EFFECT OF IRRIGATION AT DIFFERENT INTERVALS AND SPRAYING WITH ZINC SULPHATE AT DIFFERENT LEVELS ON GUAR PLANT *CYAMOPSIS TERAGONOLOBA* L. TAUB

MALAKA I. EID, EATEMAD, O. EL-GHAWWAS AND SHADIA, K. AHMED

Horticultural Research Institute, Agricultural Rsearch Centre, Giza, Egypt.

(Manuscript received 15 October 1995)

Abstract

This investigation was Carried out to study the effect of irrigation at different intervals and spraying zinc sulphate at different levels on guar. The experiments were carried out in the Medicinal and Aromatic Plants Section, Dokki during 1993 and 1994. Three intervals of irrigation (every one, two and three weeks) and four levels of zinc sulphate as foliar spraying (0.30,50 and 80 ppm) were tried in this study. The results showed that there were significant increases in the weight of pods and the weight of seeds per plant when the plants were irrigated every week and sprayed with zinc sulphate at the level of 30 ppm. The percentage and yield of guar gum increased when the plants were irrigated every three weeks and sprayed with zinc sulphate at the level of 30 ppm.

INTRODUCTION

Guar Cyamoposis tetragonoloba L. Taub is a draught resistant annual legume plant which for generations has been grown as an agricultural crop in India and Pakistan, where it is still as food and in animal feeding. Ahmed et al., (1958) stated that guar seeds are considered as an important source of guar gum. Stafford (1975) found that the gum content seeds of guar plant is in the range of 11.23 to 26.23%. Tripathi and Srivastaval (1975) stated that guar gum is used extensively in paper industry, mining explosives, foods, pharmaceuticals, cosmetics, textile and reconstituted tobacco industries. It is also used in oil industry where it is used as a stablizing material in the drilling muds. Stafford (1975).

Many investigations were carried out to study the effect of irrigation intervals on growth, seed yield, Moursi et al., (1978) and Gomaa et al., (1981) found that the height of the main stem of cotton plant was decreased by increasing the soil moisture tention .

Drought in certain cases to be considered as an effect on the growth through the lack of water needed for physiological and biochemical reactions as reported by Ong (1978).

Zinc is one of the most important elements to the growth of plants. This may be due to the necessity of zinc for the synthesis of indole acetic as well as other auxins. Skoog (1940) and Tavi (1948) mentioned that presence of zinc is necessary for tryptophane synthesis and that zinc deficiency has an indirect effect on the reduction of quantity of auxins present. Saad et al., (1980) pointed out that spraying with zn showed increases in plant height, number of leaves and stem dry weight of broad been plant. Marsh et al., (1985) stated that seeds per pod and seed yield of cowpea plants were the highest at the height application of zinc level. El-Sawah (1988) reported that the response of dry been yield to zn foliar application was mainly due to difference in number of pods produced per square meter, number of seed per pod and seed weight.

The present investigation was carried out to study the effect of the frequency of irrigation and also the spraying of guar plants with different concentration of zinc sulphate on the growth, seed yield and the percentage of guaran in the guar seeds.

MATERIALS AND METHODS

The experiment was conducted during the summer seasons of 1993 and 1994 at the Farm of Medicinal and Aromatic Plant Section at Dokki, Horticultural Research Institute, Agricultural Research Centre, A.R.E., Giza.

Seeds of guar were obtained from the same farm. They were sown in dry soil on July 15th, 1993 and 1994 respectively. The ridges were 60 cm. in width and 3m. long the plot area was ($2x2m^2$) consisting of three rows, the distance between drills was 25cm. The experiment was designed in split plots with three replicates. The irrigation treatments at different intervals (one, two and three weeks) were the main plot, while spraying with zinc sulphate at different levels (0,30,50 and 80 ppm) were sub plots. Chemical fertilizer were used at the rates of 200 Kg. ammoni-

um sulphate/Fed (20.5% N), 200 Kg calcium super phosphate/Fed (15.5 P2 O_2) and 100 Kg. potassium sulphate/Fed (48% K2O). They were added in two equal portions, the first one was when the height of the plants reached 20cm. and the second was just before flowering.

Spraying the plants with zinc sulphate at different levels was carried out in the same time of adding N.P.K. fertilization. The irrigation of plants was by using furrows irrigation method.

Plant samples for analysis were taken at the stage of full maturity by harvesting guar plants at the stage of ripening of fruits (pods) in Nov. 15th in the two seasons.

The following data were recorded, plant height, number of branches, number of pods, weight of dry pods, seed yield per plant, guar gum percentage and yield of guar gum. Guar gum was determined by using the method described by Anderson (1949), by using a sample of seeds and heated with boiling water, then precipitated by alcohol, filtered, washed with hot water and the filtered dried and weighed.

The data were statistically analyzed according to the methods of Snedecor (1967).

Table 1 shows the macro and micro elements analysis of the soil, and table 2 shows the chemical composition of the experimental soil.

Table 1 . Macro and micro element analysis of the soil in ppm.

Season	N %	P %	K %	Iron ppm	Cupp. ppm	Zinc ppm	Mang. ppm
1st	31.80	11.40	360.00	5.40	11.60	4.00	4.20
2 nd	36.20	12.13	410.00	5.20	9.40	3.60	3.30

Table 2. The analysis of the soil .

Seasons	T.S.S. %	pH	Ec mmoh/cm	F.C %
1 st	0.102	7.4	0.32	31.34
2 nd	0.120	7.3	0.39	31.29

RESULTS AND DISCUSSION

Plant height

Data presnted in Table 3 showed that there was a significant increase in plant height by applying, irrigation every three weeks in the first seasons, while in the second one, the treatment every two weeks was significantly increased compared with other treatments these results were in agreement with Halim et al., (1989) who mentioned that, the maturity of alfa plant decreased linearly with increasing water stress. These results may be due to the difference in seasonal condition in the first and second seasons.

With regards to the effect of zinc sulphate foliar spray in the level of 80 ppm presented in the same table, the data indicated that, there was a significant increase due to the increase of zn concentration in both seasons compared with control. These results were in hormony with those obtained by Saad et al., (1980) who pointed out that spraying with zn showed increase in plant height of broad bean plant.

Number of branches

Data in Table 4 indicated that plants irrigated every three weeks gave higher number of branches than those produced by plants irrigated every one or two weeks in the first season. On the other hand in the second season plants irrigated every two weeks gave higher number of branches than those irrigated every one and three weeks with other treatments in intervals of irrigation.

The application of zinc sulphate at a rate of 50 ppm, gave a significantly increase in the number of branches of guar plant compared with other treatments. Also the application of irrigation every three weeks and spraying, of zinc sulphate at the level of 50 ppm showed increasing in the number of branches in the two seasons.

Number of pods per plant

Data presented in Table 5 indicated that in both seasons, the plants irrigated every week gave a significant increase in the number of pods than then irrigation was applied every two or three weeks. This result was in agreement with Bosila (1982) who mentoined that the maximum number of pods per plant of guar was obtained by irrigating the plants every 10 days during the growing season. Spraying zinc sulphate at 30 ppm gave a significant increase in the number of pods in the two seasons as compared with other treatments. This result was in agreement with

Table 3. Effect of irrigation intervals and spraying with Zn sulphate at different levels on guar height in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	155.33	161.66	169.33	161.44	151.66	171.66	146.33	156.55
50 ppm	141.66	163.33	167.66	157.55	143.33	168.33	167.66	159.77
80 ppm	148.33	16500	177.66	163.66	141.66	177.66	167.33	162.21
Control	156.66	12.66	15.00	143.10	138.33	136.66	126.66	133.88
Mean	149.99	153.16	166.16		143.75	163.57	151.99	

L.S.D. at 0.05 for Irrigation	9.62	0.11
L.S.D. at 0.05 for Spray	7.02	5.21
L.S.D. at 0.05 for Irrigation X Spray	12.16	9.03

Table 4. Effect of irrigation intervals and spraying with Zn sulphate at different levels on the number of branches of guar plants in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	13.66	14.00	17.00	14.88	14.66	14.33	13.00	13.99
50 ppm	14.00	15.33	19.66	16.33	15.00	17.00	19.00	17.00
80 ppm	12.00	12.66	12.66	12.44	13.00	17.00	12.66	14.22
Control	13.00	8.33	12.33	11.22	13.00	14.00	13.66	13.55
Mean	13.17	12.58	15.41		13.92	15.58	14.58	

L.S.D. at 0.05 for Irrigation	1.07	0.76
L.S.D. at 0.05 for Spray	1.23	1.07
L.S.D. at 0.05 for Irrigation X Spray	2.13	1.85

Gangwar and Singh (1986) they found that seed coating with zn followed by foliar spray with zn SO increased pod number and seed/pod.

Treating plants irrigated every week and spraying with the lowest level of zinc sulphate at (30 ppm) resulted in the highest number of pods in both seasons .

Dry weight of pods per plant :

The data obtained in table 6 showed that irrigation plants every week increased significantly the dry weight of the pods compared with other treatments in the two seasons.

More further fertilization with low level treatment with zinc sulphate spraying 30 ppm. increased dry weight of pods as compared with control and other levels of zince treatments in both seasons.

These results were in agreement with El-Gizy (1990) on plant hwo mentioned that, spraying with zn SO4 at level 0.02% showed favourable effect on fresh and dry weights of pods.

Concerning the interaction between irrigation and spraying plants with zinc sulphate treatments, the data showed that the shortest period of irrigation and lowest level of zin sulphate treatment resulted in the highest dry weight of pods .

Yield of seeds per plant :

Data in Table 7 indicated that irrigation once a week significantly increased the yield of seeds per plnt compared with other treatments. These reasult were in agreement with Bosila (1982) who found that reducing irrigation intervals significant increased the weight of seeds per plant .

Spraying plants with zn sulphate 30 ppm resulted in a significant increase in the seed yield over other levels of zinc sulphate teatments in the two seasons. These results were in agreement with Villarrol et al., (1981) on *Phaseohus vulgaris*, Bank (1982) on soybean, Gabal et al., (1985) on Giza 3 common bean and El-Sawah (1988) who declared that zn foliar application increased seed yield.

Concerning the interaction between the two factors i.e. irrgation intervals and spraying with zinc sulphate data showed that, the highest yield of seeds per plant was obtained by using short irrigation intervals (one week) and lowest level of zinc sulphate (30 ppm). Table 6 and 7 show that the increase in seed weight was positively related to the increase in pod weight. Consequently, it is expected that more seed will be otained from heavier pods.

Table 5. Effect of irrigation intervals and spraying with Zn sulphate at different levels on the number of pods of guar plants in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	225.60	129.33	189.66	181.53	159.00	142.00	135.33	145.44
50 ppm	106.66	108.00	145.00	119.88	114.00	119.00	79.00	104.00
80 ppm	149.33	109.33	151.00	136.55	143.00	201.00	87.00	143.66
Control	175.66	123.33	159.00	152.66	203.00	55.00	145.00	134.33
Mean	164.31	117.49	161.16		154.75	129.25	111.58	

L.S.D. at 0.05 for Irrigation	2.21	4.06
L.S.D. at 0.05 for Spray	3.30	3.01
L.S.D. at 0.05 for Irrigation X Spray	5.72	5.21

Table 6. Effect of irrigation intervals and spraying with Zn sulphate at different levels on the dry weight of pods of guar plants in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	68.10	56.10	48.30	57.50	80.30	63.10	79.00	74.13
50 ppm	27.70	45.30	26.20	33.06	49.10	72.40	38.00	53.16
80 ppm	56.50	26.50	36.20	39.76	73.20	75.70	52.53	67.47
Control	56.13	23.00	32.30	37.13	80.30	73.46	67.90	73.90
Mean	52.10	37.72	35.75		70.74	71.16	59.35	

L.S.D. at 0.05 for Irrigation	0.41	2.50

Table 7. Effect of irrigation intervals and spraying with Zn sulphate at different levels on the seed yield of guar in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	36.30	26.60	24.60	28.50	44.10	35.70	39.80	40.06
50 ppm	20.60	24.60	16.10	20.43	30.50	31.20	18.00	26.56
80 ppm	33.20	18.40	15.30	22.30	36.40	22.10	26.00	28.16
Control	27.70	14.40	24.46	20.50	36.23	27.70	45.00	36.60
Mean	29.45	23.00	20.11		36.93	29.17	32.20	

L.S.D. at 0.05 for Irrigation	0.71	1.06
L.S.D. at 0.05 for Spray	8.46	11.68
L.S.D. at 0.05 for Irrigation X Spray	19.86	23.35

Table 8. Effect of irrigation intervals and spraying with Zn sulphate at different levels on the percentage of guar gum in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	24.80	25.37	34.50	24.89	22.87	16.93	33.87	24.56
50 ppm	13.13	28.67	33.63	25.15	13.00	27.30	32.63	24.31
80 ppm	23.67	27.60	27.00	26.09	22.87	26.33	26.00	25.07
Control	15.00	16.00	17.62	16.58	14.67	14.33	18.77	15.92
Mean	20.53	24.41	28.19		19.1	21.22	27.82	

L.S.D. at 0.05 for Irrigation	1.80	1.83
L.S.D. at 0.05 for Spray	1.62	0.17
L.S.D. at 0.05 for Irrigation X Spray	2.81	0.296

Table 9 . Effect of irrigation intervals and spraying with Zn sulphate at different levels on the gum yield in guar plants in the seasons 1993 and 1994.

Irrigation / Level of spray	season 1				season 11			
	one Week	Two Weeks	Three Weeks	Mean	one Week	Two Weeks	Three Weeks	Mean
30 ppm	6.48	8.54	8.46	7.82	10.30	6.04	15.15	10.49
50 ppm	2.69	7.01	5.41	5.03	3.97	8.57	5.55	6.03
80 ppm	8.31	5.27	3.96	5.84	8.31	5.80	6.93	7.01
Control	4.16	2.22	4.33	5.37	5.31	3.97	8.31	5.86
Mean	5.41	5.76	5.41		6.97	6.09	11.98	

L.S.D. at 0.05 for Irrigation	0.03	0.06
L.S.D. at 0.05 for Spray	0.03	0.23
L.S.D. at 0.05 for Irrigation X Spray	0.05	0.40

Percentage of guar gum in guar

Data in table 8 show that irrigation every three weeks resulted in a significant increase in the percentage of gum during the two seasons.

Data also show that the highest percentage of guar gum was obtained when spraying the plants with zinc sulphate 80 ppm compared with other zn treatments, in the two seasons.

The data also show that the highest percentage of gum was obtained when plants were irrigated every three weeks and sprayed with 30 ppm zinc sulphate .

Yield of guar gum per plant

Data Presented in table 9 showed that there was a significant increase in yield of gum per plant in case of irrigating plant every three weeks in the two seasons. This result may be due to that the yield of gum increased when the soil were drought

The data also show that, treating with zn sulphate (30 ppm) significantly increased the yield of gum per plant compared with the control in the two seasons.

Generally it could be recommended to use 30 ppm zinc sulphate and weekly irrigation for the best yield of seeds. The best percentage of guar gum was given by using 30 ppm zinc sulphate and irrigation every three weeks .

REFERENCES

1. Ahmed Z.F., N. Mekki, H.M. El-Nubi, M. Mostafa, S. Abd El-Keriem, and F.Hassanin. 1958. A preliminary investigation of guar plant as a new summer green fodder in Egypt. Proc. Pharm. Soc. of Egypt Vol. xxx , (15) .
2. Anderson, E. 1949. " Endosperm mucilages of legumes occurrence and composition" Univ. of Arizona. Tucson, Arizona Industrial Engineering of Chemistry (Vol. 41 - 288).
3. Bank, L.W. 1982. Effect of liming of foliar zinc fertilizer on yield components of soya beans. Australian Journal of Experimental Agriculture and Animal Husbandiy 22 (116) : 226-231 (Field crop Abst. 36 : (1622) .
4. Bosila, H.A. 1982. Effect of irrigation regimes and fulifertile foliar fertilizer on the growth and yield of guar. Al-Zahar Agric. Res. Bull. Fac. of Agric. bulletin No. 24, 1982 .

5. El-Gizy, S.M. 1990. Effect of some fertilizer treatments on some features and productivity of common bean plants. (Phaseolus vulgaris L.) Ph.D. Thesis Fac. Agric . Ain Shams. Univ .

6.El-Sawah, N.A. 1988 . Influence of Fe and Zn Foliar application on vegetative growth, yield and nutritional quality of bean Phaseolus vulgaris, I.M.Sc. Thesis Fac. Agric. Cairo Univ. Fayoum, A.R.E .

7. Gabal, M.R., I.M. Abdellah, I.A. Abed and F.M. El-Assiouty. 1985. Effect of Cu, Mn and Zn foliar application on common bean growth flowering and seed yield. Acta. Hort. 158 : 307-319 .

8. Gangwar, K.S. and K.S. Singh. 1986. Effect of zinc fertilization on lentil yields and yield attributes, Lens Newsletter 13 (1) 17-20 (Field crop Abst. 41 : 8011) .

9. Gomaa, M.E., A.A. Nowar., M.S. Rady. 1981. Response of Egyptian cotton to nitrogen fertilizer and irrigation frequency. 1-Growth characters and yield components Monoufia J. Agric. Res. 4 : 158 - 187 .

10. Halim, R.A., D.R. Buxton, M.J. Hattendrof and R.E. Carlson. 1989. Water-stress effect of Aifalfa forage quality after adjustment for maturity differences. Agron. Jour. Vol. 81 189 - 194 (1989) .

11. Marsh, D.B., L. Waters, and P.D. Ascher.1985. The use of a split root technique to study Zn movement and activity in a nodulation cowpea root system. Hortscience 20 (3) : 425 - 427 .

12. Moursi, M.A., N.A. Nour El-Din, Salam and M.M. Hussein. 1978. Effect of available soil moisture on cotton plant. 1- Effect on growth. Egyptian J. Agron., 3,85-91 .

13. Ong, A.T. 1978. Role of haemons in the responses of excised tomato cotyledons to mainnitol induced water stress. Biologia Plantarum, 20 (5) : 318 - 323 .

14. Saad, A.O.M., M.G. Yakout, and A.T. Thalooth. 1980. Effect of method of phosphorus application and spraying with micro nutrients on broad bean Vicia faba., Egyptian Journal of Agronomy, 5 (2) 109-118 .

15. Skoog, F. 1940. Relationship between zinc and auxin in the growth of higher plants. Amer. Jour. Bot. 27 : 939 - 951 .

16. Snedecor, G.W. 1967. Statistical method 3rd Ed. Iowa, State Univ. Press, Amer, Iowa, U.S.A .

17. Stafford, R.E. 1975. "Other uses of guar" Under exploited tropical plants with promising economic value, Washington, D.C. National Acedemy of Science 1975.

18. Tavi, C.1948. The role of zinc in auxin synthesis in the tomato plant. Amer. Jour. Bot. 35, 172,9.

19. Tripathi, R.D. and G.P. Srivastaval. 1975. Note on the gum content of some new strains of guar Cyamopsis psoraloides. Indian Journal 9 (3) 153 - 154 (En, 4 ref.) U.P. Inst. of Agric. Sci. Kanpur, U.P., India. F. Crop. Abst. Vol. 29 P. 9803, 1976.

20. Villarroel, A.J., E.R. Nunez, L.J. Cajuste and M.D. Aguirre. 1981. Response of maize and Phaseolus vulgatis to application of han and cattle manure, zinc magnanese and iron is soils of cuidad serden, Pueble, under field and green-house condition. Agrociencia, Mexico, 44 : 77, 90. (CAB Abst. 50 : 1622870)

تأثير فترات الرى و الرش بسلفات الزنك بمستويات مختلفه على نبات الجوار

ملكه ابراهيم عيد ، إعتماد عثمان الغواص ،
شادية قطب احمد

قسم بحوث النباتات الطبية والعطرية – معهد بحوث البساتين –مركز البحوث الزراعية.

اجرى البحث فى مزرعة الدقى خلال عامين ١٩٩٣ – ١٩٩٤ وكانت معاملات الرى اسبوع واسبوعين وثلاثة اسابيع بينما كانت معاملات الزنك هى (صفر ، ٣٠ ، ٥٠ ، ٨٠ جزء فى المليون) على صورة كبريتات زنك رشا .

وكان من أهم النتائج المتحصل عليها هى :

١- زاد عدد القرون وكذلك وزن القرون ووزن البذره عند الرى كل اسبوع والرش بمحلول كبريتات الزنك بتركيز ٣٠ جزء فى المليون .
٢- فى حالة الزراعه للحصول على بذور الجوار ينصح باستعمال الرش بكبريتات الزنك بمستوى ٣٠ جزء فى المليون والرى كل اسبوع .
٣- فى حالة الحصول على صمغ الجوار ينصح بالرش بكبريتات الزنك بمستوى ٣٠ جزء فى المليون والرى كل ثلاثة اسابيع .