

# Effect of Intercropping Faba Bean With Rape in Calcareous Soils

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## ABSTRACT

A field experiment was conducted at Nubaria Agric. Res. Station during 2003/2004 and 2004/2005 seasons to study the effect of two tillage systems (ploughed and unploughed), three plant spacings (15, 20 and 25 cm between plants) with two plants per hill for faba bean and five intercropping patterns (pure stand of faba bean and rape, faba bean was sown at 2:2 rows ratio with rape, faba bean was sown at 2:4 rows ratio with rape and faba bean was sown at 4:2 rows ratio with rape) on yield and its components of faba bean as well as competitive relations of faba bean and rape. A split-split plot in complete randomized design with three replicates was used. The results indicated that tillage system had significant effect on faba bean plant height, number of pods/plant, 100-seed weight, seed yield/plant and seed yield/feddan in the two seasons. Plant spacing of fabe bean had significant effect on all studied traits, except plant height in the two seasons. Intercropping patterns had significant effect on all studied characters, except 100-seed weight in the second season only. Data of rape revealed that tillage systems significantly affected seed yield/fed. and seed oil content. Plant spacing and intercropping patterns significantly affected seed yield/fed. in the two seasons. Pure stand of fabe bean and rape gave higher seed yield in all intercropping patterns. Faba bean sown at 2:4 rows with rape gave seed yield 2.80 and 2.95 ardab/fed. and 665.53 and 608.99 kg of rape in the two seasons. The 4:2 rows ratio (faba bean : rape) gave the highest seed yield in all intercropping patterns in the two seasons. Results indicated also that land equivalent ratio (LER) of faba bean and rape in all treatments was more than one. Rape was always dominate, whereas faba bean was less dominated.

## INTRODUCTION

Intercropping is considered an avenue to increase productivity per unit area. Faba bean and rape are commonly suggested as desirable intercrop species because they differ in growth vigor which could allow full utilization of the environment. On the other hand, no-tillage system leaves crop residues on the soil surface which reduce the risk of water and wind erosion, reduce evaporation and increase water availability for crops. In some environment, particularly where cropping depends on rain, conservation tillage practices that leave at least 30% of the ground covered by crop residues have been widely accepted. The plant spacing of faba bean is a limited factor to increase crop yield. Salem and El-Massri (1986) found that increasing plant density from 14 to 33 plants/m<sup>2</sup> increased seed yield/ha by 30.31 and 44.42% in first and second seasons, respectively.

Salih and Ageeb (1987) mentioned that disease incidence decreased with late sowing and was significantly higher at 16.6 plants/m<sup>2</sup> than at 49.9 plants/m<sup>2</sup>. Kahnt *et al.*(1988) reported that increasing plant population increased seed yields. Stringi *et al.* (1988) showed that weight of seeds/plant and number of pods/plant were decreased only slightly with increasing plant density up to 40 plants/m<sup>2</sup>. The 100-seed weight was significantly decreased with increasing plant density. Kitiki *et al.*(1992) showed that the effect of plant density on yield was linear. The economic plant density was 29 plants/m<sup>2</sup>. Abo-Shetaia (1990) found that 70000 plants/fed. gave the highest values for pods/plant, seed weight/plant and seed index, whereas 105000 plants/fed. gave taller plants. Furthermore, several studies were made on plant density of faba bean plants (Abou-Salama and Dawood, 1994, Farag and Shamma, 1994 and Aguilere-Diaz and Recalde Manrique, 1995. Basso *et al.*(1996) noticed that some yield components were affected by tillage and crop residues management, yields of the two species were not significantly affected. El-Douby *et al.*(1996) studied 112000, 140000 and 186666 plants/fed. given conventional ploughing or no-tillage treatment and 15, 30 or 45 kg P<sub>2</sub>O<sub>5</sub>/fed. and found that plant, however, seed yield and other yield components were unaffected by tillage treatment. Dzienia and Wereszezaka (1998) found that spring ploughing or direct drill into stubble, instead of traditional tillage ploughing decreased faba bean yield by 25 and 11%, respectively.

Tillage is considered as a technique that plays an important role in soil and water conservation where the processes of infiltration, run off and evaporation of the soil aimed at improving soil conditions affecting crop production (Hill, 1982). Faba bean yield was not significantly reduced by intercropping with sugar beet and it raised the total income (Nour and Farag, 1984; Farag, 1990 and El-Borai and Radi, 1993), whereas Abou-Keriasha *et al.*(1991), Amer *et al.*(1997), Metwally *et al.*(1997), Abd El-Ali (2002) and Marey (2003) indicated that monoculture planting gave the highest values of yield and its components of faba bean as compared to the intercropping systems. Abdel-Aal *et al.*(1989) concluded that intercropping faba bean at different densities on sugar beet decreased root length and yield of top as compared to sole planting. Abou-Keriasha *et al.*(1991) showed that seed yield/plant, seed index and seed yield/fed. of faba bean were statistically influenced by intercropping monoculture faba bean, chickpea and lentil produced the highest means of plant height and seed yield/fed. than the other intercropping systems. Amer *et al.*(1997), Metwally *et al.*(1997) and Hussein and El-Deep (1999) showed that yield of faba bean intercropped with sugar beet, onion and chickpea were reduced by intercropping. The highest values for LER were observed when

intercropping sugar beet with onion, while the lowest values were obtained when intercropping sugar beet with faba bean. Hussein and El-Deep (1999) found that intercropping faba bean at a density of 4 plants/m<sup>2</sup> with sugar beet increased profitability by LE 12.5% than solid sugar beet. The major objective of this study was to investigate the effect of tillage system, plant spacing of faba bean and intercropping patterns on yield, yield components, seed oil content of rape, besides competitive relations in calcareous soil.

## **MATERIALS AND METHODS**

A field experiment was carried out at Nubaria Agric. Res. Station during 2003/2004 and 2004/2005 seasons. A split-split plot design with three replicates was used. Two tillage systems (ploughed and unploughed) occupied the main plots, whereas the plant spacings of faba bean (15, 20 and 25 cm between plants) were arranged in the sub-plots. Five intercropping patterns (solid planting of faba bean and rape, faba bean was sown at 2:2 rows ratio with rape, faba bean was sown at 2:4 rows ratio with rape and faba bean was sown at 4:2 rows ratio with rape) occupied the sub-sub plots.

Soil chemical and mechanical analysis of the experimental site are shown in Table (1). The plot size was 14.4 m<sup>2</sup>, comprises six ridges 4 m long and 60 cm apart. Giza 716 faba bean and Serw-4 rape cultivars were used. In both solid and intercropping patterns, the preceding crop was corn in both growing seasons. Faba bean was cultivated on October 27 and November 3, whereas rape was sown on November 18 and 26 in the first and second seasons, respectively. Calcium superphosphate at a rate of 30 kg P<sub>2</sub>O<sub>5</sub>/fed. was applied as a base application. Thinning was done 17 days after sowing at two plants per hill for faba bean and rape. Other cultural practices were carried out as recommended.

Table 1. Mechanical and chemical analyses of the soil at the experimental site.

Soil properties	Seasons	
	2003	2004
Soil particles (%)		
Sand	52.9	53.3
Silt	21.8	20.8
Clay	25.3	25.9
Soil texture	Sand clay loam	Sand clay loam
Chemical analysis		
Total N (%)	0.046	0.051
Available N (ppm)	26.30	26.60
Available P (ppm)	9.68	8.40
Available K (ppm)	425.0	403.0
pH	8.2	8.1
E.C. (mmhos/cm)	2.21	1.95
O.M. (%)	0.16	0.18
CaCO <sub>3</sub> (%)	22.9	22.5

At harvest, 10 faba bean plants were randomly taken from the middle row of each sub-sub plot to determine the yield components of faba bean: plant height (cm), number of pods/plant, 100-seed weight (g) and seed yield/plant (g). Seed yield/fed. for faba bean and rape was measured on plot basis and seed oil content of rape was determined by Soxhlet apparatus on dry weight basis as described by Sorenson (1947).

The following competitive relations were determined:

**1. Land equivalent ratio (LER):** It was determined according to the equation given by De Wit (1965) equation as follows:

$$L \text{ faba bean} = \frac{y_{cs}}{y_{cc}} \qquad L \text{ rape} = \frac{y_{sc}}{y_{ss}}$$

$$LER = L \text{ faba bean} + L \text{ rape}$$

**2. Aggressivity (A):** It was determined according to McGilchrist (1965) formula as follows:

$$ACS = \frac{y_{cs}}{y_{cc} \times Z_{ab}} - \frac{y_{sc}}{y_{ss} \times Z_{ba}} \text{ for faba bean}$$

$$ASC = \frac{y_{sc}}{y_{ss} \times Z_{ba}} - \frac{y_{cs}}{y_{cc} \times Z_{ab}} \text{ for rape}$$

where:

- ycs = intercrop yield of faba bean in combination with rape
- ycc = pure stand yield of faba bean
- ysc = intercrop yield of rape in combination with faba bean
- yss = pure stand yield of rape
- Zba = sown proportion of species b (in combination with a)
- Zab = sown proportion of species a (in combination with b)
- ACS = aggressivity of faba bean
- ASC = aggressivity of rape

The collected data were statistically analyzed according to procedure outlined by Snedecor and Cochran (1967). Treatment means were compared using L.S.D test at 0.05 level of significance.

## **RESULTS AND DISCUSSION**

### **A. Faba bean**

#### **1. Effect of tillage system (T)**

The results presented in Tables (2 and 3) indicated that tillage system had a significant effect on plant height, number of pods/plant, 100-seed weight, seed yield/plant and seed yield/fed. in the two seasons. Applying ploughed tillage system gave the highest values for all studied characters. These results show that tillage system may provide better germination and seedling growth compared to no-tillage. Results showed also that using ploughed tillage system gave higher seed yield/fed. than that of no-tillage system. Yield increases were estimated by 12.7 and 18.0% in the first and second seasons, respectively. Similar results were reported by Basso *et al.*(1996), El-Douby *et al.*(1996) and Dzienia and Wereszezaka (1998).

#### **2. Effect of plant spacing (S)**

Results in Tables (2 and 3) show that number of pods/plant, 100-seed weight, seed yield/plant and seed yield/fed. significantly increased with increasing plant spacing. The plant height was decreased die to plant spacing 15, 20 and 25 cm between plants in both seasons. This increment may be attributed to the competition between plants for light within the dense population. Number of pods/plant, 100-seed weight and seed yield/plant were significantly increased by increasing plant spacing from 15 to 25 cm between plants (Table 2). This may be due to the more competition between plant root nutrient, moisture and light in dense planting. The data also showed that increasing plant spacing from 15 to 20

and 25 cm between plants decreased seed yield/fed. in the two seasons. These results are in agreement with those reported by Salem and El-Massri (1986), Salih and Ageeb (1987), Kahnt *et al.*(1988) and Abo-Shetaia (1990).

### 3. Effect of intercropping patterns

The results presented in Tables (2 and 3) indicated that intercropping patterns had significant effect on plant height, number of pods/plant, 100-seed weight, in the second season only and seed yield/plant and seed yield/fed., in the two seasons. The pure stand gave the highest values for all studied traits as compared to the intercropping patterns, in the two seasons. The obtained results could be due to higher competition between faba bean and rape for light, water and nutrition elements. The results presented in Table (2) indicated that no significant differences were found for plant height, number of pods/plant, 100-seed weight and seed yield/plant when faba bean was sown at 2:2, 2:4 and 4:2 rows ratio with rape, respectively. Also, significant differences were found when faba bean was sown at 2:2 rows ratio with rape and pure stand on all studied traits. The results in Table (3) showed that significant differences were found between all intercropping patterns on seed yield/fed., in the two seasons. The pure stand gave higher seed yield than that of all intercropping patterns, in the two seasons. It was clear that sowing 4 rows faba bean : 2 rows rape gave the highest yield compared to other intercropping patterns. The obtained results could be due to higher competition between faba bean and rape for light, water and nutrition elements. Similar results were also reported by Nour and Farag (1984), Abdel-Aal *et al.*(1989), Abou-Keriasha *et al.*(1991), Amer *et al.*(1997) and Metwally *et al.*(1997).

Table 2. Mean values of plant height, number of pods/plant, 100-seed weight and seed yield/plant of faba bean plants as affected by tillage system, plant spacing and intercropping patterns in 2003/2004 and 2004/2005 seasons.

Treatments	Plant height (cm)		Number of pods /plant		100-seed weight (g)		Seed yield /plant (g)	
	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005
<b>Tillage system</b>								
Tillage	107.47	110.59	10.77	10.32	85.81	85.28	12.50	12.50
No-tillage	83.75	93.21	10.16	9.20	83.94	84.46	10.77	11.62
L.S.D <sub>0.05</sub>	5.11	6.83	0.42	0.51	0.98	0.65	0.54	0.71
<b>Plant spacing (cm)</b>								
15	98.95	102.84	9.73	8.81	83.85	84.04	10.84	10.94
20	94.75	101.71	10.46	9.86	84.66	85.14	11.34	11.59
25	93.14	101.04	11.20	10.62	86.12	85.43	11.97	12.39
L.S.D <sub>0.05</sub>	NS	NS	1.13	1.27	1.33	0.93	0.76	1.03
<b>Intercropping patterns</b>								
2 : 2	91.10	95.58	8.13	7.88	84.12	83.59	9.81	9.30
2 : 4	93.38	97.09	9.35	8.22	84.45	84.25	9.97	10.37
4 : 2	92.93	100.42	9.24	8.66	85.16	85.24	10.85	11.42
Pure stand	105.03	114.36	15.13	14.29	85.77	86.42	14.92	15.49
L.S.D <sub>0.05</sub>	8.45	7.79	2.75	2.66	NS	1.83	1.49	2.29

Table 3. Mean values of seed yield/fed. of faba bean plants as affected by tillage system, plant spacing and intercropping patterns in 2003/2004 and 2004/2005 seasons.

Treatments	Seed yield/fed. (ardab/fed.)	
	2003/2004	2004/2005
<b>Tillage system</b>		
Tillage	4.96	5.38
No-tillage	4.40	4.56
L.S.D <sub>0.05</sub>	0.21	0.43
<b>Plant spacing (cm)</b>		
15	5.29	5.63
20	4.48	4.65
25	4.29	4.62
L.S.D <sub>0.05</sub>	0.45	0.57
<b>Intercropping patterns</b>		
2 : 2	3.94	4.04
2 : 4	2.80	2.95
4 : 2	4.96	5.35
Pure stand	7.04	7.46
L.S.D <sub>0.05</sub>	1.03	1.37

**B. rape****1. Effect of tillage system, plant spacing of faba bean and intercropping patterns on seed yield/fed. and seed oil content of rape plants**

The results presented in Table (4) indicated that tillage system, plant spacing and intercropping patterns had significant effect on seed yield/fed. and seed oil content of rape plants. Applying ploughed tillage gave the highest seed yield/fed. The results showed that ploughed tillage may provide better germination and seedling growth compared to no-tillage. Results also showed that using ploughed tillage system gave higher seed yield/fed. than that of no-tillage in the two seasons. Also, increasing plant spacing of faba bean increased seed yield of rape in the two seasons. This increase may be due to high efficiency of photosynthesis and weed control. Probably wide hill spacing in case of 25 cm led to uniform light exposure and little competition between faba bean and rape. These results are in agreement with those reported by Salem and El-Massri (1968), Basso *et al.*(1996) and El-Douby *et al.*(1996). In the same time, the pure stand gave the highest values of seed yield/fed. compared to the intercropping patterns.

Table 4. Mean values of seed yield/fed. and seed oil content of rape plants as affected by tillage system, plant spacing and intercropping patterns in 2003/2004 and 2004/2005 seasons.

Treatments	Seed yield/fed. (kg/fed.)		Seed oil content (%)	
	2003/2004	2004/2005	2003/2004	2004/2005
<b>Tillage system</b>				
Tillage	659.23	562.74	43.20	42.82
No-tillage	600.13	530.30	42.36	42.01
L.S.D <sub>0.05</sub>	7.75	16.74	0.31	0.25
<b>Plant spacing (cm)</b>				
15	624.26	587.29	42.59	42.05
20	625.40	597.96	42.68	42.92
25	639.38	616.34	42.58	42.37
L.S.D <sub>0.05</sub>	12.03	21.48	NS	NS
<b>Intercropping patterns</b>				
2 : 2	499.63	465.06	42.89	42.27
2 : 4	665.53	608.99	43.07	42.17
4 : 2	492.24	462.88	42.52	42.73
Pure stand	861.34	865.21	42.50	42.62
L.S.D <sub>0.05</sub>	37.56	44.94	NS	NS



The data also showed that significant differences were found between all intercropping patterns in the first season, but in the second season no significant differences were found between 2:2 and 4:2 rows ratio. It was clear that sowing 2 rows faba bean : 4 rows rape gave the highest yield compared to other intercropping patterns. The obtained results could be due to higher competition between faba bean and rape for light, water and nutrition elements. Similar results were also reported by Abou-Keriasha *et al.*(1991), El-Douby *et al.*(1996) and Metwally *et al.*(1997). Plant spacing and intercropping patterns did not significantly affected seed oil content in the two seasons (Table 4).

**2. Interaction effect**

Data in Tables (5 and 6) indicated that the first order and the second order were not significant in the two seasons. The data also showed significant interaction effect of tillage system, plant spacing of faba bean and intercropping patterns on seed yield of faba bean and rape plants in the two seasons. The highest seed yield was obtained from growing faba bean solid on ploughed soil, 4:2 rows ratio (faba bean and rape) and 15 cm spacing between plants. However, the lowest yield was obtained from growing faba bean solid on unploughed soil, 2:4 rows ratio (faba bean and rape) and 25 cm spacing between plants in both seasons.

Table 5. Interaction between tillage system, plant spacing and intercropping on seed yield/fed. of faba bean plant in 2003/2004 and 2004/2005 seasons.

Tillage system	Plant spacing (cm)	Seed yield/fed. (ardab/fed.)									
		2003/2004					2004/2005				
		Intercropping patterns					Intercropping patterns				
		2:2	2:4	4:2	Pure	Mean	2:2	2:4	4:2	Pure	Mean
Tillage	15	4.94	3.69	5.88	8.43	5.73	5.31	3.52	6.85	9.05	6.18
	20	3.96	2.81	4.87	7.10	4.68	4.01	2.96	5.03	7.94	4.98
	25	3.66	2.73	4.65	6.90	4.48	3.83	3.01	5.83	7.24	4.98
	Mean	4.18	3.07	5.13	7.47	4.96	4.38	3.16	5.90	8.07	5.38
No-tillage	15	3.87	2.69	5.17	7.66	4.85	4.01	3.14	5.36	7/86	5.09
	20	3.74	2.52	4.71	6.13	4.27	3.64	2.71	4.40	6.59	4.33
	25	3.51	2.36	4.51	6.02	4.01	3.45	2.84	4.63	6.13	4.26
	Mean	3.71	2.52	4.79	6.60	4.40	3.70	2.89	4.79	6.86	4.56
L.S.D <sub>0.05</sub>											
	T x S	NS					NS				
	T x I	NS					NS				
	S x I	NS					NS				
	T x S x I	1.95					2.11				

Table 6. Interaction between tillage system, plant spacing and intercropping on seed yield/fed. of rape plants as affected by tillage system, plant spacing and intercropping patterns in 2003/2004 and 2004/2005 seasons.

Tillage system	Plant spacing (cm)	Seed yield/fed. (kg/fed.)									
		2003/2004					2004/2005				
		Intercropping patterns					Intercropping patterns				
		2:2	2:4	4:2	Pure	Mean	2:2	2:4	4:2	Pure	Mean
Tillage	15	523.96	690.34	513.23	875.18	650.68	486.51	583.96	465.34	894.76	607.64
	20	531.76	711.36	520.54	859.24	655.72	490.07	608.75	471.63	880.88	612.83
	25	537.24	717.51	527.75	902.73	671.31	500.16	621.31	504.88	900.16	631.62
	Mean	530.98	706.40	520.50	879.05	659.23	492.24	604.67	480.61	891.93	617.36
No-tillage	15	453.11	612.77	450.34	875.18	597.85	422.79	600.12	430.86	814.04	566.95
	20	466.09	619.88	463.38	831.00	595.09	434.51	612.43	444.56	840.88	583.09
	25	485.64	641.36	478.13	824.73	607.46	456.33	627.37	460.03	860.56	601.07
	Mean	468.28	624.67	463.95	843.64	600.13	437.87	613.31	445.15	838.49	583.70
L.S.D <sub>0.05</sub>											
T x S		NS					NS				
T x I		NS					NS				
S x I		NS					NS				
T x S x I		56.87					66.81				

The data presented in Table (6) showed that the highest seed yield was obtained from growing rape solid on ploughed soil, 2:4 rows ratio (faba bean and rape) and 25 cm spacing between plants. However, the lowest yield was obtained from growing rape solid on unploughed soil, 2:2 rows ratio (faba bean and rape) and 25 cm spacing between plants.

## **C. Competitive relations**

### **1. Land equivalent ratio (LER)**

Results presented in Table (7) indicated that LER values were greater than one when intercropping faba bean with rape in the two seasons. It is clear that the actual productivity was higher than expected productivity. The highest values were obtained from the interaction of ploughed tillage x higher plant spacing (25 cm between plants) at the 4:2 intercropping faba bean with rape (1.36) in the second season and the interaction unploughed tillage x higher plant spacing (25 cm between plants) x 4:2 rows ratio (1.36) in the first season. Whereas, the lowest values were obtained from the interaction of unploughed tillage x lowest spacing (15 cm between plants) x 2:2 row ratio (faba bean : rape) (1.02 and 1.03) in the two seasons, respectively. Similar results were reported by Abou-Keriasha *et al.*(1991), Metwally *et al.*(1997) and Hussein and El-Deep (1999).

### **2. Aggressivity (Ag)**

Data presented in Table (7) showed that aggressivity values were larger when intercropping faba bean with rape under tillage system, plant spacing of faba bean and intercropping patterns. The highest values of aggressivity were at ploughed tillage, 20 cm spacing between plants with 4:2 row ratio (0.81 and 0.67) in the two seasons, respectively. Rape was dominate crop (positive values), whereas faba bean was the dominated crop (negative values). These results could be due to higher competition between faba bean and rape for light, water and nutrition elements. Similar results were reported by Abou-Keriasha *et al.*(1991), Metwally *et al.*(1997) and Hussein and El-Deep (1999).

Table 7. Land equivalent ratio (LER) and aggressivity for seed yield of faba bean and rape crops as affected by tillage system, plant spacing and intercropping patterns in 2003/2004 and 2004/2005 seasons.

Tillage system	Plant spacing (cm)	Inter. patterns	LER		Aggressivity			
					2003/2004		2004/2005	
			2003 /2004	2004/ 2005	ASC	ACS	ASC	ACS
Tillage	15	2:2	1.18	1.12	0.03	-0.03	0.09	-0.09
		2:4	1.22	1.04	0.15	-0.15	0.21	-0.21
		4:2	1.29	1.28	0.74	-0.74	0.43	-0.43
	20	2:2	1.18	1.06	0.12	-0.12	0.15	-0.15
		2:4	1.22	1.06	0.02	-0.02	0.10	-0.10
		4:2	1.29	1.17	0.81	-0.81	0.67	-0.67
	25	2:2	1.13	1.09	0.13	-0.13	0.05	-0.05
		2:4	1.18	1.11	0.01	-0.01	0.23	-0.23
		4:2	1.25	1.36	0.76	-0.76	0.50	-0.50
No-tillage	15	2:2	1.02	1.03	0.02	-0.02	0.46	-0.46
		2:4	1.05	1.14	0.02	-0.02	0.11	-0.11
		4:2	1.18	1.19	0.55	-0.55	0.58	-0.58
	20	2:2	1.17	1.07	0.10	-0.10	0.62	-0.62
		2:4	1.15	1.14	0.14	-0.14	0.40	-0.42
		4:2	1.33	1.20	0.54	-0.54	0.60	-0.60
	25	2:2	1.16	1.09	0.05	-0.05	0.43	-0.43
		2:4	1.15	1.19	0.03	-0.03	0.32	-0.32
		4:2	1.32	1.29	0.62	-0.62	0.49	-0.49

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## الملخص العربي

### تأثير تحميل الكانولا مع الفول البلدى فى الأراضى الجيرية

فتحى رجب رمضان نوار

قسم بحوث التكتيف المحصولى - معهد بحوث المحاصيل الحقلية -

مركز البحوث الزراعية - الجيزة

أجريت هذه الدراسة بمحطة البحوث الزراعية بالنوبارية خلال موسمى ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ لدراسة تأثير نظم الخدمة (خدمة ، بدون خدمة)، ثلاث مسافات زراعة للفول البلدى ( ١٥ ، ٢٠ ، ٢٥ سم بين الجور) مع زراعة نباتين بالجورة، وخمسة نظم تحميل (زراعة منفردة للفول البلدى، زراعة منفردة للكانولا، زراعة الفول البلدى بنسبة ٢:٢ مع الكانولا، زراعة الفول البلدى بنسبة ٢ : ٤ مع الكانولا، زراعة الفول البلدى بنسبة ٤ : ٢ مع الكانولا) على حاصل الفول البلدى والكانولا ومكونات حاصل الفول البلدى والعلاقات التنافسية بينهم. وكان التصميم المستخدم قطع منشقة مرتين فى قطاعات كاملة العشوائية. وأوضحت النتائج مايلى:

- أثرت نظم الخدمة معنوياً على ارتفاع النبات، عدد القرون/نبات، وزن ١٠٠ بذرة، حاصل البذور/نبات، حاصل البذور/فدان فى كلا الموسمين.
- أثرت مسافات زراعة الفول البلدى معنوياً على كل الصفات التى درست ماعدا ارتفاع النبات فى الموسمين.
- أثرت نظم التحميل معنوياً على كل الصفات التى درست ماعدا وزن ١٠٠ بذرة فى الموسم الثانى فقط.
- أثرت مسافات الزراعة ونظم التحميل على حاصل الفدان فى الموسمين، وأعطت الزراعة المنفردة أعلى حاصل لمحصولى الفول البلدى والكانولا، وأعطت زراعة الفول البلدى مع الكانولا بنسبة ٢ : ٤ حاصل ٢,٨ ، ٢,٩٥ أردب للفدان للفول البلدى و ٦٦٥,٥٣ ، ٦٠٨,٩٩ كيلو جرام لفدان للكانولا فى الموسمين، على الترتيب.
- أعطت زراعة الفول البلدى مع الكانولا بنسبة ٤ : ٢ أعلى حاصل بذور من الفول البلدى والكانولا فى كلا الموسمين.
- أوضحت النتائج أن قيمة المكافئ الأراضى لحاصل الفول البلدى والكانولا كانت أكبر من الواحد الصحيح، كما أشارت النتائج إلى سيادة الكانولا على الفول البلدى وذلك عند حساب العدوانية.