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EFFECT OF SPRAYING SOME AMINO ACIDS ON THE QUANTITY AND SOME CHEMICAL PROPERTIES OF WHEAT YIELD UNDER IRRIGATION WITH SALINE WATER

BY

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ABSTRACT

A pot experiment was conducted to evaluate the response of wheat (*Triticum aestivum* cv. Sakha 93) to chicken manure and amino acid spraying as a foliar nutrition on dry weight and grain weight as well as the straw yield components of N, P, K, under irrigation with water of different salinities.

Dry matter weight of wheat straw, of the no amino acid treatment averaged 1.16, increased by32%, 24%, 71 % due to foliar application with arginine, proline and proline + glutamic respectively . On the other hand the grain weight was increased by about 49% due to manure.

The positive effect of amino acids spray on nitrogen content of wheat straw was maximized under arginine spraying combined with the law salinity water but minimized under arginine with high salinity water.

The least value of P (0.12 %) was that due to proline spraying in combination with high salinity water irrigation, while the highest (0.22 %) and (0.19 %) occurred under low salinity water with proline and arginine spraying, respectively.

Addition of arginine or proline as well as with proline +glutamic increased K% in wheat straw .

INTRODUCTION

Salinity affects plant growth in a variety of ways reducing water uptake, causing toxic accumulation of sodium and chloride, and reducing nutrient availability. Salinity also induces water deficit even in well-watered soils by decreasing the osmotic potential of soil solutes, thus making it difficult for roots to extract water from their surrounding media (Jaleel *et al.*, 2007a). Excessive sodium inhibits the growth of many salt-sensitive plants, which include most crop plants. The typical first response of all plants to salt stress is osmotic adjustment. Compatible solute accumulation in the cytoplasm is considered a mechanism to impart salt tolerance (Hare *et al.*, 1998; Jaleel *et al.*, 2007b). Chemical treatment and crop management practices have been tried to alleviate salinity effects without much success. Economic pressures on water supplies may force agriculture to use greater amounts of lower-quality water with higher salinity. One possible approach to reduce the effect of salinity on plant productivity is through spraying some amino acids as a foliar application on plants

Several physiological parameters have been applied in recent years (Panneerselvam *et al.*, 1998; Sankar *et al.*, 2006) to study response to salt stress tolerance mechanisms and methods to overcome salt stress in field crops over recent years.

Wheat irrigated with saline water, was treated with foliar spray which contained proline + glutamic acid (5 mg/L 1:1) did not show any significant response regarding to dry matter yield or N and P contents (Dahdouh *et al*., 1993). Amer and Katta (1990) indicated that plant manipulated with both proline and aspartic amino acids showed higher relative growth yield than glutamic as indicated by a relative increase of both fresh and dry yield. They added that the highest relative growth yield valve was obtained from plants manipulated with combination of proline and glutamic acids only. Relative increase in fresh and dry yields were observed, thus the harmful effect of salinity can be decreased by application of amino acids at seedling stage through their promising effect to enhance plant salt tolerance. Chen and Kao, (1993) stated that the proline as well as polyamines accumulates in water – stressed plants. Proline is assumed to intervene as an osmo protecting agent in stressed plants with concentration which ranges between 10 to 1000 mM, while putrescine for instance accumulates to concentration ranging between 0.1 to 1 mM. Concerning the role of arginine in the growth process, Lin and Kao, (1995) demonstrated that, seedlings of rice increased (fresh weight) by addition of either argenine or putrescine in endosperm and shoots. Kakkar and Rai (1988) and Davis (1997) found that argenine promoted rooting and increased root growth in phaseolus vulgaris hypocotyls cuttings. Nassar *et al*. (2003) proved that addition of argenine or putrescine caused significant increases in root growth (fresh and dry weights) of bean plants.

MATERIALS AND METHODS

A pot experiment was conducted under the green house of Soil, Water and Environmental Research Institute (SWERI), Giza, to study the response of wheat (*Triticum aestivum* cv. Sakha 93) to chicken manure as a soil treatment and amino acids as a foliar spray treatments. Amino acids spray treatments included : non spraying (T1), Arginine (T2), Proline (T3) and Proline +Glutamic acid (T4). Different levels of irrigation water salinity were also assessed. There were 3 different levels of salinity by diluting sea water with tap water. There was a ratio of 1:5 (8.29 dsm^{-1}) and a ratio of 1:3 (11.02 dsm^{-1}) beside tap water itself (.59 dsm^{-1}) .

Soil from El Nubaria Research Station was air dried, gently crushed and sieved through a 2 mm screen and packed in plastic bags at a rate of 2Kg / bag, the soil bags were placed in PVC pots. Properties of the soil as well as the irrigation water and chicken manure are shown in Tables 1, 2 and 3.

The design of the experiment was a randomized complete block, factorial . Factors of the experiment are 3 as follows:

1- Manuring: non- manured (M_0) and chicken manured (M_1) [2 treatments.]
2- Salinity of irrigation water: water of dSm^{-1}: 0.59 (W_1); 8.29 (W_2); and 11.02 (W_3) [3 treatments] .
3- Amino acid foliar spray: no- spray; arginine –spray; proline – spray; and glutamic acid + praline – spray [4 treatments] .

Treatments were done in 3 replicates, Soil fertilization: fertilizers were added to soil and mixed thoroughly as follows:

Amonium nitrate (33.5%N) as a N source at the rate of 75 mg N/kg, super phosphate 6.8% P at the rate of 40 mg P/kg and the potassium sulphate (40% K) at the rate of 25 mg K /kg, respectively.

Grains of wheat were soaked in a mixture of tap and saline water (8.29dsm^{-1}) For 24 hours, then were planted 10 grains per pot and irrigated with the tap water when needed up to 10 days (seedling emergence). The seedlings were then thinned into 5 per pot followed by application of the water treatments.

After 150 days the plants were harvested, washed, dried at 70°C and the dry matter and grain yields were recorded. Plant samples were tacken, ground, wet digested and N, P, K were determined according to Schouwenburg (1968). Water consumption, and water use efficiency were calculated according to El Kommos *et al.* (1989).

Table (1): Chemical composition of the applied chicken manure

pH	EC	Oragic carb %	Total N %	C/N	Total P %	Total K%	Amonium mg/L	Nitrate mg/L	Ash %	Density Kg/m^3	Moisure %
6.88	5.43	27.04	1.8	15.02	1.83	0.74	233	121	53.4	193	6

Table (2): Chemical Analysis of the irrigation Water

Water quality	pH	EC	Soluble Ions (me/l)							
			Cations				Anions			
			CA	MG	NA	K	CO_3	HCO_3	Cl	SO_4
Tap water	7.1	0.59	2	1.5	2	0.4	0	2.7	1.75	0.44
Sea water	8.6	35.50	20.02	133	240	13.9	0.44	8.02	280	85
1:5	8.4	8.29	6.6	26.6	60.4	3.5	0	1.7	71.02	25.5
1:3	8.1	11.02	10.2	43.8	69.9	4.88	0.2	2.9	111	35.5

Table (3): Soil characteristics

Particle size distribution %			Texture	pH	Ece dSm^{-1}	Ion concentration meq L^{-1} Saturation extract							Organic matter %
Sand	Silt	Clay				HCO_3	Cl	SO_4	Ca	Mg	Na	K	
43.4	20.7	35.9	clay loam	8.2	3.3	4.3	12.4	17.0	11.6	7.5	13.4	1.2	0.7

RESULTS AND DISCUSSION

Main effect of manuring, on dry weight of wheat straw

Results in Table (4) reveal that the dry weight yield of wheat straw of unmanured pots (no chicken manure application) averaged 1.32 g dry matter/pot being increased to a mean value of 1.73 g / pot by manure.

The addition of organic manure to wheat plants induced more growth and yield . This may be due to the ability of organic manure to supper the grown plants with some micro – macro- nutrients needed for their growth. Also, it activated the microflora of the plant root rhizosphere which could result in release some of the needed nutrients ready to be absorbed by plants as well as the change of soil pH toward slight acidity which in turn could act as a suitable media for increasing nutrients absorbed by plants roots. These results are in harmony with those of Wassif *et al.* (1995)

Main effect of Irrigation water salinity

Irrigation water of 8.29 and 11.02 dSm^{-1} caused significant reduction for the dry matter yield of wheat straw on average from 2.16 g/pot to 1.74 g/pot and 0.705 g/pot for irrigation water salinity of 8.29 and 11.02 d Sm^{-1},respectively .

Manuring and irrigation water salinity

Results in Table (4) reveal that soil manuring decreased the hazardous effect of irrigation salinity on dry matter yield of wheat straw, in which dry matter yield of wheat straw increased by organic matter. The decrease was greater as the salinity was higher. This indicates the urgent need to apply organic manures to the soil at suitable rates, particularly in the case of salt affected soils or with using saline irrigation waters.

Main effect of amino acids spraying on dry matter yield of wheat straw

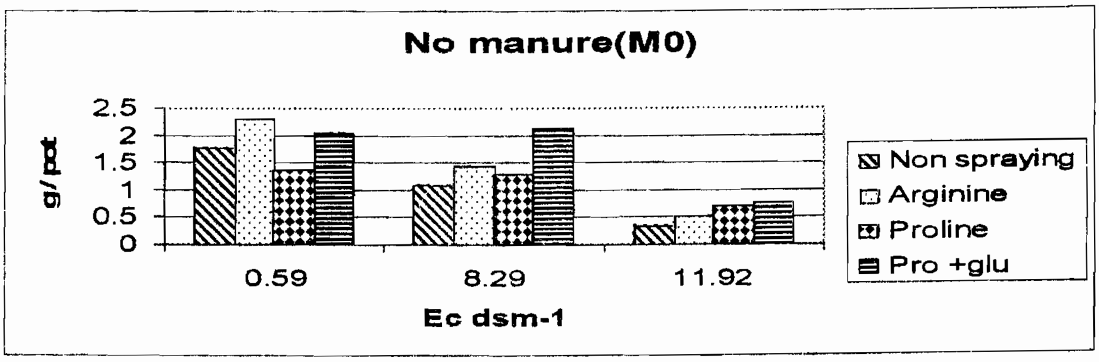
Results in Table (4) reveal that the treatment of no amino acid spraying averaged 1.16 g /pot. On the other hand, spraying with amino acids caused increases which averaged 32%, 24%, 71 % due to arginine, proline, and proline + glutamic, acid respectively .

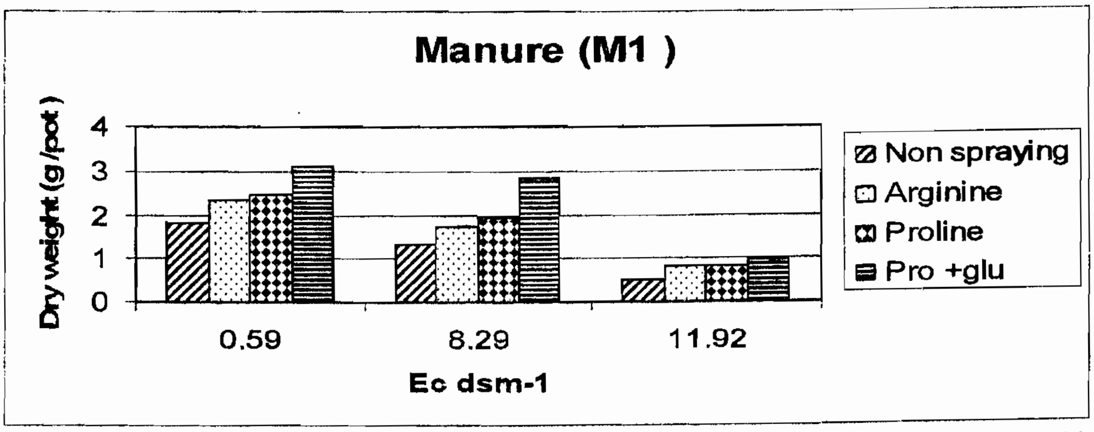
Effect of manuring and amino acids spraying

Results indicate that the dry weight yield of wheat straw averaged 1.08 g/ pot under no manuring and no amino acid spraying, while yield increased on average by 14% due to manure application. Spraying caused increases of 13%, 56%, 40% due to arginine, proline and proline + glutamic, respectively . Such result may suggest the superiority effect due to proline spraying over both arginine or proline + glutamic spraying .

Table (4): Effect of manuring, irrigation water salinity and plant spraying with some amino acids on dry weight yield of wheat

Manuring	Water	Amino Acids spraying (SP)				
CM	dSm^{-1}(I.W)	Non spraying	Arginine	Proline	Pro +glu	Mean
M_0	W_1(.59)	1.77	2.31	1.38	2.04	**1.88**
	W_2 (8.29	1.11	1.44	1.29	2.13	**1.49**
	W_3(11.02)	0.36	0.54	0.69	0.75	**0.59**
	Mean	1.08	1.43	1.12	1.64	**1.32**
M_1	W_1 (059)	1.83	2.34	2.46	3.09	**2.43**
	W_2 (8.29	1.35	1.74	1.95	2.85	**1.97**
	W_3(11.02)	0.54	0.81	0.84	0.99	**0.80**
	Mean	**1.24**	**1.63**	**1.75**	**2.31**	**1.73**
Mean		1.16	**1.53**	**1.44**	1.98	**1.53**
Water	W_1 (.59)	1.80	2.33	1.92	2.57	**2.15**
dSm^{-1}	W_2(8.29	1.23	1.59	1.62	2.49	**1.73**
	W_3 (11.02)	0.45	0.68	0.77	0.87	**0.69**
L.S.D	A=0.048	B= 0.021	AB=.03	C=0.027	AC=.036	BC=.045
	ABC=.066					





M_0: no manure; M_1: addition of chicken manure 2%; w1,w2,w3 irrigation water of 0.59, 8.29, and 11.02 dSm^{-1} respectively. glu: glutamic acid

Effect of manuring, irrigation water Salinity and amino acids spraying

Results indicate that foliar spraying of wheat plants with amino acids affected differently dry matter yield of wheat straw to reach maximum values of 2.31 and 3.09 for arginine and proline + glutamic spraying under tap water irrigation combined with no manuring and manuring, respectively . However, this effect due to amino acid application was very much retarded to reach corresponding minimum values of 0.36 and 0.54 under no spraying, with the highest salinity increased under no addition and addition of chicken manure, respectively . The beneficial effect of chicken manure was obvious.

Effect of irrigation water salinity and amino acids spraying

Results indicate that the dry weight yield of wheat straw obtained from the unsprayed treatment combined with irrigation water salinity (tap water) amounted (1.8) g / pot. This value was gradually and significantly decreased from (1.23) g / pot and there after (0.45) g / pot under salinity of 8.29 and 11.02 dSm^{-1} respectively. Increasing the irrigation water salinity causes different increases of dry matter according to the type of sprayed amino acids. The observed decrement under the different values of water salinities were 46% and 73% as compared with tap water (0.6 dSm^{-1}). The inducing effect of amino acids spray on dry weight yield of wheat straw which was maximized to 2.57 g /pot under proline + glutamic spraying combined with the least degree of salinity but minimized to 0.675 g /pot under arginine in case of highest irrigation water salinity, which indicate the clear reduction effect of irrigation water salinity on wheat straw.

Effect of manuring,irrigation water salinity and amino acids on grain weight yield of wheat

Data in Table (5) reveal that pots of no chicken manure application averaged 2.27 g /pot. This value was increased under chicken manure. Similar results were obtained by Nagi *et al.* (1988), who stated that organic manure application increases the biological wheat yield. This increase was contributed to the soil improvement which is induced by organic manure application. Khalill *et al.* (1991) concluded that the increase in wheat grain and straw yield was accompanied with the organic wastes which improved the water use efficiency.

Irrigation water salinity used for irrigation reduced the grain yield of wheat, on average from 3.68 g / pot under lowest salinity to 2.63 g / pot and 2.06 g / pot for water of medium and high salinity, respectively.

Results in Table (5) reveal that manuring reduced the hazardous effect of water salinity on grain yield of wheat by 14%, 76% and 79% with the use of the low, medium and high salinity water respectively .

Effect of manuring and amino acids spraying

Treatment of no amino acid spraying averaged 2.55 g / pot. This value was increased by 10%, 9% and 18% by sprayed with arginine, proline and proline + glutamic, respectively.

Also results demonstrate that the grain yield of wheat increased by 49% due to manure application and was increased by 53%, 45 %and 35% due to arginine, proline and proline + glutamic respectively. Such results suggest a superiority due to arginine spraying on wheat plant as compared to proline and proline + glutamic .

Irrigation water salinity and amino acids spraying

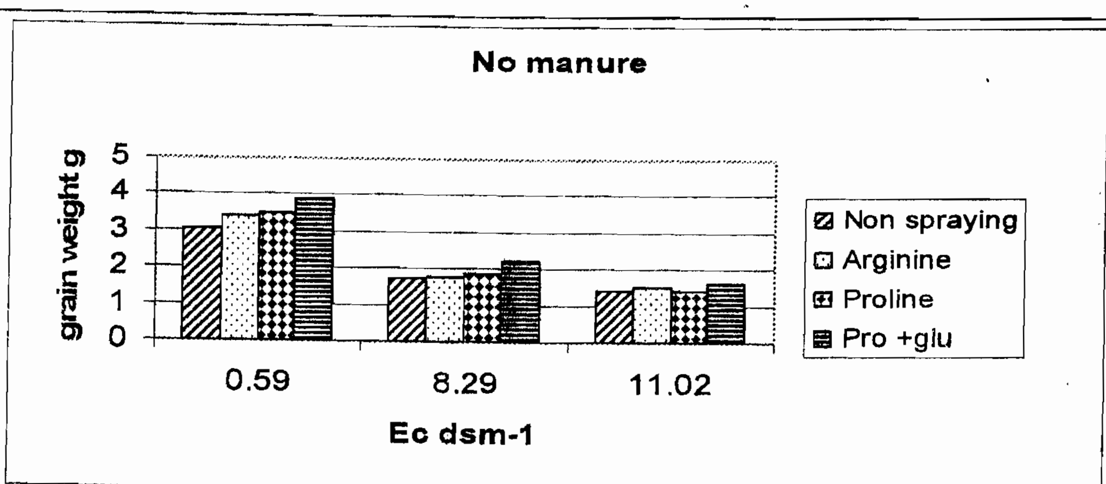
Grain yield of wheat decreased due to salinity increase of irrigation water. As for water salinity and amino acid spraying there were increments of 13%, 7% and 19% due to foliar application with arginine,proline and proline + glutamic,respectively under low salinity water and to 0.2%,4% and 12 % under the high salinity.

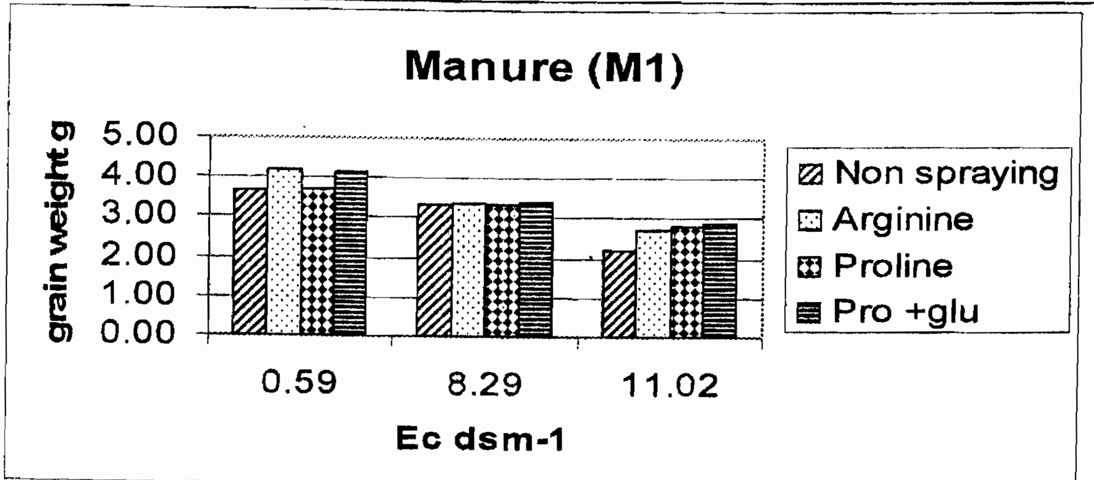
Manuring, water salinity and amino acids spraying

Spraying of wheat plants with amino acids affected differently grain yield of wheat to reach maximum values of 3.87 and 4.17 for proline+ glutamic and arginine spraying under low salinity water combined with no manuring and manuring respectively.

Table (5): Effect of manuring and amino acids spraying: Effect of manuring, irrigation water salinity and plant spraying with some amino acids on grain weight yield of wheat

Manuring	Water	Amino Acids spraying (SP)				
CM	dSm^{-1}	Non spraying	Arginine	Proline	Pro +glu	Mean
M_0	W_1 (0.59)	3.03	3.37	3.5	3.87	**3.44**
	W_2 (8.29	1.73	1.78	1.88	2.22	**1.90**
	W_3 (11.02)	1.40	1.50	1.41	1.60	**1.48**
	Mean	**2.05**	**2.22**	**2.26**	**2.56**	**2.27**
M_1	W_1 (0.59)	3.66	4.17	3.72	4.14	**3.92**
	W_2 (8.29	3.31	3.36	3.33	3.39	**3.35**
	W_3 (11.02)	2.20	2.70	2.80	2.90	**2.65**
	Mean	**3.06**	**3.41**	**3.28**	**3.48**	**3.31**
Mean		**2.56**	**2.81**	**2.77**	**3.02**	**2.79**
Water dSm^{-1}	W_1 (0.59)	3.35	3.77	3.61	4.01	**3.68**
	W_2 (8.29	2.52	2.57	2.61	2.81	**2.63**
	W_3 (11.02)	1.80	2.10	2.11	2.25	**2.06**
L.S.D BC=.029	A=0.00061 ABC=.041	B= 0.027	AB=.038	C=0.17	AC=.024	





Such effect due to amino acids was obviously retarded to reach minimum values upon irrigation with the highest water salinity under no spraying and in absence and presence of manuring respectively. The beneficial effect of manure was obvious in all cases. Amer (1994) stated that exogenous addition of amino acids porline, glutamic & arginine to barley through foliar application at seedling stage minimized the adverse effect due to salinity.

Main effect of manuring, irrigation water salinity and amino acids spraying on N % in the straw of wheat

N content in unmanured treatment averaged 0.76% N, while increased to amean value of 0.98% by manuring. (Table 6).

Irrigation saline water reduced the percentage of N from 1.08% under low salinity water to 0.85 and 0.68 under medium and high salinity respectively. Soliman *et al.* (1994) reported that NO_3 content in leaves of wheat plants decreased markedly as salinity increased up to 8.2 dS/m of saline irrigation water. Delgado & Sanchez (1998) reported that salinity caused decrease in nitrogen content in sunflower seedlings (Table 6).

Results in Table (6) reveal that soil manuring reduced the hazardous effect of irrigation salinity on N content in wheat straw by 32% using low salinity water and 16%, using medium salinity water 42% using high salinity water, respectively.

It can be noticed from Table (6) that spraying of amino acids increases N content averages to 0.78, for the no spray, and to 0.92, 0.89 and 0.88% corresponding to 17%, 14%, 13%, respectively, due to foliar application of arginine, proline and proline +glutamic respectively.

Table (6): Effect of manuring, irrigation water salinity and plant spraying with some amino acids on N% in wheat straw

Manuring	Water	some amino acids Amino Acids spraying (SP)				
CM	dSm^{-1}	Non spraying	Arginine	Proline	Pro +glu	Mean
M0	W_1 (.59)	0.88	0.95	1.05	0.84	**0.93**
	W_2 (8.29	0.77	0.93	0.67	0.77	**0.79**
	W_3 (11.02)	0.49	0.53	0.60	0.6	**0.56**
	Mean	**0.71**	**0.80**	**0.77**	**0.74**	**0.76**
M1	W_1 (.59)	1.12	1.19	1.30	1.3	**1.23**
	W_2 (8.29	0.84	1.05	0.88	0.89	**0.92**
	W_3 (11.02)	0.60	0.88	0.84	0.88	**0.80**
	Mean	**0.85**	**1.04**	**1.01**	**1.02**	**0.98**
Mean		**0.78**	**0.92**	**0.89**	**0.88**	**0.87**
Water	W_1 (.59)	1.00	1.07	1.18	1.07	**1.08**
dSm^{-1}	W_2 (8.29	0.81	0.99	0.78	0.83	**0.85**
	W_3 (11.02)	0.55	0.71	0.72	0.74	**0.68**
L.S.D	**A=.056 ABC=0.1005**	**B =0.0744**	**AB =N.S**	**C=0.041**	**AC=.058**	**BC=.07**

Manuring and amino acids

Results indicate that the nitrogen content of straw of wheat increased. by 20% due to chicken manure application and increased by 30%, 31% and 38% for arginine, proline and proline + glutamic, respectively .

Water salinity and amino acids spraying

It could be noticed that the decrease in N content caused by increasing water salinity was more severe in plants not sprayed with amino acids, in which salinity water caused 45% decrease in N content compared with the low salinity water. However, under spray with amino acids the decrease was 31 to 38 %.

Effect of manuring, irrigation water Salinity and amino acids spraying on P content

Results in Table (7) reveal that P% in wheat straw increased from 0.11% (no manure) to 0.21% by manuring. This means that the increament reached about 0.91 % as result to manuring.

Results show that P content decreased by increasing salinity. Abd-El-Hadi *et al.* (1982) found that high osmotic potential of saline water decreases P uptake by plants grown under saline conditions. Sharma & Swarup (1988) observed that uptake of P decreased by salinity. Padole (1995), on wheat plants grown under salt affected conditions, observed that uptake of P was adversely affected with increasing salinity of irrigation water.

Table (7): Effect of manuring, irrigation water salinity and plant spraying with some amino acids some amino acids on p% in wheat straw

Manuring	Water	Amino Acids spraying (SP)				
CM	dSm^{-1} (I.W)	Non spraying	Arginine	Proline	Pro +glu	Mean
M0	W1 (.59)	0.11	0.13	0.14	0.12	**0.13**
	W2 (8.29	0.09	0.10	0.12	0.10	**0.10**
	W3 (11.02)	0.08	0.09	0.09	0.10	**0.09**
	Mean	**0.09**	**0.11**	**0.12**	**0.11**	**0.11**
M1	W1 (0.59)	0.33	0.25	0.20	0.26	**0.26**
	W2 (8.29	0.24	0.19	0.18	0.21	**0.21**
	W3 (11.02)	0.15	0.16	0.15	0.19	**0.16**
	Mean	**0.24**	**0.20**	**0.18**	**0.22**	**0.21**
Mean		**0.17**	**0.15**	**0.15**	**0.16**	**0.16**
Water	W1 (0.59)	0.22	0.19	0.17	0.19	**0.19**
dSm^{-1}	W2 (8.29	0.17	0.15	0.15	0.16	**0.15**
	W3 (11.02)	0.12	0.13	0.12	0.15	**0.13**
L.S.D	A=0.036	B=.014	AB=.018	C=0.013	AC=.0183	BC=.0225

The lowest P content as affected by salinity and amino acid spray was due to proline spraying in combination with the high salinity water, while the highest percent of P occurred under the low salinity water combined with spraying with arginine or proline + glutamic acid .

Effect on K content in plant

Results in the Table (8) indicate that K in the soil treated with chicken manure slightly increased K in wheat straw, where K decreased using high salinity water.

Spraying with arginine and proline) as well as the mixture of proline +glutamic acid increased K content in straw.

Such results emphasize the positive role of suitable irrigation water source, and amino acids spraying to wheat plant. Begum *et al.* (1992) concluded that NaCl salinity decreased K in wheat. Hamada *et al.* (1992) showed that potassium content in wheat decreased with increasing salinity.

Table (8): Effect of manuring, irrigation water salinity and plant spraying with some amino acids on k% IN wheat straw

Manuring	Water	Amino Acids spraying (SP)				
CM	dSm^{-1} (I.W)	Non spraying	Arginine	Proline	Pro +glu	Mean
M0	W1 (0.59)	1.35	1.74	1.75	1.61	**1.61**
	W2 (8.29	1.10	1.71	1.51	1.57	**1.47**
	W3 (11.02)	1.08	1.28	1.49	1.19	**1.26**
	Mean	**1.18**	**1.58**	**1.58**	**1.46**	**1.45**
M1	W1 (0.59)	1.68	1.76	1.81	1.89	**1.79**
	W2 (8.29	1.23	1.54	1.71	1.89	**1.55**
	W3 (11.02)	1.17	1.62	1.23	1.53	**1.39**
	Mean	**1.36**	**1.64**	**1.58**	**1.77**	**1.59**
Mean		**1.27**	**1.61**	**1.58**	**1.61**	**1.52**
Water	W1 (0.59)	1.52	1.75	1.78	1.75	**1.70**
dSm^{-1} (I.W)	W2 (8.29	1.17	1.63	1.61	1.73	**1.53**
	W3 (11.02)	1.13	1.45	1.36	1.36	**1.32**
L.S.D	A=N.S ABC=0.1914	B=.104	AB=N.S	C=0.078	AC=.1104	BC=.1353

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تأثير الرش ببعض الحماض الامينية على بعض الصفات الكيميائية والانتاجية لمحصول القمح تحت ظروف الري بالمياة الملحية

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اجريت تجربة إصص بمعهد بحوث الأراضي والمياه والبيئة لدراسة مدى استجابة محصول القمح سخا ٩٣ لاضافة مخلفات الدواجن وكذالك الرش الورقي بواسطة الاحماض الأمينية تحت ظروف الري ومستويات مختلفة من الملوحة وتأثير ذلك على الوزن الجاف للمحصول والحبوب بالاضافة الي المحتوي من العناصر الكبرى (نيتروجين، فسفور وبوتاسيوم). اظهرت النتائج وجود زيادة معنوية في المادة الجافة للقش وكانت ٣٢%، ٢٤%، ٧١% نتيجة لبرش بواسطة الارجنين، البرولين والبرولين+الجلوتاميك على الترتيب.

اتضح من الدلراسة ان معاملة الارض بمخلفات الدواجن ادت الي حدوث زيادة قدرها ٤٩%، كما اوضحت النتائج ان استخدام الاحماض الامينية في رش النبات ادى الي حدوث زيادة في المستوى النيتروجيني في محصول القش عند استخدام الارجنين مع اقل مستوى من الملوحة للمياة وكذالك قلة المحتوى النيتروجيني في حالة الرش بالارجنين مع اعلي مستوى من الماوحة في المياة.

اظهرت النتائج ان اقل نسبة من الفسفور عند الرش بواسطة البرولين مع اعلي مستوى من الملوحة بينما ارتفعت النسبة الي ٢٢% و١٩% عند استخدام اقل مستوى من الملوحة والرش بواسطة البرولين والأرجنين على الترتيب.

استخدام الارجنين، البرولين وكذالك البرولين+الجلوتاميك ادى الي زيادة نسبة البوتاسيوم في محصول القش.