 100 ppm salicylic acid. These results may be regarded to salicylic acid effects as growth hormone whichled to in crease vegetative growth and increase the nutrient uptake. These results are in agreement with Vazirimehr and Rigi. (2014)

Table 8. Effect of different treatments on means values of phosphorus uptake by grain and straw of wheat plant (kgfed^{-1}.).

Treatments	Phosphorus uptake by grain		Phosphorus uptake by straw	
	1st season	2nd season	1st season	2nd season
Control	2.30	2.35	0.51	0.57
10 % methanol	2.27	2.31	0.56	0.63
20 % methanol	2.74	2.81	0.58	0.64
10 % ethanol	2.52	2.57	1.68	1.84
20 % ethanol	3.06	3.13	1.72	1.94
0.25 g/L ethephon	3.28	3.36	1.95	2.17
0.5 g/L ethephon	3.08	3.15	3.50	3.89
100 ppm salicylic acid	4.52	4.62	3.54	3.93
200 ppm salicylic acid	5.20	5.32	3.02	3.47
LSD at 5 %	0.67**	0.61**	0.40*	0.29**

On the other hand, phosphorus uptake by straw significantly increased by all used treatments except 10 and 20% methanol increased but this increment not significant. The treatment of 0.5g /Lethephon and 100 ppm salicylic acid gave the highest phosphorus uptake values by straw in both seasons, which gave 3.50 and 3.54kgfed^{-1}.at the first and 3.89 and 3.93kgfed^{-1}.at the second season respectively.

CONCLUSION

In general, all used treatments significantly affected wheat plant.While the salicylic acid treatmentsgave the best results which it gave the highest plant height, grain yield,nitrogen content in grains, potassium and phosphorus percent in grain and potassium and phosphorus uptake in grains. Finally,foliar application of salicylic acid with 200 ppm enhanced wheat plant production and nutrients uptake.

REFERENCES

AbdeL-Hamied.A.S. (2008). Influence of methanol on wheat plant growth grown under different level of N, P, and K. M.Sc. Thesis Mansoura University.

AOAC International (2012). Official methods of analysis of AOAC International. 19th edition. 2nd revision. Gaithersburg, MD, USA, Association of Analytical Communities.

Arberg, B. (1981). Plant growth regulators XLI. Mono Substituted Benzoic Acid. Swedish Journal of Agricultural Research, 11, 93-105.

Carter, M.R. and E.G. Gregorich (2007)"Soil Sampling and Methods of Analysis".Second Edition, Canadian Society of Soil Science.

Cottenie, A. M. Verloo, L. Kiekens, G. Velgh and R. Camerlynck (1982)."Chemical Analysis of Plants and Soils" State Univ. Ghent Belgium, 63.

Gomez, K.A. and A.A. Gomez, (1984). Statistical procedures for agricultural research (2 ed.). John Wiley and Sons, NewYork, 680p.

Gunes, A., A. Inal, M. Alpaslan, N. Cicek, E. Guneri, F. Eraslan, and T., Guzelordu (2005). Effects of exogenously applied salicylic acid on the induction of multiple stress tolerance and mineral nutrition in maize (Zea mays L.) Archives of Agronomy and Soil Science, 51: 687-695.

Haluschak, P. (2006). Laboratory methods of soil analysis Canada Manitoba soil survey p.12.

Hayat, S.; B. Ali and A. Ahmad (2007). Salicylic acid: Biosynthesis, metabolism and physiological role in plants. In S. Hayat,A. Ahmad (eds.), Salicylic acid: A plant hormone, (pp. 1 –14). Springer, Dordrecht, The Netherlands

Hesse, P. R.(1971). " A text book of soil chemical analysis" Toon Murry (publishers) Ltd,50 Albemarle street,London. p.299.

Ibrahim, O. M., A. B. Bakry, A. T. Thalooth, and M. F. El-Karamany(2014). Influence of nitrogen fertilizer and foliar application of salicylic acid on wheat. Agric. Sci., 5, 1316-1321.

Jackson, M. T. (1967). "Soil Chemical Analysis" Printic Hall of India. Pivate, New York. USA.

Nonomura, A.M and A.A. Benson (1992). The path of carbon in photosynthesis: improved crop yields with methanol. Proceedings of the National Academy of Sciences of the United States of America. 89(20): 9794-9798.

Palaanis Wamy, K. M., and K. A. Gomez (1974).Length, width method for estimating leaf area of rice.

Pasari, B. and M. SH. Yakchali (2015). Study the effect of methanol foliage spraying on chickpea cultivars in rain fed condition. Bulgarian Journal of Agricultural Science, 21 (No 1), 93-99.

Sekhon, N.K. and G. Singh (1994). Effect of growth regulators and date of sowing on grain development in wheat. Indian J. Plant Physiol., 37:1-4.

Sharma,. N. K., Raman. J. Singh, and K. Kumar (2012). Dry Matter accumulation and nutrient uptake by wheat (Triticum aestivum L.) under poplar (Populus deltoides) based agroforestry system. ISRN Agronomy.Vol.2012. ID 359673.

Shekoofa, A. and Y. Emam (2008).Effect of nitrogen fertilization and plant growth regulators yield of wheat (*Triticum aestivum L)* cv. shiraz. J. Agric. Sci. Technol. Vol. 10: 101-108

Shakirova, F.M., A. R. Sakhabutdinova, M. V. Bezrukova, R. A. Fathudinova and D. R. Fathutdinova (2003). Changes in hormonal status of wheat seedlings induced by Salicylic acid and salinity. Plant Sci.,164: 317-322.

Singh, H., S. Chandra, R.S. Jollyand I. S. Kolar(1987).Influence of chlorocholine chloride and ethrel on grain yield and uptake of nitrogen, phosphorus and potassiumin soybean. *Crop Improv.*, 14:79-83.

Taylor, I. S., K. R. Fosterl and C. D. Caldwell (1991) .Ethephon effects on barley in central Alberta. Can. J. Plant Sci. 71 : 983 -995

Van Reeuwijk, L. P. (2002). 'Procedures for soil analysis' (International Soil Reference and Information Centre (ISRIC): Wageningen.

Van Sanford, D. A., J. H. Grove, L. Grabau and C. T. MacKown (1989). Ethephon and nitrogen use in winter wheat. Agron. J.,81: 951-954.

Vazirimehr,M. Rr. andK. Rigi (2014) effect of salicylic acid in agriculture.International Journal of Plant, Animal and Environmental Sciences. ISSN 2231-4490.Vol.4 p.291-296

Zbiec, I.I; S. Karczmarczyk and C. podsiado (2003). Response of some cultivated plants to methanol as compared to supplemental irrigation. Electronic journal ofPolish agricultural universities, agronomy(6): 1-6.

تأثير بعض المركبات العضوية علي انتاج نبات القمح وامتصاص بعض العناصر الغذائية

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أقيمت تجربتان حقليتان خلال موسمي الشتاء 2013/2012 و2014/2013 لدرسة تأثير بعض المركبات العضوية (الميثانول و الايثانول والايثافون وحامض السالسيليك) رشا علي نبات القمح النامي في الأرض الرملية.تم تنظيم المعاملات في تصميم التامة العشوائية وتم اضافة جميع المعاملات ثلاث مرات عند عمر 30 و45 و 60 يوم من الزراعة . تم تقدير طول النبات ومساحة ورقة العلم ووزن 1000 حبة و محصول الحبوب (كجم فدان$^{-1}$) ومحصول القش(كجم فدان$^{-1}$) ودليل الحصاد والمحصول البيولوجي ومحتوي النبات من النيتروجين والفسفور والبوتاسيوم وكذلك الممتص من النيتروجين والفسفور والبوتاسيوم .ومن النتائج المتحصل عليها وجد أن جميع المعاملات المستخدمة أثرت علي الصفات السابقة . حيث وجد أن معاملات الايثافون أدت الي نقص معنوي في طول النبات مقارنة بالكنترول بينما معاملات 10 % ميثانول و 100 جزء في المليون حمض سالسيلك و200 جزء في المليون حمض سالسيلك أسيد أدت الي زيادة معنوية في طول النبات.أدت استخدام معاملات 10 % ميثانول و 100 جزء في المليون حمضسالسيلك و200 جزء في المليونحمض سالسيلك الي زيادة معنوية في وزن 1000 حبة مقارنة بالكنترول في كلا الموسمين . كما سجلت معاملة 200 جزء في المليون حمضسالسيلك أعلي قيم لمحصول الحبوب (2091.26 و2300.39 كجم فدان$^{-1}$) بينما سجلت أعلي قيم لمحصول القش ومساحة ورقة العلم مع معاملة 10% ميثانول في كلا الموسمين. من ناحية أخري سجلت معاملة 0.25 جم لتر$^{-1}$ ايثافون أعلي قيم لمحتوي الحبوب من النيتروجين والبروتين . كما أوضحت النتائج أيضا أنجميع المعاملات المستخدمة أدت الي زيادة قيم النيتروجين والفسفور والبوتاسيوم الممتص بواسطة الحبوب (كجم فدان$^{-1}$) وقد حققتمعاملة 200 جزء في المليونحمض سالسليك أفضل قيم للنيتروجين والفسفور والبوتاسيوم الممتص بواسطة الحبوب (كجم فدان$^{-1}$).