Zagazig J. Agric. Res., Vol. 39 No. (6) 2012 1057-1067

Zagazig Journal of Agricultural Research

www.zu.edu.eg/agr/journals

EFFECT OF TRANSPLANTED SEEDLING AGE OF INTERCROPPED FODDER BEET WITH FABA BEAN AND NITROGEN FERTILIZER LEVELS ON, YIELD AND IT'S COMPONENT OF FODDER BEET AND FABA BEAN

Abd El-Aziz M. Abou-Elela* and R.A. Gadallah

Crop Intensification Res., Dep., Field Crop Res., Institute, Agric., Res., Center, Giza, Egypt

ABSTRACT

Two field trails were conducted at El-Gemmeiza Research Station, Gharbia Governolevel during 2009/2010 and 2010/2011winter seasons to investigate the effect of transplanting fodder beet seedling at different ages 18(P_1), 32 (P_2) and 46 (P_3) days from planting and three nitrogen fertilizer levels 90 (A_1), 100 (A_2) and 110 (A_3) kg N/fad on growth, yield and yield components of intercropped fodder beet and faba bean. The results could be summarized as follows: Faba bean growth yield and yield components were reduced under intercropping. Seeds yield/fad. of faba bean was significantly reduced by intercropping with fodder beet, compared to faba bean pure stand. The reductions were 34.0 and 48.17% for P_1, 26.7 and 41.63% for P_2 as well as 21.46 and 32.8% for P_3 in the first and second seasons, respectively. There were significant effect of nitrogen fertilizer levels on faba bean growth, yield and it's components. The highest values of the traits were recorded by nitrogen level 90 kg N/fad., (A_1). Root yield and it's component of fodder beet were significantly decreased in the three transplanting ages as compared with direct seeded in both seasons. The highest reduction was observed by the third transplanting age and the lowest with the first age. These reductions estimated in the third age were 25.15 and 22.75% for top fresh weight/plant, 16.24 and 12.42% for root length, 11.75 and 20.27% for root diameter, 16.30 and 27.16% for root yield/fad., in the first and second seasons, respectively. The highest value of root weight was obtained from the transplanting seedling of 18 days age and highest of root yield (20.88 ton/fad) in the second season. The highest values of fodder beet yield components were observed by 110 kg N/fad., (A_3) nitrogen fertilization and the lowest values were observed by 90 kg N/fad., (A_1). The higher land equivalent ratio (LER) values of fodder beet (0.77 and 0.85) were observed in the first transplanted age and nitrogen fertilizer level (110 kg N/fad.), while the highest values of faba bean (0.87 and 0.79) were observed by late transplanting and the highest nitrogen fertilization. Relative crowding coefficient (K) of faba bean was higher than those of fodder beet. Aggressivity (Ag) of faba bean was dominant crop under interaction treatments whereas fodder beet was the dominated in both seasons. The highest monetary advantage index (MAI) (2667.03 and 2280.87) was observed by late transplanting age and highest nitrogen fertilization in both seasons, while the lowest values (841.16 and 410.92) were observed by late transplanting age and lowest nitrogen fertilization in both seasons.

Keyword: Intercropping fodder beet, faba bean, nitrogen fertilizer levels.

INTRODUCTION

Fodder beet (*Beta Vulgaris* L.) is a new established crop in Egypt. Fodder beet offers a higher yield potential than any other "arable" fodder crop. The roots have an excellent feed quality and they are very palatable to ruminant stock. The leaf can be utilized if required to boost the total fodder output even further (Anonymous, 2006).

Fodder beet considered a good source of energy for animal feeding, high in energy, palatability and digestibility. Fodder beet cultivation may help in overcoming the problem

* **Corresponding author: Tel. :** +201008229445
E-mail address: abdelazizabuelela@yahoo.com

of animal feeding at the beginning of summer season but it still has a weak competitive ability against berseem as winter forage. However, increasing and expanding fodder beet acreage can be realized by finding new and additional areas without changing the prevailing winter crop structure through intercropping with some winter crops.

Wang (1983) found that transplanting prolonged rapid root growth which increased the root leaf ratio at the early growth stages and increased root yield.

Ali *et al.* (1984) reported that intercropping faba bean with fodder beet reduced seed yield/ fad., of faba bean as well as, the length and diameter of fodder beet root when grown on the same ridges, compared to sole crops.

Abou-Keriasha *et al.* (1991) mentioned that the yield and yield components of fodder beet grown on the same ridge with faba bean was comparatively lower than those grown on sole ridges. While, yield and yield components of faba bean have reversely, response.

El-Geddawy *et al.* (1997) concluded that the highest responses in root dimensions were attained with the direct sowing method.

Metwally *et al.* (1997) found that intercropping faba bean with fodder beet significantly increased yield components characters of faba bean. Also intercropping pattern 3 : 2 had significantly increased length and diameter of roots, as well as root and top yields/fad., than other patterns (4: 2 and 5: 2).

Abd El-Gawad *et al.* (2000) showed that root dimension length and diameter was considerably affected by direct seeding treatments greater than those of transplanting treatments.

Nitrogen considered one of the major nutrient elements for fodder beet. It affects growth yield and nutritive value of fodder beet as it is an essential constituent for several physiological and biochemical processes which reflected on the vegetative growth and yield. Increasing N-fertilizer levels increased root diameter and top length as well as root and top fresh weights (Abd El-Hamid *et al.,* 1999).

Previous studies regarding fodder beet, indicated that the nitrogen levels influenced root yield and yield component (karczmarcz *et al.*, 1995, Geweifel and Aly, 1996, Prokopenko *et al.*, 1997, Albayrak and Camas 2005 and 2006. Yiiksel *et al.*, 2010). Indicated that raising nitrogen levels resulted in a significant increase in root length, root diameter and root fresh yield/fad., for fodder beet. Toaima (2006) stated that increasing N level up to 120 kg/fad., increased yield and yield components of fodder beet and intercroped of wheat. He added that, aggressivity values showed that fodder beat was the dominant crop, while faba was the dominated. Abd El-Gawad *et al.* (2008) showed that raising nitrogen levels (70. 90, 110 and 130 kg N/fad., increased root length and diameter, root weight/ plant and roots yield/fad. Parlak and Ekiz (2008) and Albayrak and Yiiksel (2010) reported that increasing root length, root diameter and root yield were due to increasing nitrogen levels. Turk (2010) reported that nitrogen fertilizer application (0, 70, 150 and 225 kg N/ha) increased root diameter, root length and root yield.

The objective of this investigation aimed to study the effect of transplanted seedling age of fodder beet and adding nitrogen fertilizer on yield and yield components of both fodder beet and faba bean when grown together.

MATERIALS AND METHODS

The present investigation was carried out at El-Gemmiza Agricultural Res., Sta., El-Gharbia Governolevel, Agricultural Research Center Egypt, during 2009/2010 and 2010/2011 seasons to study the effect of intercropping faba bean (Giza 716 variety) and fodder beet (Beto ply variety) with different transplanted seedling ages of fodder beet and nitrogen fertilizer levels on growth and yield components of faba bean and fodder beet. A split plot design with three replications was used. The soil was clay in texture with pH of 7.3, 1.0% organic matter and having 21.8, 9.5 and 520 ppm available N, P and K, respectively and EC 0.8 millemoh/cm^3. The experimental plot area was 10.5 m^2, consisted of 5 ridges, 3 m long and 0.7 m wide. The main plots were devoted for transplant seedling age of fodder beet, where (p_1) transplanted seedling fodder beet at the age of 18 days from planting (P_2) transplanted seedling fodder beet at the age of 32 days from planting and (P_3) transplanting fodder beet at the age 46 days from planting. Transplanting dates were kept 12th Nov., 26th Nov. and 10th Des. seedling transplanted 25 cm apart between hills. The subplots were devoted for nitrogen fertilizer. Three levels of nitrogen used were as follows (A_1) 90 kg N/fad., is the ordinary dose for fodder beet + 0 kg N/fad., for faba bean, (A_2) 100 kg N/fad., the recommended for fodder beet + 10 kg N/fad., for faba bean and (A_3) 110 kg N/fad., the recommended for fodder beet + 20 kg N/fad., for faba bean. Faba bean was grown one row on the other side of all fodder beet ridges, 40 cm apart between hills, two plants/hill (25% solid planting). Solid fodder beet as the main crop, was direct seeded in ridges, 25 cm apart between hill one plant hill (24000 plants/fad.) solid faba bean was planted in ridges, 20 cm apart between hills, on the two sides of ridges and growing two plants/hill (120000 plants/fad.) ordinary calcium superphosphate (15.5% P_2O_5) at 200 kg/fad. Nitrogen in the from of ammonium nitrate (33.5% N) at level of 90 kg N/fad., for fodder beet and 20 kg N/fad., for faba bean of solid planting and potassium sulfate (48%K_2O) was added in two equal doses before the first and second irrigation. Faba bean was sown on 12th Nov. and fodder beet on 24th Oct. Ten guarded plants from faba bean and fodder beet were chosen at random from each plot to estimate the yield components of both crops. The yield/faddan was estimated from the whole yield of the plot. The following characters were studied.

Faba bean: plant height (cm), seed weight/ plant (g), number of pods/plant, number of branches/plant, 100 seed weight (g) and seed yield/ faddan (ardab)

Fodder beet: root length (cm), top fresh weight/plant (kg), root diameter (cm), root yield/ plant (kg) and root yield /fad., (ton).

Competitive Relationships

Land equivalent ratio (LER)

It was calculated according to Willey (1979)

$$LER = \frac{yab}{yaa} + \frac{yba}{ybb}$$

where:

yab = yield of intercropped component a

yaa = yield of solid crop a

yba = yield of intercropped intercropping b

ybb = yield of solid crop b

Relative crowding coefficient (Rcc)

According to Dewit (1960) K for crop a, (K) for crop b and (Rcc) for the two crops were calculated as follows:

$$Kab = \frac{yab \times zba}{(yaa - yab) \times zab}, Kba = \frac{yba \times zab}{(ybb - yba) \times zba}$$

where = zab = sown proportion of crop a (in a intercropping with b).

zba = sown proportion of crop b (in b intercropping with a).

Aggressivity (Ag)

This was proposed by Mc-Gilchrist (1965) and was determined according to the following formula:

$$Aga = \frac{yab}{yaa \times zab} - \frac{yba}{ybb \times zba},$$

$$Agb = \frac{yba}{ybb \times zba} - \frac{yab}{yaa \times zab}$$

Monetary advantage index (MAI)

Suggests that the economic assessment should be in terms of the value of land saved; this could probably be most assessed on the basis of the rentable value of this land. MAI was calculated according to the formula, suggested by Willey (1979).

$$MAI = \frac{Value\ of\ comnined\ intercrops \times LER - 1}{LER}$$

Statistical analysis was done for only results of experimental treatments conducted on the two intercropped crops. Mean while solid yield not included in the statistical analysis, but it is used to clarify results of intercropping, thus it is put in the margin of the tables

The total income from each treatment was calculated in Egyptian pound at market price of fodder beet 200 LE/ton and faba bean 574 LE/ ardab.

Data were statistically analyzed according to Snedecor and Cochran (1988), L.S.D. was used at compare between means.

RESULTS AND DISCUSSION

Faba Bean

Effect of transplanted seedling age of fodder beet on faba bean

Results in Table 1 showed significant differences in all studied characters in both seasons. The results clear indicated that, yield and yield components of faba bean were reduced under intercropping. These results may be due to competition between fodder beet and faba bean plants for nutrient, water and solar radiation. Plant height of faba bean was more effected at the first transplanted age and less effected at third transplant age (P3) as compared with solid. seed yield components of faba bean i.e. number of pods/plant, number of branches/plant, seed yield /plant and weight of 100 seeds take the same trend of plant height in the two seasons. Concerning seed yield/fad., of faba bean, the results indicated that, significant reduction was observed by intercropping fodder beet with faba bean, compared to faba bean pure stand. similar results were recorded by Ali *et al.* (1984), Abou-Keriasha *et al.* (1991). The reduction was estimated by 34.0 and 48.17% for P1, 26.7 and 41.63% for P2 as well as 21.46 and 23.8% for P3 in the first and second seasons, respectively. This increase in yield and yield components of faba bean cleared that, the competition between faba bean and fodder beet amplified by faba bean elongation and consequently it's large shading on second and third transplanted seedling age (P_2 and P_3) of fodder beet.

Effect of nitrogen fertilizer levels on faba bean

Results in Table 2 show a significant effect of nitrogen fertilizer levels on faba bean yield and yield components. Faba bean plant height was significantly increased due to increasing nitrogen fertilizer levels from 90 to 110 kg N/fad. Also, number of pods, number of branches/ plants, seed yield/plant and weight of 100 seeds were significantly increased in both seasons. High values of the traits were recorded by nitrogen fertilizer level 110 kg N/fad., while low values were recorded by nitrogen fertilizer level 90 kg N/fad. The reduction in seed yield/fad., was 35.0 and 47.25% for A1, 29.2 and 24.55% for A2 as will as 19.51 and 32.8% for A3 as compared with solid in the first and second seasons, respectively.

Effect of interaction between transplanted seedling age and nitrogen fertilizer levels on yield and yield component of faba bean

There was no significant interaction between the effects of the transplanted seedling age of fodder beet and nitrogen fertilizer levels on all study characters expect weight of seeds/plant in the first season, number of pods/ plant and seed yield/fad., in the second season (Table 3). However, high yield and yield components values of faba bean were observed by the third transplanted seedling age of fodder beet (P3) and nitrogen fertilizer level (110 kg N/fad.,) (A3). The lowest values were observed by the first transplanted seedling age of fodder beet (P_1) and nitrogen fertilizer level (90 kg N/fad.) (A_1).

Fodder Beet

Effect of transplanted seedling age on yield and yield components of fodder beet

Results in Table 4 showed that yield and yield components of fodder beet were significantly decreased due to increasing transplanted seedling age as compared with direct seeded in both seasons. The reduction was higher with the third age and lower with the first age. This reduction was estimated in the third age by 25.15 and 22.75% for top fresh weight and by 16.24 and 12.42% for root length and by 11.75 and 20.27% for root diameter and by 16.3 and 27.16% for root yield /fad., in first and second seasons, respectively. These results may be due to the relative advantage of the early transplanting for the seedling while delaying seedling transplanting gradually decreased root length. The negative effect is due to the abnormal growth of the roots as a result to the mortality of the apical meristem which may be delayed, the natural growth of the root.

Table 1. Effect of transplanted seedling age of fodder beet on yield and yield components of faba bean in the two seasons

Transplanted sedling age	2009/2010 season						2010/2011 season					
	Plant height (cm)	Wt. of seeds /plant (g)	No.of pods	No.of branches/ plant	100 seeds weight (g)	Seed yield/ fad. *(ardab)	Plant height (cm)	Wt. of seeds /plant (g)	No. of pods	No.of branches /plant	100 seeds weight (g)	Seed yield/ fad. (ardab)
P_1	101.49	35.57	26.27	2.38	39.85	5.41	102.54	25.08	27.11	2.29	43.33	4.52
P_2	109.19	40.54	29.10	2.93	42.19	6.01	105.72	28.10	28.76	2.69	45.64	5.09
P_3	117.15	44.97	31.80	3.43	43.99	6.44	112.37	31.09	31.24	3.04	47.62	5.86
LSD 5%	3.80	3.16	1.27	0.37	2.67	0.616	3.12	1.59	1.14	0.34	3.55	0.166
Solid	121.4	46.21	32.1	3.85	48.22	8.20	117.8	37.18	32.62	3.17	50.17	8.72

* Ardab = 155 kg

Table 2. Effect of nitrogen fertilizer levels on yield and yield components of faba bean in the two seasons

Nitrogen fertilizer levels	2009/2010 season						2010/2011 season					
	Plant height (cm)	Wt. of seeds /plant (g)	No. of pods	No. of branches/ plant	100 seeds weight (g)	Seed yield/ fad. *(ardab)	Plant height (cm)	Wt. of seeds /plant (g)	No. of pods	No. of branches /plant	100 seeds weight (g)	Seeds yield/ fad. (ardab)
A_1	101.61	37.12	26.93	2.62	39.35	5.33	100.59	22.38	27.30	2.29	42.82	4.60
A_2	107.67	40.43	29.49	2.92	41.74	5.82	105.69	27.69	28.39	2.81	44.13	5.01
A_3	118.56	43.53	30.76	3.21	44.94	6.60	114.37	34.21	31.42	2.98	49.65	5.86
LSD 5%	5.40	0.86	1.58	0.043	2.43	0.476	6.93	1.34	0.94	0.487	3.66	0.141
Solid	121.4	46.21	32.1	3.85	48.22	8.20	117.8	37.18	32.62	3.17	50.17	8.72

* Ardab = 155 kg

Table 3. Interaction effect of transplanted seedling age × nitrogen fertilizer levels on yield and yield components of faba bean in the two seasons

Transplanted fodder beet age	Nitrogen fertilizer level	2009/2010 season Plant height (cm)	Wt. of seeds /plant (g)	No. of pods	No. of branches/ plant	100 seeds weight (g)	Seed yield/ fad. *(ardab)	2010/2011 season Plant height (cm)	Wt. of seeds /plant (g)	No. of pods	No. of branches/ plant	100 seeds weight (g)	Seed yield/ fad. (ardab)
P_1	A_1	96.57	30.57	24.67	2.13	36.41	4.85	95.95	19.49	25.92	1.77	41.73	4.03
	A_2	101.73	35.87	26.5	2.33	40.50	5.49	103.97	24.02	27.0	2.43	43.03	4.41
	A_3	106.19	40.27	27.63	2.70	42.63	5.88	107.71	31.73	28.4	2.67	43.70	5.14
P_2	A_1	99.93	38.2	26.81	2.67	40.2	5.79	98.69	22.48	27.54	2.37	42.63	4.69
	A_2	106.53	40.7	29.67	2.93	41.4	5.92	103.09	27.35	28.60	2.77	43.93	4.95
	A_3	121.1	42.73	30.83	3.20	44.96	6.32	115.39	34.46	30.15	2.93	45.83	5.64
	A_1	108.33	42.59	29.3	3.10	41.43	5.67	107.13	25.16	28.45	2.70	45.63	5.10
P_3	A_2	114.73	44.73	32.3	3.50	43.33	6.05	109.99	31.69	29.57	3.23	49.96	5.68
	A_3	128.40	47.60	33.8	3.73	47.22	7.17	119.99	36.43	35.72	3.33	53.34	6.79
LSD 5%		NS	1.49	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	1.62	N.S.	N.S.	0.25
Solid		121.4	46.21	32.1	3.85	48.22	8.20	117.8	37.18	32.62	3.17	50.17	8.72

* Ardab = 155 kg

Table 4. Effect of transplanted seedling age of fodder beet on yield and yield components of fodder beet in the two seasons

Transplanted fodder beet age	2009/2010 season Root length (cm)	Root diameter (cm)	Top fresh weight/ plant (kg)	Root weight/ plant (kg)	Root yield/fad. (ton)	2010/2011 season Root length (cm)	Root diameter (cm)	Top fresh weight/ plant (kg)	Root weight/ plant (kg)	Root yield/fad. (ton)
P_1	29.99	8.59	0.974	1.101	17.73	28.67	9.47	1.068	1.175	20.88
P_2	26.98	7.81	0.822	0.913	16.05	27.86	8.58	0.926	0.954	18.78
P_3	25.12	7.58	0.729	0.772	14.84	25.11	7.55	0.825	0.893	15.21
LSD 5%	2.16	0.749	0.069	0.131	NS	2.61	1.204	0.124	0.101	N.S.
Solid	33.1	8.97	1.451	1.507	14.11	33.8	9.91	1.518	1.415	26.13

Sowing fodder beet seedling of 18 days age attained superiority in root diameter over that recorded by other seedling olds. Once more, it could be observed that delaying the seedling age before transplanting decreased root thickness. These results are in line with those found by Wang (1983) and El-Geddawy *et al.* (1997) who suggested that the highest response was in root dimensions.

Results showed that, top fresh weight significantly affected by seedling olds. Using seedling of 18 days age for sowing fodder beet recorded a district effect on this trait compared with other seedling aged 32 or 46 days. Highest root yield weight was obtained from the transplanted seedling of 18 days age. The lowest weight of root yield was produced from the thinning plants.

The highest root yield (20.88 tons/fad.) was produced when fodder beet seedling were transplanted at 18 days age. This observation was true compared with the other seedling age. Followed was second and third transplanting seedling age (P_1 and P_2). Similar results were observed by El-Geddawy *et al.* (1997) and Abd El-Gawad *et al.* (2000)

Effect of nitrogen fertilizer levels on yield and yield components of fodder beet

Results presented in Table 5 showed significant effects of nitrogen fertilizer levels on yield and its component of fodder beet in both seasons. Fodder beet root yield and yield components were decreased under intercropping condition as compared with solid in both seasons. Highest yield components of fodder beet were observed when the nitrogen fertilizer was 110 kg N/fad., (A_3). The lowest values were observed by 90 kg N /fad. (A_1). The reduction that found in roots yield/fad., in (A_1) were estimated by 11.75 and 12.99% while in (A_2) the reduction were 4.66 and 6.34% in the first and second seasons, respectively. This reduction may be due to decrease of nitrogen fertilizer levels used in intercropping which affects growth yield and nutritive value of fodder beet as it is an essential constituent for several physiological and biochemical processes which reflected on the vegetative growth and yield. Increasing nitrogen fertilizer levels increased root diameter and top length as well as root and top fresh weights. Similar results are observed by Abd El-Hamid *et al.* (1999).

Interaction Effects

Results in Table 6 show no significant effect of interaction between transplanted seedling age and nitrogen fertilizer levels in the first and second seasons.

Competitive Relationships and Yield Advantage of Intercropping

Land Equivalent Ratio (LER)

Results presented in Table 7 indicates that land equivalent ratio (LER), relative crowding coefficient (Rcc) and aggressivity (Ag) varied considerable due to the effect of transplanted seedling age of fodder beet and nitrogen fertilizer levels in the two seasons. The higher land equivalent ratio of fodder beet (Ry_F) (0.77 and 0.85) was observed at early transplanting age of fodder seedling and the highest nitrogen fertilizer level ($P_1 \times A_3$). While the highest value of faba bean (Ry_b) (0.87 and 0.79) were observed in the third transplanted seedling age and the nitrogen fertilizer was 110 kg N/fad. ($P_3 \times A_3$). Land equivalent ratio (LER) of both crops was greater than one. It could be concluded that the actual productivity was higher than the expected productivity. Highest LER value (1.56) found by the interaction between $P_3 \times A_3$ in the first season and (1.45) between $P_3 \times A_3$ in the second seasons, while the lowest LER value (1.08) was recorded due to the interaction between $P_3 \times A_1$ in the second season and the interaction between $P_1 \times A_1$ in the first season. This result agree with those obtained by Toaima (2006).

Relative crowding coefficient (Rcc)

Faba bean intercropped with fodder beet proved advantageous in both seasons as shown in Table 7. Faba bean relative crowding coefficient (k faba) was higher than fodder beet relative crowding coefficient (K fodder). The interaction between $P_3 \times A_3$ in the first season and $P_1 \times A_3$ in the second season gave the best Rcc values for crop advantageous, while the interaction $P_1 \times A_1$ showed the lowest Rcc

Table 5. Effect of nitrogen fertilizer levels on yield and yield components of fodder beet in the two seasons

Nitrogen fertilizer levels	2009/2010 season					2010/2011 season				
	Root length (cm)	Root diameter (cm)	Top fresh weight/ plant (kg)	Root weight/ plant (kg)	Root yield/fad (ton)	Root length (cm)	Root diameter (cm)	Top fresh weight/ plant (kg)	Root weight/ plant (kg)	Root yield/fad (ton)
A_1	24.07	6.55	0.697	0.777	15.67	23.78	7.25	0.801	0.882	17.01
A_2	26.38	7.92	0.885	0.913	16.58	27.37	8.42	0.929	0.984	18.31
A_3	31.19	9.52	1.023	1.127	17.39	30.49	9.93	1.088	1.157	19.55
LSD 5%	3.079	0.502	0.073	0.065	0.428	1.735	1.003	0.103	0.092	2.344
Solid	33.1	8.97	1.451	1.507	24.11	33.8	9.91	1.518	1.415	26.13

Table 6. Interaction effect of transplanted seedling age × nitrogen fertilizer levels on yield and yield components of fodder beet in the two seasons

Transplanted Fodder Beet age	Nitrogen fertilizer levels	2009/2010 season					2010/2011 season				
		Root length (cm)	Root diameter (cm)	Top fresh weight/ plant (kg)	Root weight /plant (kg)	Root yield/ fad. (ton)	Root length (cm)	Root diameter (cm)	Top fresh weight /plant (kg)	Root weight /plant (kg)	Root yield /fad. (ton)
P_1	A_1	26.10	7.22	0.805	0.931	17.10	25.10	8.56	0.892	1.031	19.52
	A_2	30.13	8.17	0.952	1.085	17.61	28.20	9.21	1.043	1.143	21.02
	A_3	33.73	10.39	1.167	1.287	18.47	32.70	10.65	1.269	1.352	22.10
P_2	A_1	24.37	6.04	0.685	0.787	14.91	24.63	7.01	0.801	0.832	18.41
	A_2	26.07	7.83	0.791	0.832	16.12	28.30	8.71	0.900	0.927	18.65
	A_3	30.50	9.56	0.911	1.121	17.12	30.73	10.01	1.076	1.104	19.28
P_3	A_1	21.73	6.38	0.601	0.614	15.00	21.70	6.18	0.711	0.784	13.10
	A_2	24.30	7.75	0.673	0.727	16.01	25.60	7.34	0.846	0.881	15.26
	A_3	29.33	8.61	0.912	0.975	16.57	28.03	9.12	0.919	1.015	17.26
LSD 5%		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Solid		33.1	8.97	1.415	1.507	24.11	33.8	9.91	1.518	1.415	26.13

Table 7. Competitive relationships of transplanted seedling age and nitrogen fertilizer levels between fodder beet and faba bean in the first and second seasons

Transplanted fodder Beet age	Nitrogen fertilizer levels	2009/2010 season									2010/2011 season								
		LER			K			Ag		MAI	LER			K			Ag		MAI
		Fodder	Faba	LER	Fodder	Faba	K	Fodder	Faba		Fodder	Faba	LER	Fodder	Faba	K	Fodder	Faba	
	A_1	0.71	0.59	1.30	0.61	5.79	3.53	-2.79	+2.79	1431.67	0.75	0.46	1.21	0.74	3.44	2.55	-2.02	+2.02	1079.02
P_1	A_2	0.73	0.67	1.40	0.68	8.10	5.51	-2.48	+2.48	1906.65	0.80	0.51	1.31	1.03	4.09	4.21	-1.52	+1.52	1593.86
	A_3	0.77	0.72	1.49	0.82	10.14	8.31	-2.07	+2.07	2324.74	0.85	0.59	1.44	1.37	5.74	7.86	-1.26	+1.26	2252.05
Mean		0.74	0.66	1.40	0.70	8.01	5.48	-2.45	+2.45	1887.69	0.80	0.52	1.32	1.05	4.42	4.87	-1.6	+1.6	1641.64
	A_1	0.62	0.71	1.33	0.41	9.61	3.94	-3.18	+3.18	1564.51	0.70	0.54	1.24	0.60	4.66	2.80	-2.36	+2.36	1233.69
P_2	A_2	0.67	0.72	1.39	0.50	10.39	5.20	-2.86	+2.86	1857.99	0.71	0.57	1.28	0.62	5.25	3.26	-1.95	+1.95	1437.47
	A_3	0.71	0.77	1.48	0.61	13.45	8.20	-2.73	+2.73	2287.03	0.74	0.65	1.39	0.70	7.32	5.12	-1.78	+1.78	1990.22
Mean		0.67	0.73	1.40	0.51	11.15	5.52	-2.92	+2.92	1903.18	0.71	0.59	1.03	0.65	5.74	3.73	-2.03	+2.03	1553.79
	A_1	0.62	0.69	1.31	0.41	8.96	3.67	-3.70	+3.70	841.16	0.50	0.58	1.08	0.25	5.64	1.41	-3.27	+3.27	410.92
P_3	A_2	0.66	0.74	1.40	0.49	11.26	5.52	-2.95	+2.95	1902.14	0.58	0.65	1.23	0.35	7.47	2.61	-2.53	+2.53	1180.35
	A_3	0.69	0.87	1.56	0.55	27.84	15.31	-2.68	+2.68	2667.03	0.66	0.79	1.45	0.49	14.07	6.89	-2.10	+2.10	2280.87
Mean		0.66	0.70	1.44	0.48	16.02	7.29	-3.11	+3.11	1803.44	0.58	0.67	1.25	0.36	9.06	3.64	-2.63	+2.63	1290.71

values in the first season and $P_3 \times A_1$ in the second season. This result agree with these obtained by Toaima (2006).

Aggressivity (Ag)

The results in Table 7 clearly show that, aggressivity faba bean was dominant crop under interaction treatments whereas fodder beet was the dominated one in both seasons. The present results indicate clearly that faba bean has higher competitive abilities than fodder beet. The highest Ag values were from the interaction between $P_3 \times A_1$ whereas the lowest Ag values obtained from the interaction between $P_1 \times A_3$ in both seasons. This result agree with these obtained by Toaima (2006).

Monetary advantage index (MAI)

The results in Table 7 clearly indicat that, the values of monetary advantage index (MAI) were positive when intercropping fodder beet with faba bean under transplanting seedling age and nitrogen fertilizer levels. The results clearly showed that the MAI values were increased under nitrogen fertilizer level (A_3), the high MAI values (2667.03 and 2280.87) were observed when $P_3 \times A_3$ in both seasons, while the low MAI values (841.16 and 410.92) were observed when $P_3 \times A_1$ in both seasons.

REFERENCES

Abd El-Gawad, A.A., H.Kh. Hassan and W.M. Hassany (2000). Transplanting technique to adjust plant stand of sugar beet under saline conditítions. Transplanting versus direct seeding effect on sugar beet yield. Proc. 9th Conf., Agron., Minufiya Univ., 549-560.

Abd El-Gawad, M.S.M., T.K. Abd El-Aziz and M.A. Abd El-Galil (2008). Effect of intercropping wheat with fodder beet under different levels of N. application on yield and quality. Ann. Agric. Sci., Ain Shams Univ., Cairo, 53 (2): 353-362.

Abd El-Hamid, M.F., H.M.M. Abd El Dayem, A.M. El-Sewedy and A.I.E. El-Shatie (1999). Effect of nitrogen and potassium on some growth characteristics, yield and chemical composition of fodder beet plant (*Beta vulgaris* L.). Proc 1st Symp. of the Egyption Society of plant Nutrition and Fertilization. Cairo, 41-60.

Abou-Keriasha, M.A., M.M. El-Mihi, K.E. El-Habbak, M.A. El-Masry and A.S. Kamel (1991). Varietal responses of fodder beet intercropping with faba bean to different patterns of intercropping. Egypt. J. Appl. Sci., 6 (8): 225-232.

Albayrak, S. and N. Camas (2005). Influence of row spacing on root yield and yield components of fodder beet (*Beta vulgaris vra.* Crassa Mansf.) in the Black Sea Coastal Region. Tarim Bilim Derg., 11(2): 160-164.

Albayrak, S. and N. Camas (2006). Yield components of fodder beet (*Beta vulgaris vra.* Crassa Mansf.) under the Middele Black Sea Region conditions. Tarim. Derg., 12(1). 65-69.

Albayrak, S. and O. Yuksel (2010). Effects of nitrogen fertilization and harvest time on root yield and quality of fodder beet (*Beta vulgaris vra.* Crassa Mansf.) Bulg. J. Agric. Sci., 16: 212-219.

Ali, F.A., M.A. Harfoush, A.M. Rammah and M. Nasr (1984). Production of fodder beet in faba bean fields under different intercropping patterns. Proceeding EMCIP Symposium, 184-193.

Anonymous (2006). Fodder beet. http:/ www. seed 2 grow.co. uk/acatabloy/ fodder beet seed.himi. (16.01.2006).

Dewit, C.T. (1960). On competition verslag land bov wkandige onderzoek, 66 (8): 1-82.

El-Geddawy, I.H., S.S. Zalat and L.M. Saif (1997). Transplanting sugar beet seedling with relation to yield and quality of sugar beet. J. Agric. Sci., Mansoura Univ., 22 (2): 361-368.

Geweifel, H.G.M. and R.M. Aly (1996). Effect of nitrogen and potassium fertilization treatments on growth, yield and quality of some fodder beet varieties. Ann. of Agric. Sci., Moshtoher, 34 (2): 441-454.

Karczmarczyk, S., Z. Kaszamski, M. Roy and D. Sciazko (1995). Effect of sprinkler irrigation and nitrogen fertilizer application on sugar and fodder beets cultivated on a good rye complex soil II. Chemical composition of the crop. Zeszyty Naukowe Akademii Rolniczejw Suzecinie, rolnictwo, 59: 65-72.

Mc-Gilchrist, C.A. (1965). Analysis of competition experiments Biometrics, 1: 975-985.

Metwally, I.O.E., S.A.A. Bassal, E.M.A. Gabr and A.M. Abd El-All (1997). Effect of potassium fertilizer level on productivity of intercropped fodder beet and faba bean. J. Agric., Mansoura Univ., 22 (1): 23-31.

Parlak, A.O. and H. Ekiz (2008). Ankara kosullarinda bazi yemlik pancar (*Beta vulgaris* L.SSp. Crassa Mansf.) cesitlerinin verim ve verim at ogeleri bakimindan karsi lastirilmasi. Tarem Billmeri Dergisi., 14 (2): 95-100.

Prokopenko, L.S, R.V. Olonicheva and I.F. Pidpalii (1997). Amino acid composition and protein nutritive value of fodder beet. Visnik Agromoi Nauki, 1: 26-28.

Snedecor, G.W. and W.G. Cochran (1988). Statisical Method 7th Ed.Iowa State Univ. Press, Ames., Iowa U.S.A.

Toaima, S.E.A. (2006). Response of onion, faba bean and wheat to intercropping with fodder beet under different fertilizer levels of N.P.K. Minufiya J. Agric. Res., 31 (4):939-956.

Turk, M. (2010). Effects of fertilization on root yield and quality of fodder beet (*Beta vulgaris vra.* Crassa Mansf.) Bulg. J. Agric. Sci., 16: 212-219.

Wang, J.G. (1983). A preliminary study to the growth of transplanted sugar beet seedling raised in paper bages. J. of North East Agricultural, 2: 21-25.

Willey, R.W. (1979). Intercropping, it's importance and research needs. Part 10 competition and yield advantage, Field Crops Abst., 32: 1-10.

Yiiksel, O., S. Albayrak and M. Tark (2010). Yemli pancer (*Beta vulgaris vra.* Crassa Mansf.) Cesilerinin Isparta kosullarina adaptasyonu. Turkiye VIII. Tarla Bit. Kong., 761-764.

تأثير عمر شتلات بنجر العلف المحمل مع الفول البلدى ومعدلات السماد النتروجينى على محصول بنجر العلف والفول البلدى المحملين ومكوناتهما

عبد العزيز محمود أبو العلا - رأفت عايد جاد الله

قسم بحوث التكثيف المحصولي – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – الجيزة – مصر

أقيمت تجربتان حقليتان في محطة بحوث الجميزة فى محافظة الغربية خلال الموسمين الشتويين ٢٠١٠/٢٠٠٩ و٢٠١١/٢٠١٠ وذلك لدراسة تأثير عمر شتلات بنجر العلف وهى (١٨، ٣٢، ٤٦ يوم أى P_1 , P_2 , P_3) وثلاث معدلات سماد نتروجينى هى (٩٠، ١٠٠، ١١٠ وحدة نتروجين أى A_1 , A_2 , A_3) على محصول بنجر العلف والفول البلدى المحملين ومكوناتهما وقد أستخدم تصميم القطع المنشقة مرة واحدة في ثلاث مكررات وشغل فى القطع الرئيسية عمر شتلات بنجر العلف (P_1 , P_2 , P_3) بينما القطع الشقية شغلها معدلات السماد (A_1 , A_2 , A_3). وكانت أهم نتائج الدراسة فيما يلى: انخفض محصول الفول البلدى ومكوناته تحت التحميل بمقارنة الزراعة المنفردة، وكانت نسبة الإنخفاض ٣٤، ٤٨,١٧٪ فى عمر شتلة (P_1) و ٢٦,٧ ، ٤١,٦٣٪ فى عمر شتلة (P_2) و٢١,٤٦ ، ٣٢,٨٪ فى عمر شتلة (P_3) خلال الموسم الأول والثانى على التوالى. وكان هناك تأثير معنوى لمعدلات السماد النتروجينى على محصول الفول البلدى ومكوناته وكانت أعلى قيم مسجلة عند التسميد النتروجينى بمعدل ١١٠ وحدة نتروجين (A_3) بينما أقل قيم مسجلة مع معدل التسميد النتروجينى بمعدل ٩٠ وحدة نتروجين (A_1)، وكان انخفاض محصول الفدان ٣٥,٠٠ و ٤٧,٢٥٪ مع (A_1) و٢٩,٠٢ ، ٢٤,٥٤٪ مع (A_2) و ١٩,٥١، ٣٢,٨٪ مع (A_3) بمقارنة الزراعة المنفردة للموسم الأول والثانى على التوالى. وجد انخفاض معنوى فى محصول بنجر العلف ومكوناته مع عمر شتلات البنجر بالمقارنة بالزراعة المباشرة بالبذرة. وكان انخفاضاً عالياً مع العمر الثالث عن العمر الأول وقدر الانخفاض فى العمر الثالث فكان ٢٥,١٥ و ٢٢,٧٥٪ فى وزن العرش للنبات و ١٦,٢٤، ١٢,٤٢٪ لطول الجذر و ١١,٧٥ ، ٢٠,٢٧٪ فى قطر الجذر و ١٦,٣ ، ٢٧,١٦٪ لمحصول الجذر. وكانت أعلى القيم فى محصول بنجر العلف ومكوناته قد سجلت عند عمر شتلات ١٨ يوم وكذلك أعلى محصول للجذر ٢٠,٨٨ طن/فدان فى الموسم الثانى، وأعلى قيم لمكونات محصول بنجر العلف مع ١١٠ وحدة نتروجين بينما أقل القيم مع ٩٠ وحدة نتروجين وكان نسبة الانخفاض ١١,٧٥ ، ١٢,٩٩٪ مع معدل (A_1) و ٤,٦٦ ، ٤,٦٤٪ مع معدل (A_2) خلال الموسم الأول والثانى على التوالى. أظهرت النتائج أن أعلى قيم لمعدل استغلال الأرض LER لبنجر العلف تتراوح بين (٠,٧٧– ٠,٨٥) مع العمر الأول للشتلات ومعدل التسميد الثالث ١١٠ وحدة نتروجين للفدان بينما أعلى قيم للفول البلدى تتراوح بين (٠,٧٩-٠,٨٧) مع العمر الثالث للشتلات ومعدل التسميد العالى فى كلا الموسمين. كان معامل الحشد النسبى للفول البلدى أعلى من بنجر العلف ، وأظهرت العدوانية أن الفول البلدى هو المحصول السائد بينما بنجر العلف هو المحصول المسود مع المعاملات خلال موسمى الزراعة. كان أعلى دليل صافى العائد (٢٦٦٧,٠٣ - ٢٢٨٠,٨٧) مع العمر الثالث للشتلات ومعدل التسميد العالى خلال موسمى الزراعة، بينما أقل دليل صافى العائد (٨٤١,١٦ – ٤١٠,٩٢) مع العمر الثالث للشتلات ومعدل التسميد المنخفض خلال موسمى الزراعة. يمكن التوصية للحصول على محصول جذور عالى من بنجر العلف المحمل مع الفول البلدى وذلك عند العمر الأول لشتلات بنجر العلف مع تسميد ١١٠ وحدة نتروجين للفدان.