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EFFECT OF INTERCROPPING SYSTEMS AND NITROGEN LEVELS ON CERTAIN CHARACTERS OF SNAP BEAN AND PEPPER. I. EFFECT ON PLANT GROWTH

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ABSTRACT

This study was carried out at El-Baramoon Horticultural Research Farm during summer seasons of 2000 and 2001 to study the effect of some intercropping systems (snap bean intercropped with pepper) and different nitrogen levels on certain growth characters. Split-plot design with three replications was used. The main plots were assigned for intercropping systems, while, the sub-plots were devoted to nitrogen levels. The obtained results revealed that the most effective intercropping systems were IS_2 (planting pepper on one side of the ridge and snap bean on the other side), and IS_3 (planting pepper on one side of the ridge and snap bean on the two sides of the ridge without leaving one row for hoeing). Both systems of cultivation caused an increase in plant height, number of branches, stem diameter and plant dry weight of the two tested crops. Whereas, the highest plant height was recorded with IS_1 system of the two tested crops.

With respect to the effect of nitrogen level applied, plant height, number of branches, stem diameter and plant dry weight in both crops were increased as the nitrogen level was raised up to 100 kg N/fed.

Plants of both crops studied grown under the combination between IS_3 and IS_4 intercropping systems and received the zero level of nitrogen gave the highest values in all characters in both seasons of study.

INTRODUCTION

In Egypt, the cultivated area of vegetable crops is very limited corresponding with population. Therefore, this work was designed to improve the soil utility by intercropping snap bean with pepper during their first vegetative growth stage, where the plants of pepper grow slowly in this period and stay in the field at least more than 60 days to reach the optimum growth because of their sensitivity to low temperatures during the first period of setting up transplants of pepper in the field at the first week of March. So areas of the same pepper can be utilized during this period for planting short period crop without any injury on the main crop. The snap bean is considered the favourable legume crop to intercrop with pepper, it takes about 60 days to produce green pod yield. It is a good way to raise the farmer income.

The growth of plants has been examined by several investigators; Moursi (1965 and 1966) reported that growing onion and garlic plants on ridges of cotton reduced the growth and dry matter content of the different parts of the plant. On the contrary, Son and Chug (1969) found that intercropping between sorghum and soybean stimulated stem length and diameter of soybean plants.

El-Shamma (1980) found that the growing lettuce or pea plants on the ridges of pepper depressed the growth of pepper plants as estimated by

measuring stem length and diameter as well as number of leaves and branches. Otherwise, the study also proved that growing broad bean plants on the ridges of pepper stimulated the growth of the latter crop. The growth of lettuce in plants grown alone expressed as plant high was greater than those intercropped with pepper. The plant height of broad bean was also higher with pepper plants, whereas that of pea plants was not affected with intercropping. El-Gazar *et al.* (1988a) studied some intercropping systems on kidney beans and okra. They found that intercropping systems had a significant effect on plant height of kidney beans plants and on leaves number of both kidney beans and okra plants. Also, they showed an increase of plant dry weight with I_0 (A solid crops), I_2 (planting kidney beans on one side of the ridge and okra on the other side with leaving one row for hoeing (20 cm in width), and I_3 (planting kidney beans between okra hills on one side of the ridge only) systems in both seasons.

Osorio and Freire (1982) studied the effects of inorganic nitrogen on *Phaseolus vulgaris* L *Rhizobium phaseoli* symbiosis. The results showed that the dry matter of shoots and roots was significantly increased by increasing nitrogen applied.

El-Gazar *et al.* (1988b) showed that the highest yield of both kidney beans and okra was obtained from interaction between the high level of nitrogen and I_4 and I_2 intercropping systems, respectively.

They added that the interaction between I_2 system and medium nitrogen level gave significantly high average pod fresh weight of kidney-beans.

El-Moursi (1999) found that the interaction between intercropping systems and nitrogen level had a significant effect on plant height and plant dry weight of garlic in both seasons, whereas plant height of snap bean was not affected and the interaction had a significant effect on plant dry weight of snap bean in the second season only, and IS_2 system and 150 kg N/fed gave the highest plant dry weight of garlic in the second season and snap bean in both seasons.

The aim of this investigation was to study the effect of intercropping systems (Snap bean and pepper) and different nitrogen levels on some vegetative characters. This study was carried out on the Balady variety of pepper (*Capsicum annuum*) and Bronco variety of snap bean (*Phaseolus vulgaris*, L.).

MATERIALS AND METHODS

Two field experiments were carried out at El-Baramoon Horticultural Research Farm, Dakahlia Governorate during 2000 and 2001 growing seasons.

Six intercropping systems were evaluated to investigate their effect on pepper and snap bean characters. These intercropping systems were illustrated in Figure (1) as follows:-

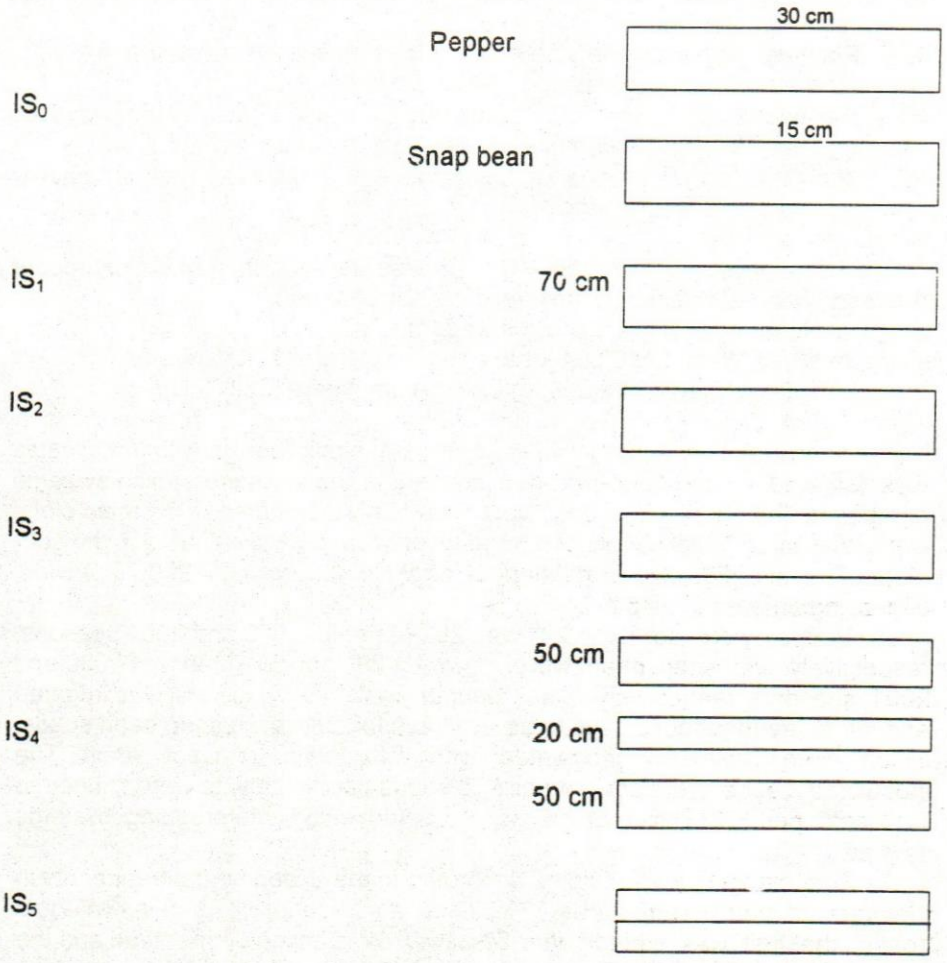

Fig. 1. Hand drawing representing the six intercropping system used.
x Represents pepper sites.
• Represents snap bean sites.

The width of ridge = 70 cm.

IS_0 : Planting both pepper and snap bean as solid crops with spacing of 30 and 15 cm between plants of the two crops, respectively. Both crops were planted on the one side of the ridge.

IS_1 : Planting pepper on one side of the ridge with spacing of 30 cm between plants and one snap bean hill between every two pepper plants.

IS_2 : Planting pepper on one side of the ridge and snap bean on the other side.

IS_3 : Planting pepper on one side of the ridge and snap bean on the two sides of the ridge without leaving one row for hoeing.

IS_4 : Planting pepper on one side of the ridge and snap bean on the two sides of the ridge with leaving one row for hoeing (20 cm in width).

IS_5 : Planting pepper on top of the ridge and snap bean between pepper plants on top of the ridge.

Three levels of nitrogen were applied to study their effect on pepper and snap bean characters. These levels of nitrogen were:

a. No nitrogen applied (Zero nitrogen).
b. 50 kg N/fed = 149.254 kg ammonium nitrate (33.5% N).
c. 100 kg N/fed = 298.500 kg ammonium nitrate (33.5% N).

A split-plot in a randomized complete block design with 3 replicates was followed in both experimental seasons. The six intercropping systems comprised the main plots and were randomly distributed in the main plots, while the three tested levels of nitrogen were randomly distributed in the sub-plots. The sub-plot size contained 3 ridges of 4.5 m long and 0.70 m wide, occupying an area of 9.45 m^2.

Pepper were sown on 24th and 26th March of 2000 and 2001 seasons, respectively and snap bean were sown on 29th and 31th March of 2000 and 2001 seasons, respectively. After pepper were sown, the soil was irrigated and left to dry for about 6 days to be available for cultivating snap bean seeds, which were previously inoculated with *Rhizobium phaseoli* strain. The inoculated seeds were sown on hills (3 seeds per hill), plants were thinned to 2 plants per hill. This method was adopted in all intercropping systems studied.

The nitrogen was applied according to the experimental treatments in the form of ammonium nitrate (33.5%) as a source for nitrogen in two equal doses, the first was added after 30 days from planting pepper time and the second 30 days later. Other cultural practices were carried out as usual.

Six plants of both pepper and snap bean were randomly chosen and taken from each of the different treatments after 65 days from sowing to obtain the following data: plant height, number of branches, stem diameter and plant dry weight.

Data were statistically analyzed according to Snedecor and Cochran (1967). Treatment means were compared at 5% level of probability by LSD test (Waller and Duncan, 1969).

RESULTS AND DISCUSSION

1. Effect of intercropping systems:

Data presented in Table (1) concerning plant vegetative growth measurements of pepper and snap bean indicated that among the tested intercropping systems, the most effective ones were IS_2 (planting pepper on one side of the ridge and snap bean on the other side), and IS_3 (planting pepper on one side of the ridge and snap bean on the two sides of the ridge without leaving one row for hoeing). Both systems of cultivation caused an increase in plant height, number of branches, stem diameter and plant dry weight of the two tested crops. The highest plant height records on both crops were obtained from IS_1 (planting pepper on one side of the ridge and snap bean between pepper plants) in the two experimental seasons. The IS_0 system (planting both pepper and snap bean as solid crops) gave results in harmony with those of IS_2 and IS_3.

Table 1. Vegetative growth of pepper and snap bean as affected by intercropping system in the 2000 and 2001 seasons.

Inter-cropping system	Plant height (cm)		No. of branches		Stem diameter (cm)		Plant dry weight (g)	
	2000	2001	2000	2001	2000	2001	2000	2001
Pepper								
IS_0	81.22	85.22	4.22	4.56	3.33	3.42	93.33	88.67
IS_1	95.11	99.89	2.67	2.78	3.72	3.80	97.33	92.44
IS_2	80.67	85.11	5.33	5.67	4.41	4.47	110.00	104.44
IS_3	87.11	91.44	4.00	4.33	4.04	4.12	109.33	103.78
IS_4	79.33	83.22	3.67	3.89	3.66	3.72	73.33	69.56
IS_5	84.22	88.44	5.67	6.00	4.04	4.12	95.22	90.44
LSD 5%	4.92	3.83	0.49	0.83	0.24	0.21	10.68	8.60
Snap bean								
IS_0	44.67	51.44	9.78	10.44	0.64	0.76	26.89	28.36
IS_1	51.44	52.78	9.56	10.22	0.67	0.73	22.40	22.73
IS_2	48.89	50.22	9.11	9.78	0.61	0.68	21.94	22.28
IS_3	48.11	49.44	8.33	9.00	0.61	0.68	18.87	19.20
IS_4	50.44	51.78	9.56	10.22	0.63	0.70	23.30	23.63
IS_5	47.44	48.78	9.89	10.56	0.61	0.68	21.68	22.01
LSD 5%	4.91	3.13	NS	NS	NS	NS	4.77	4.59

This increasing effect of such intercropping systems could be attributed to either the less competition among plants on the available nutrients in the surrounding media or to more exposure to sunlight or both as the IS_0 and IS_2 systems allow. The superiority of the IS_3 system in that respect could be ascribed to the beneficial effect of fertilizers applied to pepper plants along with under this system,. In addition, the plants exposed to sunlight longer time than plants grown on northern side especially in the early morning.

These aforementioned conclusion are in line with Moursi (1968) with garlic, who found that growing plants on one side of the ridge increased average dry weight / plant. These results are in agreement with those reported by El-Moursi (1999), with garlic and El-Shamma (1980) on broad bean and pepper.

2. Effect of nitrogen levels:

Data presented in Table (2) revealed (in both seasons studied) that the application of nitrogen at the rate of 100 kg N/fed was the most effective treatment for increasing plant height, number of branches, stem diameter and plant dry weight in both crops. The response of the pepper plants and snap bean to nitrogen levels were shown in the previous table and stimulative effect of nitrogen on growth parameters may be due to that nitrogen as an essential element for building up protoplasm, amino acids and proteins, which induce cell division and initial meristematic activity (Mengel and Kirkby, 1982.

These results are in line with those reported by El-Bakry *et al.* (1978) with okra and Osorio and Freire (1982) with *Phaseolus vulgaris*, El-Gazar *et al.* (1988) on kidney beans and okra and El-Moursi (1999) on snap bean and garlic.

Table 2. Vegetative growth of pepper and snap bean as affected by nitrogen level in the 2000 and 2001 seasons.

Nitrogen level (kg/fed)	Plant height (cm)		No. of branches		Stem diameter (cm)		Plant dry weight (g)	
	2000	2001	2000	2001	2000	2001	2000	2001
Pepper								
0	83.33	87.72	4.17	4.50	3,79	3.88	86.78	82.44
50	83.94	88.11	4.17	4.44	3.76	3.83	97.78	92.83
100	86.56	90.83	4.44	4.67	4.05	4.12	104.72	99.39
LSD 5%	2.76	1.88	NS	NS	0.12	0.11	4.47	4.01
Snap bean								
0	48.33	50.11	9.06	9.83	0.61	0.68	21.88	22.28
50	48.72	51.00	9.17	9.83	0.61	0.68	21.86	22.32
100	48.44	51.11	9.89	10.44	0.67	0.74	23.80	24.51
LSD 5%	NS	NS	NS	NS	0.04	0.05	NS	NS

3. Effect of intercropping systems-nitrogen levels interactions:

The results in Tables (3 and 4) demonstrated that plants of the 2 tested crops grown under the IS_0, IS_1, IS_2 and IS_5 intercropping systems of cultivation and received the high levels of nitrogen (100 kg N/fed) measured the highest values in almost characters in both seasons of study. These positive effects could be attributed to that such combination allowed less competation among plants and made cultural practices easier to be done. Moreover, the addition of nitrogen fertilizer to pepper plants greatly helped in that respect. These results agreed with El-Gazar *et al.* (1988), who found that plants of both crops studied (kidney beans and Okra) grown under the combination between IS_2 or IS_3 intercropping system and 46 kg N/fed gave the highest measures for plant height and plant dry weight, and these agreed with El-Moursi (1999),

On the other hand, plants of the two tested crops grown under the IS_3 and IS_4 intercropping systems cultivation and received the zero level of nitrogen measured the highest values in all characters in both seasons of study. These results may be due to high intensivety of snap bean plants in those two systems and snap bean plants are able to fix atmospheric nitrogen.

Table 3. Vegetative growth of pepper as affected by intercropping system-nitrogen level interaction in the 2000 and 2001 seasons.

Treat IS	N level (kg/ fed)	Plant height (cm)		No. of branches		Stem diameter (cm)		Plant dry weight (g)	
		2000	2001	2000	2001	2000	2001	2000	2001
IS_0	0	72.00	75.67	3.33	3.67	3.10	3.20	60.00	57.00
	50	82.67	86.67	4.33	4.67	3.33	3.40	96.00	91.33
	100	89.00	93.33	5.00	5.33	3.57	3.67	124.00	117.67
IS_1	0	91.33	96.00	3.33	3.67	3.30	3.40	68.00	64.67
	50	99.33	104.33	2.33	2.33	3.67	3.73	112.00	106.33
	100	94.67	99.33	2.33	2.33	4.20	4.27	112.00	106.33
IS_2	0	72.33	77.33	4.33	4.67	4.37	4.40	82.00	78.00
	50	82.67	86.67	5.33	5.67	4.43	4.50	124.00	117.67
	100	87.00	91.33	6.33	6.67	4.43	4.50	124.00	117.67
IS_3	0	102.67	107.67	5.33	5.67	5.13	5.27	152.00	144.33
	50	72.00	75.67	3.33	3.67	3.43	3.47	70.00	66.33
	100	86.67	91.00	3.33	3.67	3.57	3.63	106.00	100.67
IS_4	0	82.00	86.00	5.33	5.67	3.60	3.67	90.00	85.33
	50	82.33	86.33	3.33	3.67	3.50	3.57	72.00	68.33
	100	73.67	77.33	2.33	2.33	3.87	3.93	58.00	55.00
IS_5	0	79.67	83.67	3.33	3.67	3.27	3.33	68.67	65.33
	50	84.67	89.00	6.33	6.67	4.20	4.30	112.67	107.00
	100	88.33	92.67	7.33	7.67	4.67	4.73	104.33	99.00
LSD 5%		6.24	4.59	0.96	0.69	0.30	0.27	10.95	9.82

Table 4. Vegetative growth of snap bean as affected by intercropping system-nitrogen level interaction in the 2000 and 2001 seasons.

Treat IS	N level (kg/ fed)	Plant height (cm)		No. of branches		Stem diameter (cm)		Plant dry weight (g)	
		2000	2001	2000	2001	2000	2001	2000	2001
IS_0	0	43.67	47.67	8.00	9.33	0.57	0.67	24.20	24.93
	50	44.67	51.67	9.67	10.33	0.63	0.73	25.30	26.40
	100	45.67	55.00	11.67	11.67	0.73	0.87	31.17	39.73
IS_1	0	50.00	51.33	9.67	10.33	0.60	0.67	21.30	21.63
	50	51.33	52.67	8.67	9.33	0.63	0.70	20.20	20.53
	100	53.00	54.33	10.33	11.00	0.67	0.83	25.70	26.03
IS_2	0	47.67	49.00	9.33	10.00	0.63	0.70	21.30	21.63
	50	49.00	50.33	9.33	10.00	0.57	0.63	21.37	21.70
	100	50.00	51.33	8.67	9.33	0.63	0.70	23.17	23.50
IS_3	0	48.33	49.67	9.00	9.67	0.60	0.67	17.87	18.20
	50	49.00	50.33	8.67	9.33	0.60	0.67	20.30	20.63
	100	47.00	48.33	7.33	8.00	0.63	0.70	18.43	18.77
IS_4	0	52.33	53.67	10.33	11.00	0.67	0.73	25.93	26.27
	50	49.67	51.00	9.67	10.33	0.63	0.70	21.47	21.80
	100	49.33	50.67	8.67	9.33	0.60	0.67	22.50	22.83
IS_5	0	48.00	49.33	8.00	8.67	0.60	0.67	20.70	21.03
	50	48.67	50.00	9.00	9.67	0.60	0.67	22.50	22.83
	100	45.67	47.00	12.67	13.33	0.63	0.70	21.83	22.17
LSD 5%		4.06	4.00	2.71	2.51	0.11	0.13	7.20	6.76

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تأثير نظم التحميل ومستويات مختلفة من التسميد الأزوتى على بعض الصفات فى الفاصوليا والفلفل المحملين معاً٠

١- التأثير على النمو الخضرى٠

عايده محمد محمود عبد الرحيم - السعيد لطفى السيد فتحى - حامد محمد محمد غبارى - السعيد محمود السعيد٠

قسم بحوث الخضر - مركز البحوث الزراعية - القاهرة - مصر٠

أجرى هذا البحث فى المزرعة البحثية بالبرامون بمحافظة الدقهلية فى الموسم الصيفى ٢٠٠٠ ، ٢٠٠١ وذلك بهدف دراسة تأثير بعض نظم التحميل (الفاصوليا على الفلفل) ومستويات من التسميد الأزوتى على بعض صفات النمو فى كلا المحصولين٠ وكانت نظم التحميل هى:-

زراعة كل من الفلفل البلدى والفاصوليا صنف برونكو منفرداً٠

- النظام الأول: زراعة الفلفل على ريشه واحدة وزراعة الفاصوليا بين نباتات الفلفل على نغس الريشة٠
- النظام الثانى: زراعة الفلفل على ريشه وزراعة الفاصوليا على الريشة الأخرى فقط٠
- النظام الثالث: زراعة الفلفل على ريشه وزراعة الفاصوليا على الريشتين مع عدم ترك خط للعزيق٠
- النظام الرابع: زراعة الفلفل على ريشه وزراعة الفاصوليا على الريشتين مع ترك خط للعزيق عرضة ٢٠ سم تقريباً٠
- النظام الخامس: زراعة الفلفل على قمة الخط وزراعة الفاصوليا بين نباتات الفلفل على قمة الخط٠

وكانت مستويات التسميد الأزوتى التى درست كما يلى:-

أ- صفر (بدون تسميد للأزوتى)٠

ب- ٥٠ كيلو جرام أزوت (١٤٩,٢٥٤ كجم من نترات النشادر ٣٣,٥%)٠

جـ- ١٠٠ كيلو جرام أزوت (٢٩٨,٥٠٠ كجم من نترات النشادر ٣٣,٥%)٠

وكان التصميم المستخدم فى التجربة هو تصميم القطع المنشقة حيث رتبت نظم التحميل فى القطع الرئيسية بينما رتبت مستويات التسميد الأزوتى فى القطع المنشقة وزرعت شتلات الفلفل فى ٢٤ ، ٢٦ مارس فى الموسم الأول والثانى على التوالى على مسافة ٣٠ سم وزرعت الفاصوليا عندما أصبحت الأرض مستحرثة (أى بعد حوالى ٦ أيام تقريبا) بنظم التحميل السابقة٠

ويمكن تلخيص النتائج المتحصل عليها فيما يلى:-

١- تأثير نظم التحميل: كانت أكثر نظم التحميل تأثيراً هما النظامان الثانى والثالث حيث سببا زيادة فى إرتفاع النبات ، عدد الأفرع ، قطر الساق والوزن الجاف لكلا المحصولين (الفلفل والفاصوليا)٠ وكان أعلى إرتفاع نبات قد سجل مع نظام التحميل الأول لكلا المحصولين فى الموسمين٠

٢- تأثير التسميد الأزوتى: أدى التسميد بـ ١٠٠ كيلو جرام أزوت للفدان إلى الحصول على زيادة فى إرتفاع النبات وعدد الأفرع وقطر الساق والوزن الجاف للنبات لكلا المحصولين

٣- تأثير التفاعل بين التحميل ومستويات التسميد الأزوتى: أدى التفاعل بين نظم التحميل الأول والثانى والخامس والزراعة المنفردة مع إضافة ١٠٠ كجم أزوت للفدان إلى الحصول على أعلى القيم لمعظم الصفات فى كلا الموسمين٠ ومن ناحية أخرى أدى التفاعل بين نظام التحميل الثالث والرابع مع مستوى النتروجين صفر إلى الحصول على أعلى القيم فى كل الصفات فى كلا الموسمين٠