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# EFFECT OF INTERCROPPING SYSTEMS ON LAND EQUIVALENT RATIO, AGGRESSIVITY AND CORRELATION COEFFICIENTS OF ROSELLE AND GUAR

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**ABSTRACT: The present work was conducted at Inshas El-Raml District, Sharkia during 1997 and 1998 seasons aiming to study the effect of intercropping systems on competitive relationships; land equivalent ratio (LER) and aggressivity (A) in cropped roselle and guar as well as correlation coefficients between the characters of either roselle or guar under the effect of intercropping systems conditions at Sharkia Governorate . The intercropping systems used were (1:1), (1:2), (1:3), (2:1) and (3:1) of roselle and guar, respectively. Solid planting of both roselle and guar was used as control. Intercropping of one row of roselle with three rows of guar (1:3) gave higher values of land equivalent ratio (LER) (1,48 and 1.17 in the first and second season, respectively) compared to the other intercropping systems. On the contrary, the least value of (LER) was obtained from two rows of roselle cropped with one row of guar (2:1) when compared with the other systems .Furthermore, roselle was the dominant component in both 2:1 and 3:1 cropping systems, whereas it was the dominated in 1:1 and 1:2 systems. In addition, under intercropping systems conditions, anthocyanin production in roselle sepals showed positive and insignificant correlations with each of sepals weight / plant, sepals number / plant , dry weight of leaves / plant , total nitrogen and phosphorus as well as potassium contents. Also, there was positive and significant relation with total carbohydrate content in this respect. Meanwhile, under intercropping systems conditions, guaran percentage in guar seeds showed negative and insignificant pertinences with each of seed**

**weight per plant, seed number per plant, total carbohydrate, nitrogen, phosphorus and potassium percentages. On the other hand, there was positive and insignificant relation with dry weight of leaves per plant in this concern. Likewise, correlation coefficients between the other characters of either roselle or guar were studied in this connection. Generally, using of intercropping system of one row of roselle and three rows of guar (1:3) maximized the productivity of yield / fad. of roselle sepals and guar seeds compared to those of solid planting system of both roselle and guar, so this treatment could be recommended.**

## INTRODUCTION

In Egypt, as in the other developing countries, intercropping may be a method to increase total land productivity, which is a basic consideration in evaluating various intercropping experiments. However, because roselle is cultivated as a summer crop , it might compete with guar which is considered as important crop for intensive utilization of land, sunlight, temperature and water which are, to a large extent, wasted in monocropping systems. Therefore, the outcome will be more profitable for farmers.

Consulting the available review of literature, there was no information concerning the effect of intercropping systems treatments on competitive relationships; land equivalent ratio (LER) and aggressivity (A) in cropped roselle and guar as well as correlation coefficients between the characters of either roselle or guar under the effect of intercropping systems condition. Therefore, the following available review of literature on other plants might be useful in this concern. However, Moursi *et al.* (1983) reported that growing maize and soybean together resulted in an increase in LER more than one. They added that maize crop was dominant and soybean was dominated when they were intercropped with 1:1 system. Shahien *et al.* (1996) indicated that the best values of LER of cowpea were obtained when cowpea plants were intercropped with 2/3 maize.

Moreover, Aly *et al.* (1993) found that the aggressivity value was positive for cotton and

negative for onion, indicating that cotton was always dominant intercrop component, whereas onion was the dominated one. The highest values were obtained when two rows of onion were grown on the other side of cotton ridge. Ali (1999) found that the aggressivity value was negative for strawberry and positive for phaseolus, carrot and lettuce. This indicate that these crops were the dominant intercrop components and strawberry was the dominated one.

The aim of this work was to test the possitibility of getting additional yield for roselle cropped with guar by having knowledge about the nature and degree of competition between those two component crops by studying the effect of intercropping systems on Land equivalent ratio (LER) and aggressivity (A). In addition, to find out correlation coefficients between the characters of both roselle and guar under intercropping systems conditions.

## MATERIALS AND METHODS

The present work was conducted at an special Farm in Inshas El-Raml District, Sharkia ,Government during the two successive growing seasons of 1997 and 1998 to study the effect of intercropping systems between roselle and guar on competitive relationships; land equivalent ratio (LER) and aggressivity (A) in cropped roselle and guar as well as correlation coefficients between the characters of either roselle or guar under the effects of intercropping systems conditions at Sharkia Governorate .

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

Seeds of both roselle and guar crops were handly sown on the first of May in the two tested seasons of 1997 and 1998 and immediately irrigated. Germinated plants 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 1.

The plot area was (2 x 7.80 m) and included twelve rows, each row was 60 cm apart and 2 m in length. In the meantime, the two components were intercropped using the same ridges and within ridge spacings as in respective sole systems i.e. 50 x 60 cm for roselle and 30 x 60 cm for guar.

The intercropping systems treatments were as follows:

1. One row of roselle + one row of guar (1:1) intercropping system: planting one row of roselle alternated with one row of guar. This provides the proportional area of 50: 50 to each crop.
2. One row of roselle + two rows of guar (1:2) intercropping system: planting one row of roselle alternated with two rows of guar. This was equal to 33.3: 66.7 proportion area of roselle and guar, respectively.
3. One row of roselle +three rows of guar (1:3) intercropping system: planting one row of roselle alternated with three guar rows to provide 25:75 proportional area for roselle and guar, respectively.
4. Two rows of roselle + one row of guar (2:1) intercropping system: planting two roselle rows alternated with one guar row. This provides 66.7: 33.3 proportional area of roselle and guar, respectively.
5. Three rows of roselle + one row of guar (3:1) intercropping system: planting three rows of roselle (75%) in alternation with one guar row (25%).

Table 1. The physical and chemical properties of the used soil.

| Physical properties (%) | | Chemical properties | |
|---|---|---|---|
| Sand | 17.4 | Total nitrogen | 0.52% |
| Silt | 36.10 | Water soluble phosphorus | 0.05% |
| Clay | 46.50 | Available potassium | 0.59 Meg/l. |
| Organic matter | 1.75 | pH | 7.90 |

6.Solid planting system of roselle, since it was practices on one side of the row, one plant / hill, in 50 cm distance apart hills. Such treatment was used as control for roselle characters.

7.Solid planting system of guar, since it was applied on one side of the row, two plants/ hill, in 30 cm distance apart hills . Such treatment was used as control for guar characters.

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

All plants received normal agricultural practices whenever they needed. All plants received NPK. fertilization at the rats of 200kg of ammonium sulphate (20.5%N), 150 kg of calcium super phosphate (15.5% $P_2O_5$) and 100 kg of potassium sulphate (50% $k_2O$) per faddan, respectively.

The outer two rows (1st and 12th) of each plot were considered as belt. For measuring growth analysis, samples were randomly taken from guarded plants in center of each plot. The central rows were kept for yield and yield attributes determinations.

Yield of roselle sepals / faddan (fad.) = sepal yield / row x no. of rows of roselle /plot x 4200 / plot area ($m^2$)

Yield of guar seeds / faddan (fad) = seed yield / row x no. of rows of guar / plot x 4200 / plot area ($m^2$).

The following data were recorded

1. Competitive Relationships

1.1 Land equivalent ratio (LER)

This gives an indication to the relative land area under sole crops that is required, to produce the same yields achieved by intercropping. It was determined for both roselle and guar yield recorded per faddan according to Dewit and Den Bergh (1965) as follows:

$$LER = L_r + L_g$$

Where :

Lr ( relative yield of roselle) = $\frac{\text{Intercrop yield of roselle sepals}}{\text{Solid yield of roselle sepals}}$

Lg ( relative yield of guar) = $\frac{\text{Intercrop yield of guar seeds}}{\text{Solid yield of guar seeds}}$

1.2 Aggressivity (A)

Aggressively value was calculated according to Mc Gilchrist equation (1965) as follows:

1. For the combination of 50:50 and 100 : 100 they were calculated according to the following equations :

$$Ar = \frac{\text{Mixture yield of roselle}}{\text{Solid yield of roselle}} - \frac{\text{Mixture yield of guar}}{\text{Solid yield of guar}}$$

$$Ag = \frac{\text{Mixture yield of guar}}{\text{Solid yield of guar}} - \frac{\text{Mixture yield of roselle}}{\text{Solid yield of guar}}$$

2-For the other combination ratios the equations used were :

$$Arg = \frac{Yrg}{Yrr \times Zrg} - \frac{Ygr}{Ygg \times Zgr}$$

$$Agr = \frac{Ygr}{Ygg \times Zgr} - \frac{Yrg}{Yrr \times Zrg}$$

Where :

Yrg = Intercrop yield of roselle
Ygr = Intercrop yield of guar
Yrr = Solid yield of roselle
Ygg = Solid yield of guar
Zrg = Sown proportion of roselle
Zgr = Sown proportion of guar

Data were statistically analyzed using L.S. D. at 5% and 1% levels according to Steel and Torrie (1980).

2. Correlation study

Correlation coefficients between some characters of both roselle and guar plants under the effect of intercropping systems conditions were calculated according to the procedure outlined by Svab (1973). Roselle characters examined were anthocyanin production (according to the method described by Fuleki and Francis (1968) and developed by Du and Francis (1973) for *Hibiscus sabdariffa*. The anthocynin values were expressed as absorpance at 520 nm]; dry weight of sepals/ plant (gm), fruits number / plant; dry weight of leaves/ plant (gm); nitrogen content (according Naguib 1969); carbohydrate content

(according to Dubios *et al.* (1956); phosphorus content (according to Hucker and Catroux 1980); potassium content (according to Brown and Lilleland 1964) . Whereas guar examined characters were guaran percentage (according to Anderson 1949), seed weight / plant (gm), seeds number /plant; dry weight of leaves/plant (gm), carbohydrate, nitrogen, phosphorus and potassium contents.

## RESULTS AND DISCUSSION

1.Effect of Intercropping Systems on Competitive Relationships of Roselle and Guar Plants

1.1 Land equivalent ratio (LER)

Total land productivity in terms of LER and its fractions of relative sepals yield of roselle per faddan (Lr) and relative seeds yield of guar per faddan (Lg) obtained from yield of sepals or seeds per faddan of the roselle–guar intercrop as influenced by intercropping systems treatments are given in Table 2.

However, many workers calculated the land equivalent ratio (LER) to evaluate over yielding. It was observed from data presented in Table 2 that the studied treatments of intercropping system had significant or highly significant effect on land equivalent ratio (LER). However, although the intercrop yield of sepals of roselle (Lr) as well as seeds of guar (Lg) crop in the roselle - guar cropping system was

Table 2. Land equivalent ratio (LER) for roselle sepals (Lr) and guar seeds (Lg) affected by intercropping systems during the two successive seasons of 1997 and 1998

| Intercropping systems | First season | | | Second season | | |
|---|---|---|---|---|---|---|
| | $L_r$ | $L_g$ | LER | $L_r$ | $L_g$ | LER |
| 1 row of roselle + 1 row of guar | 0.42 | 0.72 | 1.14 | 0.49 | 1.0 | 1.49 |
| 1 row of roselle + 2 rows of guar . | 0.39 | 0.81 | 1.20 | 0.33 | 1.09 | 1.42 |
| 1 row of roselle + 3 rows of guar | 0.34 | 0.83 | 1.17 | 0.35 | 1.13 | 1.48 |
| 2 rows of roselle + 1 row of guar | 0.71 | 0.27 | 0.98 | 0.72 | 0.34 | 1.06 |
| 3 rows of roselle + 1 row of guar | 1.00 | 0.25 | 1.25 | 0.82 | 0.25 | 1.07 |
| L.S.D at 5% | | | 0.152 | | | 0.208 |
| L.S.D. at 1% | | | 0.205 | | | 0.285 |

decreased in mixed relative to pure stands, the combined intercrop yield of both crops (LER) yielded more than respective pure stand yields. That means, intercropping of roselle and guar was more productive than growing them separately, as seen from the total LER values which were greater than 1.00 . These results were true for all cases of LER determinations. Since, LER values of roselle – guar intercrop ranged from 1.06 to 1.49 in the 2nd season. These LER indicate that 0.06% to 0.49% more land would require to plant the sole crops to produce the same quantities of roselle and guar were produced in the cropping systems. On the assumption that photosynthesis under field conditions, and consequently total dry matter assimilation, is limited by the amount of leaf canopy of the intercrops may make better use of light in this respect. In the meantime, the beneficial effects of the combined leaf canopy of the intercrops, as reported in the literature can be achieved through more efficient use of light rather than greater light intercrption.

Moreover, the relative sepals yield / fad. of roselle; i.e., Lr was relatively higher than that of Lg under intercropping system treatments of (2+1) and (3+1) systems. Such result suggests that shading of guar plants during later growth stages probably reduced the supply of photosynthate for developing guar seeds. Therefore, Lg determination was less than that of Lr under intercropping system of (2+1) and (3+1) systems. Whereas, Lg was relatively higher than that of Lr under intercropping system treatments of (1+1), (1+2) and (1+3) systems. These results were recorded in the two seasons. In other words, the higher yield of non –legume / legume combinations as compared to non- legume alone or in combinations may be explained by studies of other workers. Since, Willey (1979) showed that probably the main way that complementarity occurs is when the growth patterns of the component crops differ in time so that the crops make their major demands on

resources at different times. Also, Natarajan and Willey (1980) reported that the most commonly suggested reason for higher yields is that the component crops are in some way able to utilize growth resources rather differently, so that when grown together they "complement" each other and make better overall use of resources than when grown separately.

The highest values of (LER) were obtained by using intercropping system of one row of roselle with three rows of guar in the second season (1.48) and in most cases of the first season (1.17) compared with the other intercropping system treatments. On the contrary, the lowest values of LER were obtained from the treatment of intercropping system of two rows of roselle with one row of guar comparing with the others in the two seasons. Furthermore, (LER) values were increased by increasing number of roselle rows in the cropping system of 2:1, this was true in both seasons. In the same time, LER was increased as guar row number increased (from 1 to 2) in the cropping system of 1:2 in the first season.

These results indicate that the intercropping treatments was efficient in producing more yield from the same area if compared to growing the same plants in single cropping.

Similar results were reported by Aly *et al* (1993) who found that growing onion in three rows on the other side of cotton ridges gave the highest value of LER (average of two seasons =1.84). Whereas, the least value was obtained when onion was grown in two rows on the other side of cotton ridges, (average of two seasons = 1.52). Malhotra and Kumar (1995) planted potato, cabbage, turnip, Chinese cabbage, lettuce or pea alone/or intercropped with potato, these vegetables were planted between the 2 rows of potato. They found that the highest LER, in this respect, was (1.31). Shahien *et al.* (1996) indicated that the best values of LER (calculated on fresh or dry yield basis) of cowpea were obtained when cowpea plants were intercropped with 2/3 maize. They were 1.74–1.31 and 1.59–1.27 in the first and second seasons, respectively

El-Khalla *et al.* (1997) reported that intercropping faba bean with onion in a system of 2:4 rows on 120 cm raised beds increased land usage by 52 and 51% in the two seasons, respectively. Mahmoud *et al.*, (1999a) indicated that LER values were more than one for all tested intercropping systems. Pepper + tomato + cucumber gave the highest LER values (1.64 and 1.75 in the two seasons of study, respectively), compared with other intercropping systems (cucumber + pepper, cucumber + tomato or pepper +tomato). They also (1999b) indicated that the highest values of LER were observed from intercropping tomato + pea (2.50 and 2.31 in the two seasons of study, respectively)followed by tomato + pea + carrot (1.96 and 1.93 in the two seasons of study, respectively).

1.2 Aggressivity (A)

Data presented in Table 3 indicate the effect of intercropping system treatments on aggressivity values (A) of roselle (Ar) and guar (Ag) calculated for yield per faddan of sepals for roselle and of seeds for guar.

It is known that an aggressivity value of zero indicates that the component crops are equally competitive. For any other situation, two crops will have the same numerical value by positive for the dominant crop and negative for the dominated one. The greater the numerical value, the larger the difference in competitive abilities.

It is evident, from the data, that aggressivity values for roselle (Ar) as well as for guar (Ag) calculated from the yield per faddan was significantly and highly significantly affected by most of the used intercropping system treatments. Under cropping system treatments of (1+1) and (1+2) guar plants was the aggressor crop compared to that of (2+1) and (3+1) systems in the two seasons. Whereas, under intercropping system treatments (2+1) and (3+1), roselle plants was the aggressive to guar in the two seasons comparing to those of the other ones. The aggressivity values for roselle to guar (Arg) were ,

almost , equally competitive i.e. 0.08 and 0.01 for (2+1) 0.08 and 0.01 for (2+1) intercropping system in the first and second seasons, respectively. While, the highest values of aggressivity for guar (Agr) were 0.30 and 0.48 in (1+1) in the first and second seasons, respectively. Whereas, the least values of aggressivity(0.01) were obtained from the cropping system treatments of (1+2) and (2+1) in the first and second seasons, respectively compared with the other systems.

Such aggressivity reached its maximum in the (1+1) intercropping system treatment in the two seasons followed by that of (1+2) in the second one , where guar plants were the aggressors to roselle in both intercropping system treatments. Whereas, when roselle plants were the aggressors to guar, differences did not detected in the aggressivity values. In all these cases, aggressivity of roselle was almost proportional to the intercropping ratio.These results were valid in the two seasons.

Similar results were found by Aly *et al.* (1993) who found that the aggressivity value was positive for cotton and negative for onion, indicating that cotton was always dominant intercrop component, whereas onion was the dominated one. The highest values were obtained when two rows of onion were grown on the other side of cotton ridge. Zohry (1997) found that the aggressivity values was positive for sugar cane and negative for onion under three intercropping patterns, this means that sugar cane, as expected, was the dominant intercrop component and onion was the dominated one. The highest values were obtained by intercropping three rows of onion between rows of sugar cane. Ali (1999) found that the aggressivity value was negative for strawberry and positive for phoseolus, carrot and lettuce. This indicates that the latter three crops were the dominant intercrop components and strawberry was the dominated one.

2.1 Effect of intercropping systems on correlation coefficients between some characters of roselle plants

The results of simple correlation coefficients between

some characters of roselle plants viz., anthocyanin production, dry weight of sepals/plant, fruits/plant, dry weight of leaves /plant as well as chemical constituents of roselle plants under intercropping systems treatments (pooled data of the two seasons) are presented in Table 4.

It is clear that anthocyanin production showed positive and insignificant correlation with dry weight of sepals /plant, fruits number / plant, the dry weight of leaves/ plant, total nitrogen and phosphorus as well as potassium contents. Also, there was positive and significant relation with total carbohydrate content in this respect.

Also, sepals weight per plant was positively and significantly correlated with each of fruits number / plant, dry weight of leaves per plant and total carbohydrate content, as well as insignificantly and positively correlations with both total nitrogen, phosphorus and potassium contents. In addition, there was positive and highly significant relation between fruits number per plant with the dry weight of leaves per plant. But, it recorded positive and insignificant pertinence with each of total carbohydrate, nitrogen, phosphorus and potassium contents. Furthermore, dry weight of leaves/plant was positively and highly significantly correlated with

Table 3. Aggressivity values (A) for roselle (Arg) and guar (Agr) plants as affected by intercropping systems during the two successive seasons of 1997 and 1998

| Intercropping system treatments | First season | | Second seaso | |
|---|---|---|---|---|
| | Arg | Agr | Arg | Agr |
| 1 row of roselle + 1 row of guar | -0.30 | +0.30 | -0.48 | +0.48 |
| 1 row of roselle + 2 rows of guar | -0.01 | +0.01 | -0.20 | +0.20 |
| 1 row of roselle + 3 rows of guar | +0.06 | -0.06 | -0.02 | +0.02 |
| 2 rows of roselle + 1 row of guar | +0.08 | -0.08 | +0.01 | -0.01 |
| 3 rows of roselle + 1 row of guar | +0.06 | -0.06 | +0.01 | -0.01 |
| L.S.D at 5% | 0.138 | | 0.101 | |
| L.S.D. at 1% | 0.198 | | 0.147 | |

each of total carbohydrate, phosphorus and potassium contents. Also, there was positive and significant pertinence with total nitrogen content. At the same time, there was positive and significant relation between total carbohydrate content and total nitrogen as well as phosphorus contents. Also, there was positive and highly significant correlation with total potassium content. Likewise, positive and significant pertinence was found between total nitrogen content with both total phosphorus and potassium contents. Also, total phosphorus content exhibited highly significant and positive correlation with total potassium content.

Generally, consulting, the available literature, there was no information regarding the effect of intercropping systems treatments on correlation coefficients between some characters of roselle plants.

Regarding the effects of intercropping systems on correlation coefficient, the present results show that anthocyanin production was increased with increasing each of fruits number and dry weight of sepals/plant, leaves dry weight/plant, total carbohydrate, nitrogen, phosphorus and potassium contents. Such result might attribute the importance of carbohydrate in anthocyanin formation. Besides, the importance of dry matter which supply carbohydrate, nitrogen, phosphorus and potassium to form plant sepals and anthocyanin in roselle plants. The positive relations found under intercropping system treatments might be due to the increase in leaves dry weight / plant and anthocyanin production, by intercropping as found in the present work. Furthermore, the positive interrelationship, under intercropping system treatments, noticed between dry weight of sepals / plant and each of fruits number, dry weight of leaves / plant, total carbohydrate, nitrogen, phosphorus and potassium contents might be attributed to the positive effect of intercropping on these characters. However, the positive pertinence found between leaves dry weight / plant and each of total carbohydrate, nitrogen, phosphorus and potassium contents might be due

to that, as the dry weight of leaves /plant was increased, the mentioned characters were increased (under some intercropping system treatments).

Generally, these results bear indication that characters of growth, dry sepals of yield components, anthocyanin production and chemical constituents of roselle were positively correlated in most cases, with few exceptions. Therefore, most of these variables exhibited positive interrelationships with anthocyanin production of roselle plants, under the treatments of intercropping system.

2.2Effect of intercropping systems on correlation coefficients between some characters of guar plants

Data presented in Table 5 show correlation coefficients between some characters of guar plants namely, guaran percentage, seed weight per plant, seed number / plant, dry weight of leaves per plant as well as some chemical constituents of guar plants under the effect of intercropping systems treatments.

It is clear that guaran percentage showed negative and insignificant pertinences with each of seed weight / plant, seed number /plant, total carbohydrate, nitrogen, phosphorus and potassium contents .On the other hand, there was positive and insignificant relation with dry weight of leaves per plant in this regard. At the same time, seed weight per plant was negatively and insignificantly correlated with each of seed number per plant, dry weight of leaves per plant, total carbohydrate, nitrogen, phosphorus and potassium contents.

Furthermore, there was positive and highly significant relation between seed number per plant and dry weight of leaves per plant, also it exhibited positive and insignificant relationships with each of total carbohydrate, nitrogen, phosphorus and potassium contents in this concern. In addition, dry weight of leaves per plant was positively and significantly correlated with both total carbohydrate and phosphorus contents and showed positive and insignificant pertinence with total nitrogen content, but there was positive and highly significant correlation with total

potassium content in this regard. Also, total carbohydrate content exhibited significant and positive associations with total nitrogen and phosphorus contents as well as positive and highly significant pertinence with total potassium content. Meanwhile, positive and insignificant correlations were recorded between total nitrogen content and each of total phosphorus and potassium contents. Finally, total phosphorus content showed positive and significant correlation with total potassium content.

However, the negative correlation found, under intercropping system treatments, between guaran percentage and carbohydrate content in this study might be due to that carbohydrate consumption in guaran formation taking into consideration that guaran consists mainly of a complex of carbohydrate polymers of galactose and mannose [galactomannan]. On the other hand, the positive pertinences noticed between the dry weight of leaves / plant and each of total carbohydrate, nitrogen, phosphorus and potassium contents might refer to that, as the dry weight of leaves / plant was increased, the mentioned characters were increased. Such result might be attributed to that seeds of guar plant are consisting of metabolites such as carbohydrate, protein (containing nitrogen), phosphorus and potassium. This result bear indication to the importance of carbohydrate in dry weight of leaves /plant formation by guar plants. On the contrary, the negative correlations found in this respect between guaran content and each of total nitrogen, phosphorus and potassium contents might confirm the results found in this study, since intercropping system treatments decreased total nitrogen, phosphorus and potassium contents. However, the positive pertinences found in this concern between dry weight of leaves /plant and total nitrogen, phosphorus and potassium contents might be due to the consumption of nitrogen, phosphorus and potassium in dry matter formation and its migration to seeds of guar plants [Legumy plant].

Generally, these results bear indication that characters of growth, seed yield components, guaran content and chemical constituents of guar were

positively or negatively correlated in most cases, with few exceptions. Therefore, most of these variables exhibited positive or negative interrelationships with guaran content of guar plants, under the treatments of intercropping system.

Table 4. Simple correlation coefficients between some characters of the growth, sepals yield and anthocyanin production as well as chemical constituents of roselle plants under intercropping systems (pooled data of the two successive seasons of 1997 and 1998)

| Character | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Y-Anthocyanin production | 0.7734 | 0.7219 | 0.5016 | 0.8445* | 0.5305 | 0.5989 | 0.7622 |
| 1- Dry weight of sepals /plant (gm) | | 0.8427* | 0.8223* | 0.8395* | 0.4889 | 0.6126 | 0.7710 |
| 2-Fruits number / plant | | | 0.9532** | 0.5218 | 0.1004 | 0.3430 | 0.4344 |
| 3-Dry weight of leaves/ plant (gm) | | | | 0.9569** | 0.8983* | 0.9600** | 0.9537** |
| 4-Carbohydrate content | | | | | 0.8820* | 0.9009** | 0.9744** |
| 5-Nitrogen content | | | | | | 0.9169* | 0.8935* |
| 6-Phosphorus content | | | | | | | 0.9197** |
| 7-Potassium content | | | | | | | |

Table 5. Simple correlation coefficients between some characters of the growth, seed yield and guaran content as well as chemical constituents of guar plants under intercropping systems (pooled data of the two successive seasons of 1997 and 1998)

| Character | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Y-Guaran percentage | -0.7103 | -0.6222 | 0.2967 | -0.3266 | -0.0336 | -0.5377 | -0.5747 |
| 1- Seed weight /plant (gm) | | -0.4918 | -0.5530 | -0.2489 | -0.0586 | -0.5346 | -0.4825 |
| 2- Seed number / plant | | | 0.9572** | 0.3337 | 0.3385 | 0.5047 | 0.2116 |
| 3- Dry weight of leaves / plant (gm) | | | | 0.8538* | 0.6308 | 0.8467* | 0.9762** |
| 4- Carbohydrate content | | | | | 0.8945* | 0.9080* | 0.9220** |
| 5-Nitrogen content | | | | | | 0.6692 | 0.6992 |
| 6- Phosphorus content | | | | | | | 0.8873* |
| 7- Potassium content | | | | | | | |

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# تأثير نظم التحميل على نسبة المكافئ الارضى والعدوانية ومعاملات الارتباط للكركدية والجوار

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تم أجراء هذا العمل فى قرية أنشاص الرمل شرقية فى موسمي ١٩٩٧ و ١٩٩٨ ، يهدف هذا العمل إلى دراسة تأثيرنظم التحميل للكركدية والجوار على العلاقات التنافسية (نسبة المكافىء الارضى والعدوانية) وكذلك معاملات الارتباط بين صفات كلا من الكركدية والجوار تحت تأثير ظروف نظم التحميل فى محافظة الشرقية، وكانت نظم التحميل المستخدمة هى (١:١) ، (٢:١) ، (٣:١) ، (١:٢) ، (١:٣) من الكركدية والجوار على الترتيب ، واستخدام نظام الزراعة المنفردة لكل من الكركدية والجوار كمعاملة مقارنة.

واشارت النتائج المتحصل عليها إلى أن استخدام نظام تحميل خط واحد من الكركدية مع ثلاثة خطوط من الجوار (٣:١) أعطى أعلى قيم من نسبة المكافىء الارضى LER ( ٤٨ر١ ، ١٧ر١ فى الموسم الاول والثانى على الترتيب) بالمقارنة بباقى نظم التحميل الاخرى ، وعلى العكس من ذلك تم الحصول على أقل قيمة من نسبة المكافىء الاراضى (LER) باستخدام نظام تحميل خطان من الكركدية مع خط واحد من الجوار (١:٢) مقارنة بباقى نظم التحميل الأخرى، وعلاوة على ذلك، كانت نباتات الكركدية سائدة على الجوار باستخدام نظم تحميل (١:٢) ، (١:٣) ، بينما كانت نباتات الجوار هى السائدة على الكركدية باستخدام نظم تحميل (١:١) ، (٢:١)٠ بالاضافة إلى ذلك، وتحت ظروف نظم التحميل، سجل إنتاج الانثوثيانين فى سبلات الكركدية ارتباطا موجباً وغير معنوياً مع كل من وزن السبلات لكل نبات ، وعدد السبلات لكل نبات ، والوزن الجاف للاوراق لكل نبات ، ومحتوى السبلات من النيتروجين والفوسفور والبوتاسيوم ، وايضاً كانت هناك علاقة موجبة ومعنوية مع المحتوى من الكربوهيدرات الكلية فى هذا الصدد ، علاوة على ذلك، وتحت ظروف نظم التحميل ، فلقد سجلت النسبة المئوية للجوران فى بذور الجوار علاقات سالبة وغير معنوية مع كل من وزن البذور لكل نبات وعدد البذور لكل نبات ، ومحتوى البذور من الكربوهيدرات والنيتروجين والفوسفور والبوتاسيوم، ومن ناحية أخرى كان هناك ارتباطاً موجباً وغير معنوياً مع الوزن الجاف للاوراق لكل نبات فى هذا الخصوص ، بالمثل، فقد تم دراسة معامل الارتباط بين باقى الصفات الاخرى لكل من الكركدية والجوار ٠

وبصفة عامه فقد أدى استخدام نظام تحميل خط واحد من الكركدية مع ثلاثة خطوط من الجوار (٣:١) إلى تعظيم إنتاجية الفدان من محصول السبلات فى الكركدية والبذور فى الجوار مقارنة بنظام الزراعه المنفردة لكل منهما.