Zagazig J.Agric. Res., Vol .30 No.(1) 2003 129-145

EFFECT OF INTERCROPPING SYSTEM TREATMENTS ON GROWTH, YIELD COMPONENTS, ANTHOCYANIN PRODUCTION AND CHEMICAL CONSTITUENTS OF ROSELLE PLANT

. Meawad A. A* , A. A. Helal ** and Amer , E. H. ***
*Hort. Dept., Agric. Fac., Zagazig Univ., Zagazig
** Efficient Productivity Institute , Zagazig University
***Hort. Dept., Agric. Fac., El-Azhar Univ., Assuit

Received 11 / 1 / 2003 *Accepted 14 / 1 / 2003*

ABSTRACT : The present work aimed to study effect of intercropping system treatments on growth characters, yield components , anthocyanin production and some chemical constituents of roselle plant when intercropped with guar plant. However, the intercropping system treatments were (1+1) , (1+2),(1+3) , (2+1) and (3+1) of roselle and guar, respectively . Moreover, solid planting system of roselle , was used as control . The obtained results reffered to that the intercropping system of one row of roselle with three rows of guar (1+3 system) treatment mostly recorded an increase in vegetative growth and root system characters (expressed as plant height , number of leaves, fresh and dry weights of leaves, shoots, or root and root length per plant), yield components (expressed as number of sepals and their weight per plant , anthocyanin production as well as sepal percentages and contents of each of total carbohydrate, nitrogen, protein, phosphorus or potassium comparing to solid planting system and those of the other ones . Moreover, most of intercropping system treatments used increased roselle characters of growth and yield components compared to that of solid planting system one . Whereas, there was a decrease in this respect in some growth characters and chemical constituents comparing to solid planting system treatment. Generally, it could be concluded that using intercropping system treatment of one row of roselle with three rows of guar resulted in the highest values of growth characters, yield components and anthocyanin production of roselle plant cultivated under Sharkia Governorate conditions .

INTRODUCTION

Nowadays, there is a tendency in an increase of herbal therapy by using substituted medicine . Roselle is one of the most important medicinal plants used in this respect. The main product of roselle is the dried sepals contained anthocyanin pigment which are used in preparing acidulous refreshing hot or cold drink in many climatic countries, besides its other medicinal uses.

In Egypt , the available area of cultivation is very limited and is not enough to meet our needs. It is settled that intercropping may be one way to increase the productivity of land and increasing the yield of unit area.

Consulting the available review of literature, there was no information concerning the effect of intercropping system treatments on medicinal plants including roselle or those of between roselle and guar on growth, yield components and chemical constituents (i.e. total carbohydrates , nitrogen, protein, phosphorus and potassium) of roselle plant. Also, there was no information regarding the effect of intercropping system treatments on the productivity of roselle sepals or anthocyanin . Therefore, the following available review of literature on other plants or organs might be usefull in this connection. However , intercropping system treatments showed an increase in plant height [as found by El-Shamma (1980) on broad bean intercropped with pepper , Hussein (1981) on soybean intercropped with maize, Shahien (1991) on tomato intercropped with some leguminous crops and Gawish *et al.* (1992) on tomato intercropped with pea]; number of branches [as reported by Gawish *et al.* (1992) on tomato with pea and Itulya *et al.* (1997) on intercropping collard with cowpea] ; number of leaves [as recorded by Bonaparte and Brawn (1976) on 2 maize cultivars when intercropped with soybean]; fresh and dry weights of shoots and leaves [as mentioned by Change and Shibles (1985) on intercropping

cowpea with maize, Mendoza (1986) on sugar cane when intercropped with maize , cassava , sweet potatoes, Itulya *et al.* (1997) on collard with cowpea and El-Dokaishy (1999) on cauliflower intercropped with white clover or earth clover]; total nitrogen , phosphorus and potassium [as stated by Chang and Ho (1969) on groundnut intercropped with sugar cane or sweet potato and El-Shamma (1980) on pepper when intercropped with broad bean].

On the other side, there was a decrease, by using some intercropping system treatments comparing to that of solid one , in plant height [Moursi (1965) on onion intercropped with cotton, El-Shamma (1980) on lettuce or pea intercropped with pepper, Shahien (1991) on broad bean or peas intercropped with tomato, Gawish *et al.* (1992) on pea intercropped with tomato, Abd El-Baky (1994) on cowpea or squash intercropped with okra, El-Gamili (1994) by intercropping onion with strawberry and Ali (1999) on garlic , onion or phaseolus intercropped with strawberry]; number of branches [Mohamed (1989) on guar intercropped with maize, El-Doubi (1992) on soybean intercropped with maize, El-Waraky (1996) on cowpea, squash, beans, Jew's mallow or spinach intercropped with eggplant and Ali (1999) on phaseolus intercropped with strawberry] ; number of leaves Ali (1999) on onion, garlic and phaseolus by intercropping with strawberry]; dry weight of shoots [Abd El-Baky (1994) on cowpea or squash with okra, El-Gamili (1994) on onion intercropped with strawberry, El-Waraky (1996) on each of squash, cowpea, beans, Jew's mallow or spinach when intercropped with eggplant and Soliman (1999) on garlic intercropped with turnip, carrot or radish] and total nitrogen , phosphorus and potassium contents [Moursi (1968) on garlic intercropped with cotton].

Therefore, the present work aimed to study the effect of intererepping system

treatments between roselle and guar plants on growth, yield components, anthocyanin production and chemical constituents of roselle plant cultivated under Sharkia Governorate conditions .

MATERIALS AND METHODS

The present work was conducted at a special farm in Inshas El-Raml District, Sharkia Governorate during two successive growing seasons of 1997 and 1998.

The seeds of roselle (*Hibiscus sabdariffa,* L)and guar (*Cyamopsis tetragonoloba,* Tuab) plants were obtained from Research Center of Medicinal and Aromatic Plants, Dokky, Giza.

The seeds of both roselle and guar plants were sown in the first of May in both two seasons of 1997 and 1998. The seeds were handly sown, immediately irrigated and after germination the seedling were thinned after three weeks from planting to be one plant /hill for roselle and two plants /hill for guar. The physical and chemical properties of the used soil are shown in Table (A).

The plot area was [2 x 7.80m] and included twelve rows, each row was 60 cm apart and 2m in length. The plants were sown on rows in hills on one side. The distances between successive hills were 50 cm for roselle and 30 cm for guar plant.

Table (A):The physical and chemical properties of the used soil

Sand	17.40	%
Silt	36.10	%
Clay	46.50	%
Organic matter	1.73	%
Total nitrogen	0.52	%
Water soluble phosphorus	0.05	%
Available potassium	0.59	Meq/l.
pH	7.90	

The intercropping system treatments were as follows :

1-1 row of roselle + 1 row of guar (1+1).
2-1 row of roselle + 2 rows of guar (1+2).
3-1 row of roselle + 3 rows of guar (1+3).
4-2 rows of roselle + 1 row of guar (2+1).
5-3 rows of roselle + 1 row of guar (3+1).
6-Solid planting system of roselle, since it was practised on one side of the row , one plant / hill, 50 cm distance apart hills. Such treatment was used as control for roselle characters.

The experimental design was simple in complete randomized block design with three replicates. Each replicate contained twelve rows.

All the plants received normal agricultural practices whenever they needed.

The following data were recorded :

The outer two rows of each plot were considered as belt . For measuring growth characters, samples were taken from guarded plants in center of each plot . The central rows were kept for yield components determinations.

Growth characters recorded were plant height (cm), number of branches per plant, number of leaves per plant, fresh and dry weights of leaves per plant (gm), fresh and dry weights of shoots per plant (gm) and fresh and dry weights of root per plant (gm). At harvesting, the central rows of each plot were used for yield components of roselle plant expressed as number of sepals / plant and weight of sepals / plant (gm). However, sepals of roselle was taken 180 days after seed sowing in both growing seasons.

Anthocyanin pigment of roselle sepals was extracted in 1% acidified (HCl) ethanol, and was determined cholorimetrically according to the method described by Fuleki and Francis (1968) and developed by Du and Francis (1973) for *Hibiscus sabdariffa* . The anthocyanin values

were expressed as absorbance at 520 nm.

Total carbohydrates percentage was determined in roselle sepals according to Dubios *et al.* (1956). Total carbohydrates content per plant was calculated by multiplying total carbohydrate percentage by weight of sepals per plant of roselle.

Total nitrogen percentage was determined in roselle sepals according to that reported by Naguib (1969). Total nitrogen content per plant was calculated by multiplying total nitrogen percentage by weight of sepals per plant of roselle to obtain the content of total nitrogen per plant. Total protein percentage was calculated by multiplying total nitrogen percentage by the factor 6.25 to obtain the percentage of total protein. Total protein content per plant was calculated by multiplying total protein percentage by weight of sepals per plant of roselle to obtain the content of total protein per plant. Total phosphorus percentage was determined according to the method adapted by Hucker and Catroux (1980) . Total phosphorus content per plant was calculated by multiplying total phosphorus percentage by weight of sepals per plant of roselle to obtain the content of total phosphorus per plant. Potassium percentage was determined by using flame photometer, according to the method described by Brown and Lilleland (1964). Potassium content per plant was calculated by multiplying potassium percentage by weight of sepals per plant of roselle to obtain the content of potassium per plant.

Data of this work were statistically analyzed according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

1.Effect of intercropping system treatments on vegetative growth and root system characters of roselle plant

Data illustrated in Table (1) reveal that intercropping system of alternating one row

Table 1. Effect of intercropping system treatments on growth characters of roselle plants during 1997 and 1998 seasons

Intercropping systems treatments	Plant height (cm)	Number of branches / plant	Number of leaves / plant	Fresh weight of leaves / plant (gm)	Dry weight of leaves / plant (gm)	Fresh weight of shoots / plant (gm)	Dry weight of shoots / plant (gm)	Fresh weight of roots / plant (gm)	Dry weight of roots/ plant (gm)	Root length (cm)
					First season					
1 + 1	146.55	12.20	101.11	163.88	30.98	203.45	39.73	26.66	6.74	27.55
1+ 2	165.11	13.30	113.55	198.33	37.74	289.98	48.32	30.67	8.00	31.88
1 + 3	181.22	14.20	133.44	240.33	42.68	332.27	65.72	33.06	9.57	33.11
2 + 1	171.33	9.70	126.11	224.00	40.02	232.07	42.26	28.97	7.25	29.66
3 + 1	179.77	15.60	134.77	217.78	38.76	326.06	62.46	27.82	7.01	26.88
Solid	153.33	14.40	96.22	159.51	30.39	205.65	40.02	26.68	6.72	26.99
L.S.D. at 5%	5.86	1.89	7.44	12.79	1.91	23.46	3.57	1.67	0.57	3.35
L.S.D. at 1 %	7.86	2.54	9.99	17.16	2.56	31.48	4.79	2.24	0.77	4.50
					Second season					
1 + 1	132.00	11.33	107.00	170.29	32.29	211.42	43.34	28.72	7.71	24.44
1+ 2	138.00	13.00	108.88	203.64	38.88	296.97	52.19	32.19	8.96	30.11
1 + 3	167.11	13.33	121.88	225.96	45.10	338.08	67.21	34.21	10.20	32.33
2 + 1	159.33	14.00	116.11	235.95	42.38	237.60	43.07	30.46	8.01	29.55
3 + 1	169.55	11.66	122.11	223.02	40.68	331.94	63.83	28.88	7.87	26.33
Solid	132.55	11.33	86.22	162.94	31.21	210.38	43.63	27.11	7.39	23.33
L.S.D. at 5%	3.13	1.83	8.62	10.79	1.82	13.03	3.70	3.13	0.92	2.14
L.S.D. at 1 %	4.20	2.45	11.57	14.47	2.41	17.49	4.97	4.21	1.24	2.87

of roselle with three rows of gurar (1+3 system) treatment resulted in higher value in number of leaves per plant, fresh and dry weights of leaves, shoots or root and root length per plant compared to most of the other ones including solid system in the two seasons. In addition , most of intercropping system treatments showed an increase in this concern comparing with that of solid system. On the other hand, there was a decrease in this regard by using intercropping system treatment of one row of roselle with one row of guar (1+1 system) in plant height, fresh and dry weight of shoots per plant . Regarding number of branches per plant, Table (1) shows that, it was increased by using intercropping system treatment of three rows of roselle with one row of guar compared to that of solid system one in the two seasons. Whereas, there was a decrease in number of branches per plant by using that of one row of roselle with one row of guar intercropping system treatment (1+1) if compared with that of solid system one in the first season only.

Such increase, by using intercropping system treatments, was also found by El-Shamma (1980) on broad bean intercropped with pepper , Hussein (1981) on soybean intercropped with maize, Shahien (1991) on tomato with some leguminous crops and Gawish *et al.* (1992) on tomato intercropped with pea regarding plant height; Gawish *et al.* (1992) on tomato with pea and Itulya *et al.* (1997) on intercropping collard with cowpea as for number of branches; Bonaparte and Brawn (1976) on 2 maize cultivars when intercropped with soybean concerning number of leaves; Change and Shibles (1985) on intercropping cowpea with maize , Mendoza (1986) on sugar cane when intercropped with maize , cassava, sweet potatoes , Itulya *et al.* (1997) on collard with cowpea , and El-Dokaishy (1999) on cauliflower intercropped with white clover or earth clover regarding fresh and dry weights of plant organs .

Whereas, similar decrease was recorded by using intercropping system treatments by Moursi (1965) on onion intercropped with cotton, El-Shamma (1980) on lettuce or pea intercropped with pepper, Shahien (1991) on tomato intercropped with broad bean or peas, Gawish *et al.* (1992) on pea intercropped with tomato, Abd El-Baky (1994) on cowpea or squash intercropped with okra, El-Gamili (1994) by intercropping onion with strawberry and carrot , Ali (1999) on garlic , onion or phaseolus intercropped with strawberry [as for plant height]; Mohamed (1989) on guar intercropped with maize, El-Doubi (1992) on soybean intercropped with maize, El-Waraky (1996) on each of squash, cowpea, beans, Jew's mallow and spinach when intercropped with eggplant, Ali (1999) on phaseolus intercropped with strawberry [regarding number of branches]; Ali (1999) on onion, garlic and phaseolus by intercropping with strawberry [connecting to number of leaves]; Abd El-Baky (1994) on cowpea or squash with okra, El-Gamili (1994) when intercropping onion with strawberry, El-Waraky (1996) on each of squash, cowpea, beans, Jew's mallow or spinach when intercropped with eggplant, Soliman (1999) on garlic when intercropped with turnip, radish and carrot [concerning fresh and dry weights of leaves, shoots and roots].

2.Effect of intercropping system treatments on yield components of roselle plant

Results in Table (2) demonstrate that number of sepals and weight of sepals per roselle plant were increased by using intercropping system treatments [except that 1+1 system] comparing to solid planting system in both seasons. Furthermore, alternating one row of roselle with three rows of guar (1+3 system) gave the highest values in this regard compared to solid planting system or those of the other ones during the two seasons.

Table 2. Effect of intercropping system treatments on yield components of roselle plant during 1997 and 1998 seasons

Intercropping system treatments	Number of sepals / plant	Weight of sepals / plant (gm)	Number of sepals / plant	Weight of sepals / plant(gm)
	First season		Second season	
1+1	33.00	8.29	37.77	11.86
1+2	36.77	11.55	44.77	12.45
1+3	45.11	13.60	49.11	16.88
2+1	36.44	10.49	42.66	12.91
3+1	38.88	12.78	38.66	13.14
Solid	33.55	9.83	40.77	12.05
L.S.D. 5%	3.31	0.84	2.88	0.76
L.S.D. 1%	4.44	1.13	3.87	1.02

Consulting the available review of literature, there was no information regarding the effect of intercropping system treatments on yield components of roselle plant .

3.Effect of intercropping system treatments on anthocyanin production of roselle sepals

Data presented in Table (2) show that alternating one row of roselle with three rows of guar (1+3 system) gave higher values of anthocyanin content compared with solid planting system or the other planting system treatments in the two seasons. Whereas , using intercropping system treatments [except that of 1+3 system] mostly decreased anthocyanin content compared to solid planting system during the two seasons . However, consulting the available review of literature there was no information regarding the effect of intercropping system treatments on anthocyanin production in roselle sepals .

4.Effect of intercropping system treatments on some chemical constituents of roselle sepals

4.1.Total carbohydrates percentage and content

Data in Table (3) indicate that total carbohydrate percentage and content were increased by alternating one row of roselle with three rows of guar (1+3 system) comparing to solid planting system and the other planting system treatments in the two seasons. On the other hand, using intercropping system treatments[except that of 1+3 system] decreased total carboh - ydrate percentage compared to solid planting system. Whereas, total carbohydrate content was mostly increased by using intercropping system treatments [except that of 1+1system] comparing to solid planting system during the two seasons. However, consulting the available review of literature there was no information concerning the effect of intercropping system treatments on total carbohydrates percentage or content in roselle sepals or even other plant organs.

4.2 Total nitrogen as well as protein percentages and contents

Results in Table (3) reveal that alternating one row of roselle with three rows of guar (1+3 system) gave the highest values of total nitrogen as well as protein percentages and contents of roselle sepals comparing to solid planting system or other treatments of intercropping in the two seasons, whereas the other intercropping system treatments showed a decrease in this regard compared to solid planting system in both seasons .

4.3.Phosphorus and potassium percentages and contents

Data in Table (3) show that phosphorus and potassium percentages and contents recorded the higher values by alternating one row of roselle with three rows of guar [1+3 system treatment] compared to the other ones or solid planting system during the two seasons. On the other side, using the other intercropping system treatments showed a decrease in this

Table 3. Effect of intercropping system treatments on chemical constituents of the sepals roselle plants during 1997 and 1998 seasons

Intercropping systems treatments	Anthocyanin content	Total carbohydrate percentage	Total carbohydrate content /plant	Total nitrogen percentage	Total nitrogen content/ plant	Total protein percentage	Total protein content / plant	Total phosphorus percentage	Total phosphorus content / plant	Potassium percentage	Potassium content/ plant
					First season						
1 + 1	61.67	18.94	1.57	2.75	0.227	17.18	1.42	0.3989	0.0330	2.80	0.232
1+ 2	63.55	18.89	2.18	2.76	0.318	17.25	1.99	0.4052	0.0468	3.13	0.361
1 + 3	69.68	23.05	3.13	4.19	0.569	26.18	3.56	0.4524	0.0615	4.38	0.595
2 + 1	63.87	19.06	1.99	2.79	0.292	17.43	1.82	0.4352	0.0456	3.16	0.331
3 + 1	65.80	19.62	2.50	3.13	0.400	19.56	2.49	0.4167	0.0532	3.28	0.419
Solid	67.62	20.23	1.98	3.94	0.387	24.62	2.42	0.4419	0.0434	3.91	0.384
L.S.D. at 5%	4.22	1.81	NS	0.34	0.0533	3.805	0.332	NS	NS	0.97	NS
L.S.D.at 1%	5.66	2.44	NS	0.45	0.0757	5.412	0.472	NS	NS	1.30	NS
					Second season						
1 + 1	57.35	17.09	2.02	3.01	0.356	18.81	2.23	0.3545	0.0420	1.98	0.234
1+ 2	58.70	19.11	2.37	2.79	0.347	17.43	2.17	0.3387	0.0446	2.94	0.366
1 + 3	68.44	21.90	3.69	3.74	0.631	23.37	3.94	0.4342	0.0732	3.98	0.671
2 + 1	63.86	19.31	2.49	3.18	0.410	19.87	2.56	0.3884	0.0501	2.88	0.371
3 + 1	62.52	19.41	2.55	3.23	0.424	20.18	2.65	0.3768	0.0495	2.93	0.385
Solid	63.83	20.27	2.44	3.71	0.447	23.18	2.79	0.4157	0.0500	3.37	0.406
L.S.D. at 5%	2.77	2.04	0.599	0.35	0.103	2.954	0.649	0.042	NS	0.50	0.108
L.S.D. at 1%	3.71	2.73	0.853	0.47	0.147	4.202	0.923	0.057	NS	0.67	0.154

respect compared to that of solid one in the two seasons.

Consulting the available review of literature, there was no information connecting the effect of intercropping system treatments on total nitrogen , protein and phosphorus as well as potassium percentages or contents of roselle sepals . Therefore, the following available review of literature on other organs of other plants might be useful. However, Chang and Ho (1969) found that intercropping of groundnut with sugar cane or sweet potato increased P32 and K absorption in sugar cane or sweet potato. Moreover, El-Shamma (1980) found that percentages of N , P and K and their total uptake in leaves and stems of pepper plants seemed to be higher in intercropped plants than that of pepper plants grown in pure stand. On the contrary, Moursi (1968) on garlic intercropped with cotton found that intercropping treatment decreased the absolute contents of N, P and K compared to that of solid one.

Generally , it could be concluded that using intercropping system treatment of one row of roselle with three rows of guar resulted in the highest values in growth characters , yield components and anthocyanin production of roselle plant cultivated under Sharkia Governorate conditions.

REFERENCES

Abd El-Baky, M. M. H. 1994. Effect of intercropping on growth and productivity of some vegetable plants. M. Sc. Thesis, Fac. Agric. Ain Shams Univ., Egypt.

Ali, R.A. H. 1999. Comparative studies on the intercropping of some vegetable crops on strawberry plantation . M. Sc. Thesis, Fac. Agric. Minofiya Univ., Egypt.

Brown, J.D. and O. Lilleland 1964: Rapid determination of potassium and sodium in plant material and soil extracts by flame photometry. Proc. Amer. Soc. Hort. Sci., 48 : 341-46.

Bonaparte, E.E. N. A. and R. I. Brawn 1976. Effect of plant density and planting date on leaf number and some developmental events in corn. Can J. of plant Sci., 56 (3):691-698.

Chang, C.H., and F.W. Ho, 1969. Competition between sugar cane and intercrops for fertilizer tagged with P 32 and Rb. 86. J. Agric. Ass. China No. 67, 43-g. Bibl. 7, ch, e. [C.F. Field Crop Abst., Vol. (23), No. 4].

Change, J. F. and M.R. Shibles 1985. An analysis of competition between intercropped cowpea and maize. I-soil N and P levels and their relationships with dry matter and seed productivity . Field Crops Res., 12 (2):133-143.

Dubios, H.;K.A. Gillo, J. Hamillon; R. Robers and I. Smith. 1956: Colorimetric method for determination of sugars and related substances. Anal. chem., 28: 350.

Du, C.T. and F.J. Francis 1973. "Anthocyanin of roselle" Dept. Food Sci. Techn. Univ. Massachusetts, Amherst, Mass. J. Food Sci., 38 (5) : 810- 12.

El-Dokaishy, M. H. Z. 1999. Intercropping cauliflower (*Brassica oleracea* var. botrytis) with different green manures. Ph.D. Thesis, Fac. Agric. Assiut Univ., Egypt.

El-Doubi, K.A. 1992. Response of maize grain yield to different intercropping patterns. Ph. D. Thesis., Fac. Agric., Moshtohor, Zagazig Univ., Egypt.

El-Gamili, A. 1994. Studies on intercropping of onion with some vegetable crops. Menofiya J. Agric. Res., 19 (1) : 581-595.

El-Shamma, H. A. 1980. Studies on the effect of intercropping of some vegetable crops. M. Sc. Thesis, Fac. Agric., Zagazig Univ Egypt.

El-Waraky, Y.B.A. 1996. Studies on the effect of intercropping system and nitrogen fertilization levels on growth, yield and quality of some vegetable

crops. Ph. D. Thesis, Fac. Agric., Alex. Univ., Egypt.

Fuleki, T. and F.J. Francis 1968. "Quantitative methods of anthocyanin" 1- Extraction and determination of anthocyanin in cranberries. J. Food Sci., 32 (1) : 72.

Gawish, R. A.; M.A. Fattahallah and F.A. Ali 1992. Effect of intercropping tomato with pea on growth, yield quality and land productivity in relation to N, P and K fertilization. Menofiya. J. Agric. Res., 17 (2) : 743-764.

Hussein, A.H.A. 1981. Effect of some argonomic practices on growth and yield of soybean. Ph. D. Thesis, Fac. Agric., Al-Azhar Univ., Egypt.

Hucker, T.W.G. and G. Catroux 1980. Phosphorus in sewage ridge and animal waster slurries. Proceeding of the EEC Seminar, Haren (Gr); Groningen Netherlands, 12, 13 June.

Itulya, F. M.; V.N. Mwaja and J.B. Masiunas 1997. Collard-cowpea intercrop response to nitrogen fertilization, red root pigweed density and collard harvest frequency. Hortscience, 32 (5) : 850-853.

Mendoza, T.C.1986. Light interception and total biomass productivity in sugar cane intercropping . Philippine J. of Crop Sci.,11 (3) : 181-187. (C.F. Hort. Abst., 58 (9) No. 6332).

Mohamed, M.A. 1989. Effect of intercropping and nitrogen fertilization on forage and seed yield of guar. Zagazig J. Agric. Res., Vol. 16 (1), 1989.

Moursi, A,A., 1965. The interaction between cotton and other crops growing together.1- Effect of interplanting onion plants in rows of cotton plants on the competition for nutrients. Annuals of Agric. Sciences, Faculty of Agric., Ain Shams Univ. Vol. 10, No. 1 June, 1965.

Moursi , M. A., 1968. The interrelation between cotton and other crops growing

together . 3-Effect of interplanting garlic with cotton plants on the chemical contents and yield of cotton and garlic crops . Ann of Agric. Sciences, Fac. of Agric. Ain Shams Univ.

Nagiub , M. I. 1969. Colorimeter determination of nitrogen components of plant tissues . Bull. Fac. Sci. Cairo Univ. 43 :1.

Shahien, A.H. 1991. Effect of inter and intera specific competition between tomato and some leguminous crops. Ph. D. Thesis, Fac. Agric., Cairo Univ., Cairo, Egypt.

Soliman, M.F.Z. 1999. Studies on intercropping some vegetable crops on garlic plants. M. Sc. Thesis, Fac. Agric. Cairo Univ. Egypt.

Steel, R.G.D. and S.H. Torrie 1980. Principles and procedure of statistics. Second edition, Mc Grow. Hill. Inc.

تأثير معاملات نظم التحميل علي النمو ومكونات المحصول وإنتاج الأنثوسيانين والمكونات الكيميائية لنبات الكركدية

على عبدالحميد معوض* ، عبدالمحسن عبدالشافى هلال ، السيد حماد عامر*****

* قسم البساتين - كلية الزراعة جامعة الزقازيق- الزقازيق

** معهد الكفاية الأنتاجية - جامعة الزقازيق

*** قسم البساتين - كلية الزراعة- جامعة الأزهر - أسيوط

يهدف هذا العمل إلي دراسة تأثير معاملات نظم التحميل على النمو ومكونات المحصول وإنتاج الأنثوسيانين وبعض المكونات الكيميائية فى نبات الكركدية عند تحميلة مع نبات الجوار . وكانت نظم التحميل هى (١+١) ، (١+٢) ، (١+٣) ، (٢+١) ، (٣+١) من الكركدية والجوار علي الترتيب . وأستخدم نظام الزراعة الفردى للكركدية ككنترول . وأشارت النتائج المتحصل عليها إلى أن معاملة نظام تحميل ١ خط من الكركدية مع ٣ خطوط من نبات الجوار (١+٣) غالباً سجلت زيادة فى صفات النمو الخضرى والمجموع الجذرى { معبراً عنه بطول النبات وعدد الأوراق والوزن الطازج والجاف للأوراق والساق والجذر وطول الجذر لكل نبات} ومكونات المحصول { معبراً عنه بعدد السبلات ووزنها لكل نبات } وإنتاج الأنثوسيانين وكذلك النسبة المئوية ومحتويات السبلات لكل من الكربوهيدرات والنيتروجين والبروتين والفوسفور أو البوتاسيوم مقارنة بنظام الزراعة الفردى وباقى نظم التحميل الأخرى . وعلاوة على ذلك ، فقد أدت معظم معاملات نظم التحميل المستخدمة إلى زيادة صفات النمو ومكونات المحصول للكركدية مقارنة بنظام الزراعة الفردى . بينما وجد نقص فى هذا الصدد فى بعض صفات النمو وبعض المكونات الكيميائية مقارنة بنظام الزراعة الفردى فى معظم الأحوال .

وعموماً يمكن أن نستنتج أن استخدام نظام تحميل خط واحد من الكركدية مع ثلاثة خطوط من الجوار قد أدى إلى الحصول على أعلى قيم فى صفات النمو ومكونات المحصول وإنتاج الأنثوسيانين لنبات الكركدية المنزرع تحت ظروف محافظة الشرقية .