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تأثير تحميل القمح مع الفول البلدي على بعض صفات النمو والمحصول ومكوناته للفول البلدي تحت ظروف الاراضى الرملية.

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الملخص العربي

أقيمت تجربتان حقليتان بالمزرعة البحثية لكلية الزراعة – جامعه دمنهور – بمنطقه البستان بمحافظه البحيرة– ج.م.ع. خلال موسمي ٢٠٠٩/٢٠١٠ و٢٠١٠/٢٠١١ وذلك بهدف دراسة تأثير تحميل بعض أصناف القمح المصري (جيزة ١٦٨ ،سخا ٩٤ ، جميزة ٩ وسدس ١) مع الفول البلدي (صنف سخا ١) باستخدام أربعة نظم زراعيه وذلك على بعض صفات النمو والمحصول ومكوناته للفول البلدي تحت ظروف الاراضى الرملية. حيث تمثلت النظم الزراعية الأربع بزراعه الفول البلدي منفردا ومحملا مع ثلاث كثافات نباتيه للقمح (٣٠٠ و٣٥٠ و٤٠٠ حبه /م^{٢}) بإتباع نظام التحميل في سطور فرديه متبادلة (١:١) على مسافات ٢٠سم بين السطور. وقد نفذت هذه الدراسة باستخدام تصميم القطع المنشقة مره واحده بأربعة مكررات حيث خصصت القطع الرئيسية لأصناف القمح في حين خصصت القطع الفرعية للنظم الزراعية ويمكن تلخيص أهم النتائج المتحصل عليها على النحو الاتى:–

١. كان لأصناف القمح تأثيرا عالي المعنوية على صفه عدد الأيام حتى بلوغ نباتات الفول البلدي مرحله النضج (في الموسمين) وكذا صفه عدد القرون/نبات (في الموسم الأول) بينما لم تتأثر باقي الصفات التي تم دراستها على الفول البلدي معنويا بأصناف القمح في كلا موسمي الدراسة. هذا وقد سجلت أعلى المتوسطات لصفات عدد الأيام من الزراعة وحتى بلوغ نباتات الفول البلدي مرحله النضج وعدد الأفرع/نبات وعدد القرون/نبات وعدد البذور/قرن ووزن البذور/نبات ووزن المائة بذره (في الموسمين) وكذا صفه محصول البذور /هكتار (في الموسم الثاني) وذلك لنباتات الفول البلدي المحملة مع نباتات القمح

صنف سدس ١ بينما سجلت اقل القيم لهذه الصفات وذلك لنباتات الفول البلدي المحملة مع القمح صنف جيزة ١٦٨ وذلك خلال موسمي الدراسة.

٢. أدى تحميل نباتات القمح باى من الكثافات النباتية المختبرة مع نباتات الفول البلدي إلى حدوث نقص معنوي في جميع الصفات المدروسة على نباتات الفول البلدي باستثناء صفه ارتفاع النباتات والتي تزايدت معنويا بالتحميل مقارنه بالزراعة المنفردة للفول البلدي وذلك خلال موسمي الدراسة. هذا وقد أدى تحميل الفول البلدي مع القمح المنزرع بمعدل ٣٠٠ حبه/م^{٢} إلى حدوث زيادة معنوية في جميع صفات الفول البلدي المدروسة باستثناء صفتي ارتفاع النباتات ووزن المائة بذره واللتين تناقصتا معنويا مقارنه بتحميل الفول البلدي مع القمح المنزرع بمعدلات التقاوي الأعلى (٣٥٠ . ٤٠٠ حبة/ م^{٢}.

٣. كان التفاعل بين أصناف القمح والنظم الزراعية لتحميل القمح على الفول البلدي معنويا (في الموسم الأول) وذلك بالنسبة لصفه عدد الأيام من الزراعة وحتى نضج نباتات الفول البلدي هذا وتشير نتائج هذا التفاعل إلى أن تحميل الفول البلدي مع القمح صنف جيزة ١٦٨ بمعدل تقاوي ٤٠٠ حبه/ م^{٢} قد أدى إلى التبكير في نضج نباتات الفول البلدي مقارنه بباقي الأصناف ومعدلات التقاوي الأخرى تحت الدراسة.

٤. في ضوء نتائج هذه الدراسة يتضح امكانيه تحميل محصول الفول البلدي (صنف سخا ١) بكثافة نباتيه ١٦٦٦٦٧ نبات فول/ هكتار مع محصول القمح بمعدل تقاوي ٣٠٠ حبه / م^{٢} في سطور فردية متبادلة "١ : ١" (على مسافات ٢٠ سم بين السطور) وذلك في الاراضى الرملية بمنطقه البستان بمحافظه البحيرة حيث أن هذه المعاملة قد أعطت إنتاجيه قدرت بحوالي ٨٥% من محصول الفول البلدي المنزرع منفردا هذا بالاضافه إلى محصول القمح الناتج من نفس وحده المساحة الارضيه المنزرعة.

EFFECT OF INTERCROPPING WHEAT WITH FABA BEAN ON SOME GROWTH CHARACTERISTICS, YIELD AND YIELD COMPONENTS OF FABA BEAN UNDER SANDY SOIL CONDITIONS

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ABSTRACT: ***Two field experiments were carried out at the Experimental Station Farm of the Faculty of Agriculture, Damanhour University, El-Bostan region, El- Behera Governorate, Egypt during 2009/2010 and 2010/2011 seasons. This study aimed to investigate the effect of intercropping four Egyptian wheat varieties (Giza 168, Sakha 94, Gemmiza 9 and Sids 1) with faba bean under four intercropping patterns on some growth characteristics, yield as well as yield components of faba bean Sakha 1 cultivar in sandy soil conditions. The four intercropping patterns were: faba bean sole cropping as well as faba bean intercropped with wheat at the three wheat plant densities (300, 350 and 400 grains m^{-2}) in alternate single rows (1:1). A split-plot design with four replications was used in each experiment. The wheat varieties occupied the main plots while the intercropping patterns were arranged in the sub-plots.***

Wheat varieties had highly significant effect on number of days to maturity stage (in both seasons) and of number of pods plant $^{-1}$ (in the 1st season), while the other studied traits were insignificantly affected by wheat varieties, in both seasons. Intercropping wheat variety Sids 1 with faba bean resulted in the highest values of number of days to maturity stage, number of branches plant $^{-1,}$ number of pods plant $^{-1}$, number of seeds pod^{-1}, weight of seeds plant $^{-1}$ and 100-seed weight (in both seasons), and seed yield ha^{-1} of faba bean (in the 2nd season), while the lowest values of these traits were obtained from the intercropping of wheat variety Giza 168 with faba bean in both seasons.

Intercropping faba bean with wheat at the three tested seeding rates significantly increased plant height but significantly decreased the rest characters studied of faba bean as compared with faba bean sole cropping in the two seasons. Intercropping faba bean with wheat seeded at the rate of 300 grains m^{-2} significantly increased all studied traits with exception plant

height and 100- seed weight as compared with the intercropping of faba bean with wheat seeded at 350 and 400 grains m^{-2} in both seasons.

There was a significant effect of the interaction between wheat varieties and intercropping patterns in the 1^{st} season on the number of days to maturity stage of faba bean. The earliest maturity faba bean plants were obtained when faba bean plants were intercropped with wheat variety Giza 168 seeded at 400 grains m^{-2}.

The results obtained from this study emphasizes the possibility of intercropping faba bean (Sakha 1 cultivar) at plant density of 166667 plants ha^{-1} with wheat plants seeded at a rate of 300 grains m^{-2} in alternative single rows (1:1), 20 cm apart, under sandy soil conditions of El-Bostan Region, El-Behera Governorate, which gave a substantial faba bean productivity (about 85% of faba bean sole cropping, as an average of both seasons) and an additional wheat grain yield.

Key words: ***Faba bean, Wheat, Growth characters, Seed yield, Yield components, Intercropping patterns.***

INTRODUCTION

Faba bean (*Vicia faba* L.) is the most important legume crop in Egypt. Faba bean seeds are used on a large scale for the Egyptian diet. It is of highly nutritive values (20-41% protein, B complex vitamins and minerals, Chavan *et al*.; 1989). The local planted area of faba bean was estimated by about 90 thousand hectares with an average seed yield of about 3.35 tons ha^{-1} (Journal of Agricultural Statistics, 2009). Therefore, the local production of this crop is insufficient to meet the continuous increase of the consumption, and increasing faba bean production become one of the major targets of the agricultural policy. To satisfy the national requirement of that important crop, either the cultivated area and /or the productivity of unit area should be increased. Intercropping faba bean with some winter crops may be considered as one of the means to increase its cultivated area. Faba bean and wheat crops are commonly suggested as desirable intercrop species because of their different growth rate and spacing which allow full utilization of the environment competition for light.

Hence, intercropping faba with wheat crops, under newly cultivated sandy soil conditions is considered a convenient practice which may lead to reduce labour peaks, minimize crop failure risk, reduce the adverse effect of pests, provide higher returns and, finally, save irrigation water. Liben *et al*. (2001) showed that the intercropping of maize with faba bean is more advantageous than sole cropping of both crops. Fenliang *et al*. (2006) indicated that the seed yield of faba bean intercropped with maize was greater than that of faba bean in monoculture due to increase of the stems per plant and the pods/stem of faba bean. Faba bean growth was suppressed in the wheat

/faba bean intercropping system and facilitated in the maize/faba bean intercropping system which disagrees with the traditional view that legumes are, generally, weak competitors compared with cereals in legume/cereal intercropping systems.

Little information is available about the effect of intercropping faba bean with wheat under newly cultivated sandy soil conditions. Therefore, the aim of the present investigation was to study the effect of intercropping four Egyptian wheat varieties seeded at three seeding rates with faba bean in alternative single rows (20 cm apart) on some growth characteristics, yield as well as yield components of faba bean under sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive winter growing seasons of 2009/2010 and 2010/2011 at the Experimental Farm of the Faculty of Agriculture, Damanhour University, El-Bostan region, El- Behera Governorate, Egypt. The main objective of this work was to study the effect of intercropping four Egyptian wheat varieties (Giza 168, Sakha 94, Gemmiza 9 and Sids 1) with faba bean under four intercropping patterns on some growth characteristics, yield and yield components of faba bean in sandy soil conditions. The four intercropping patterns were as follows:

1. **Sowing faba bean as sole crop (F_1W_0).**
2. **Intercropping of faba bean with wheat seeded at a rate of 300 grains m^{-2} (F_1W_L).**
3. **Intercropping of faba bean with wheat seeded at a rate of 350 grains m^{-2} (F_1W_m).**
4. **Intercropping of faba bean with wheat seeded at a rate of 400 grains m^{-2} (F_1W_h).**

A split–plot experimental design with four replicates was used in both seasons. The wheat varieties were randomly assigned to the main–plots, while the intercropping patterns were allocated to the sub–plots. The area of sub–plots was 7.0 m^2 (3.5 m length and 2.0 m width) and included 10 rows of row width 20 cm. Wheat seeds were hand-drilled, while faba bean was hand-planted in hills, in both seasons. Faba bean (Sakha 1 cultivar) was intercropped with wheat varieties in alternate single rows (1:1). The plant population of faba bean was about 166667 plants ha^{-1} and was maintained through thinning seedlings to one plant $hill^{-1}$, spaced at 30 and 15 cm for solid and intercropping treatments, respectively. In both seasons, both crops were sown on 5th November and faba bean plants were harvested at maturity stage. Phosphorus fertilizer was broadcasted during soil preparation in the form of calcium super phosphate (15.5 P_2O_5%) at a rate of 75.0 kg P_2O_5 ha^{-1}. Potassium sulphate (48% K_2O) was side dressed at a rate of 60.0 kg K_2O ha^{-}

[1] before the first irrigation. Ammonium sulphate (20.5% N), at a rate of 240 kg N ha^{-1}, was added in three doses (1/5) was broadcasted after sowing and before irrigation and (4/5) was side dressed at two equal doses before 1st and 2nd irrigations. All other cultural practices were applied as recommended for faba bean fields in El-Bostan region. Number of days to maturity was recorded as the number of days from sowing to harvest time. At harvest time, ten guarded plants were taken from each sub-plot to determine the growth characters; i.e., plant height (cm), number of branches plant $^{-1}$, as well as yield and yield components; i.e., number of pods plant $^{-1}$, number of seeds pod $^{-1}$, weight of seeds plant $^{-1}$ (g) and weight of 100 seeds (g).

The six middle rows were harvested from each sub-plot to determine the seed yield in ton ha $^{-1}$. The obtained data were statistically analyzed according to Steel and Torrie (1980). Soil samples were taken from the experimental site and analyzed mechanically according to method described by Piper (1950), as shown in Table (1).

Table 1: Soil mechanical analysis of the experimental field sites before sowing.

Characteristics	Seasons	
	2009/2010	2010/2011
Sand (%)	77.37	74.25
Silt (%)	4.66	5.11
Clay (%)	17.97	20.64
Texture class	Sandy	

RESULTS AND DISCUSSIONS

A. Effect of wheat varieties on faba bean traits:

A.1. Growth characteristics:-

Regarding the number of days to maturity stage of faba bean plants, data presented in Tables (2 and 3) indicate that wheat varieties had highly significant effect on this character in both seasons. The results reveal that the earliest faba bean plants (136.03 days) were for those intercropped with wheat variety Giza 168, while the latest plants to mature (140.00 days) were for those intercropped with wheat variety Sids 1, as an average of both seasons. These results could be justified on the basis that wheat variety Sids 1 is known to have weak tillering capacity compared with the other tested wheat varieties. This means that the lower population density of wheat variety Sids1 might lead to increasing the vegetative growth period of faba bean plants. Similar results were reported by Amer *et al*. (1992) and El-Galaly *et al*. (2008).

Concerning faba bean plant height, data in Tables (2 and 3) revealed that faba bean plants were insignificantly affected by intercropping with the tested wheat genotypes in both seasons. However, it is clear that faba bean intercropped with wheat variety Giza 168 had the tallest plants (94.75 cm), while the shortest plants (88.75 cm) were obtained from faba bean intercropped with wheat variety Sids 1, as an average of both seasons.

Table 2

Table 3

With respect to the number of branches plant $^{-1}$, data in Tables (2 and 3) obviously show that faba bean plants were insignificantly affected by the intercropping with any tested wheat varieties in both seasons. Faba bean plants intercropped with wheat variety Sids 1 had the highest value (3.32 branches plant $^{-1}$), meanwhile, faba bean plants intercropped with wheat variety Giza 168 had the lowest one (2.82 branches plant $^{-1}$), as an average of both seasons. These results might be related with the differences between both varieties in their tillering capacity resulting in different plant population densities per unit area for these varieties.

A.2. Seed yield and yield components:

The data presented in Tables (2 and 4) show the effect of intercropping the wheat varieties (Giza 168, Sakha 94, Gemmiza 9 and Sids 1) with faba bean plants on seed yield ha $^{-1}$, as well as studied yield components of faba bean crop. It is clear from Table (4) that faba bean plants intercropped with wheat variety Sids1 had the highest values of number of pods plant $^{-1}$, number of seeds pod^{-1} and 100-seed weight (in both seasons) and seed yield ha^{-1} (in the 2nd season) while, the lowest values were produced from faba bean plants intercropped with wheat variety Giza 168 in both seasons.

B. Effect of intercropping patterns on faba bean traits:

B.1. Growth characteristics:

Data of the studied faba bean characteristics; i.e., number of days to maturity stage, plant height and number of branches plant $^{-1}$ as affected by intercropping patterns with wheat varieties during 2009/2010 and 2010/2011 seasons are shown in Tables (2 and 3).

The data show that intercropping wheat with faba bean under different patterns significantly decreased both number of days to maturity stage and number of branches plant $^{-1}$ compared to faba bean sole cropping in both seasons. The decrease in number of branches in intercropping treatments may be due to more competition between plants for nutrients, moisture and light (Attallah and Mohamed, 2004). On the contrary, intercropping wheat with faba bean led to a significant increase in the faba bean plant height in both seasons (Table 3). The increase in faba bean plant height, as a result of intercropping with wheat, might be due to the shading effect of wheat on faba bean plants, which resulted in marked elongation of the internodes of faba bean plants searching for more light energy among wheat plants. These

results are in general agreement with those reported by El-Naggar *et al*. (1991), Radwan (1993) and Abou-Kerisha *et al*. (2008).

Concerning the comparison among intercropping of faba bean with wheat at low, medium and high seeding rates of wheat i.e., 300, 350 and 400 grains m^{-2}, respectively, the data reveal that both number of days to maturity stage

Table 4

and number of branches plant $^{-1}$ of faba bean were significantly reduced, while faba bean plant height was significantly increased with increasing wheat seeding rates from 300 up to 400 grains m^{-2} (Tables 2 and 3). This means that higher plant population of both intercrops per unit area leads to decreasing the vegetative growth period, enhances the translocation of metabolites quickly to fruits and decreases the chance to get more light, nutrients and elements. On the other hand, faba bean plants height was significantly increased with increasing wheat seeding rates above 350 grains m^{-2} in both seasons (Table 3). These results may be due to the increasing competition for light due to dense population. The reduction in light intensity for faba bean encourages IAA synthesis along stem tissues and this causes cell enlargement and hence plant height. Several researchers reported that faba bean plant height was increased with increasing population density (Khalil *et al.,* 1993; El-Douby *et al.,*1996; Abdel-Aziz and Shalaby ,1999 , El-Banna *et al*. ,2009 and Mehdi *et al.,*2010).

B.2. Seed yield and yield components:

The data in Table (2) reveal that intercropping faba bean with wheat under different seeding rates significantly affected the faba bean seed yield ha^{-1} and all studied yield components in both seasons. Moreover, it is evident from Table (4) that intercropping wheat under any seeding rate with faba bean led to a decrease in all traits as compared with faba bean sole cropping. The increase in number of pods plant $^{-1}$ in faba bean sole cropping may be due to the increase in the number of branches plant $^{-1}$. Faba bean sole cropping may also furnished favorable conditions for number of pods plant $^{-1}$; i.e., climatic and edaphic factors, to faba bean plants to grow and to produce productive organs compared to conditions under intercropping.

In comparison among the intercropping of faba bean with different seeding rates of wheat (300,350 and 400 grains m^{-2}), the data reveal that the number of pods plant $^{-1}$, number of seeds pod^{-1} , weight of seeds plant $^{-1}$ and seed yield ha^{-1} were significantly affected in both seasons (Table 2). Data in Table (4) reveal that intercropping wheat at seeding rate of 300 grains m^{-2} with faba bean led to significant increases for the above -mentioned four traits by 25.11, 40.46 and 29.07 and 24.22% , respectively compared to seeding wheat at the rate of 400 grains m^{-2} (as an average of both seasons). This means that the dense planting of wheat negatively affected the growth, as well as yield of individual. With respect to both 100-seed weight and seed yield ha^{-1}, it is clear from Tables (2 and 4) that the differences were

insignificant in both seasons. This means that wheat seeding rate at intercropped with faba bean plays a major role on yield improvement of faba bean crop. In this concern, El-Shazly and Nasser (1989) reported that plants with a more extensive and well distributed root system could exploit a large soil volume, thereby making more effective use of soil water and nutrients. Also, changes in plant density, as a result of changing seeding rate for one and /or both intercropping crops, alter the structure and size of the canopy and affect yield ha^{-1} and its components. Therefore, faba bean growth, yield as well as yield components were affected significantly by plant density (Selim and El-Seessy, 1991; Hussein *et al*.,1994; El-Deeb *et al.* ,2006 and Hussein *et al*. , 2006)

C- Effect of the interaction between wheat varieties and intercropping patterns:

There was a significant effect for the interaction between wheat varieties and intercropping patterns on number of days to maturity stage of faba bean in the 1st season, as shown in Table (5). The data show that the earliest maturity faba bean plants were obtained when faba bean plants were intercropped with wheat variety Giza 168 seeded at 400 wheat grains m^{-2}, while the latest maturing plants were obtained by solid plantings of faba bean under wheat variety Sakha 94. On the other hand, the rest growth characters as well as yield and yield components were not significantly affected by the interaction between wheat varieties and intercropping patterns in both seasons. Therefore, the data were excluded.

Table 5: Number of days to maturity stage of faba bean plants as affected by the interaction between the wheat varieties (V) and intercropping patterns(I) in 2009/2010 seasons.

Intercropping patterns (I)	Wheat varieties (V)			
	Giza 168	Sakha 94	Gemmiza 9	Sids 1
F_1W_0	145.25	147.00	146.00	145.00
F_1W_L	138.00	138.00	143.00	144.00
F_1W_m	135.00	137.00	139.00	142.00
F_1W_h	133.00	134.00	136.00	141.00
$L.S.D_{0.05}$	1.38			

F_1W_0=Faba bean sole cropping.
F_1W_L=Intercropping faba bean with wheat seeded at the rate of 300 grains m^{-2}.
F_1W_m=Intercropping faba bean with wheat seeded at the rate of 350 grains m^{-2}.
F_1W_h=Intercropping faba bean with wheat seeded at rate of 400 grains m^{-2}.

Conclusion

The results obtained from this study emphasizes the possibility of intercropping faba bean at plant density of 166667 plants ha^{-1} with wheat plants seeded at a rate of 300 grains m^{-2} in alternative single rows (1:1), 20 cm apart, under sandy soil conditions of El-Bostan Region, El- Behera Governorate, which gave a substantial faba bean productivity (about 85% of faba bean sole cropping, as an average of both seasons) and an additional wheat grain yield.

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تأثير تحميل القمح مع الفول البلدي على بعض صفات النمو والمحصول ومكوناته للفول البلدي تحت ظروف الاراضى الرملية.

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الملخص العربي

أقيمت تجربتان حقليتان بالمزرعة البحثية لكلية الزراعة – جامعه دمنهور – بمنطقه البستان بمحافظه البحيرة– ج.م.ع. خلال موسمي ٢٠٠٩/٢٠١٠ و٢٠١٠/٢٠١١ وذلك بهدف دراسة تأثير تحميل بعض أصناف القمح المصري (جيزة ١٦٨ ،سخا ٩٤ ، جميزة ٩ وسدس ١) مع الفول البلدي (صنف سخا ١) باستخدام أربعة نظم زراعيه وذلك على بعض صفات النمو والمحصول ومكوناته للفول البلدي تحت ظروف الاراضى الرملية. حيث تمثلت النظم الزراعية الأربع بزراعه الفول البلدي منفردا ومحملا مع ثلاث كثافات نباتيه للقمح (٣٠٠ و٣٥٠ و٤٠٠ حبه /م^2) بإتباع نظام التحميل في سطور فرديه متبادلة (١:١) على مسافات ٢٠سم بين السطور. وقد نفذت هذه الدراسة باستخدام تصميم القطع المنشقة مره واحده بأربعة مكررات حيث خصصت القطع الرئيسية لأصناف القمح في حين خصصت القطع الفرعية للنظم الزراعية ويمكن تلخيص أهم النتائج المتحصل عليها على النحو الاتى:–

١. كان لأصناف القمح تأثيرا عالي المعنوية على صفه عدد الأيام حتى بلوغ نباتات الفول البلدي مرحله النضج (في الموسمين) وكذا صفه عدد القرون/نبات (في الموسم الأول) بينما لم تتأثر باقي الصفات التي تم دراستها على الفول البلدي معنويا بأصناف القمح في كلا موسمي الدراسة. هذا وقد سجلت أعلى المتوسطات لصفات عدد الأيام من الزراعة وحتى

بلوغ نباتات الفول البلدي مرحله النضج وعدد الأفرع/نبات وعدد القرون/نبات وعدد البذور/قرن ووزن البذور/نبات ووزن المائة بذره (في الموسمين) وكذا صفه محصول البذور /هكتار (في الموسم الثاني) وذلك لنباتات الفول البلدي المحملة مع نباتات القمح صنف سدس ١ بينما سجلت اقل القيم لهذه الصفات وذلك لنباتات الفول البلدي المحملة مع القمح صنف جيزة ١٦٨ وذلك خلال موسمي الدراسة.

٢. أدى تحميل نباتات القمح باى من الكثافات النباتية المختبرة مع نباتات الفول البلدي إلى حدوث نقص معنوي في جميع الصفات المدروسة على نباتات الفول البلدي باستثناء صفه ارتفاع النباتات والتي تزايدت معنويا بالتحميل مقارنه بالزراعة المنفردة للفول البلدي وذلك خلال موسمي الدراسة. هذا وقد أدى تحميل الفول البلدي مع القمح المنزرع بمعدل ٣٠٠ حبه/م^{٢} إلى حدوث زيادة معنوية في جميع صفات الفول البلدي المدروسة باستثناء صفتي ارتفاع النباتات ووزن المائة بذره واللتين تناقصتا معنويا مقارنه بتحميل الفول البلدي مع القمح المنزرع بمعدلات التقاوي الأعلى (٣٥٠ . ٤٠٠ حبة/ م^{٢}.

٣. كان التفاعل بين أصناف القمح والنظم الزراعية لتحميل القمح على الفول البلدي معنويا (في الموسم الأول) وذلك بالنسبة لصفه عدد الأيام من الزراعة وحتى نضج نباتات الفول البلدي هذا وتشير نتائج هذا التفاعل إلى أن تحميل الفول البلدي مع القمح صنف جيزة ١٦٨ بمعدل تقاوي ٤٠٠ حبه/ م^{٢} قد أدى إلى التبكير في نضج نباتات الفول البلدي مقارنه بباقي الأصناف ومعدلات التقاوي الأخرى تحت الدراسة.

٤. في ضوء نتائج هذه الدراسة يتضح امكانيه تحميل محصول الفول البلدي (صنف سخا ١) بكثافة نباتيه ١٦٦٦٦٧ نبات فول/ هكتار مع محصول القمح بمعدل تقاوي ٣٠٠ حبه / م^{٢} في سطور فردية متبادلة "١ : ١" (على مسافات ٢٠ سم بين السطور) وذلك في الاراضى الرملية بمنطقه البستان بمحافظه البحيرة حيث أن هذه المعاملة قد أعطت إنتاجيه قدرت بحوالي ٨٥% من محصول الفول البلدي المنزرع منفردا هذا بالاضافه إلى محصول القمح الناتج من نفس وحده المساحة الارضيه المنزرعة.

Table 2: Mean squares for the analysis of variance of faba bean growth characteristics, seed yield (ton ha^{-1}) and its components, as affected by wheat varieties and intercropping patterns (I) in 2009/2010 and 2010/2011 winter growing seasons.

SOV	DF	Traits							
		Growth characters						Yield and its components	
		No. of days to maturity (day)		Plant height (cm)		No. of branches plant $^{-1}$		No. of pods plant $^{-1}$	
		2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011
Replications	3	93.14**	292.13**	230.71	193.42	0.49	0.98	5.87	1.51
Wheat varieties (V)	3	83.31**	33.67**	96.00	181.67	1.07	0.77	13.95**	15.93
Error "a"	9	5.75	1.96	189.65	535.25	0.29	0.29	11.36	19.14
Intercropping patterr	3	283.97**	345.67**	668.67**	1659.00**	5.57*	6.84**	228.97**	226.43**
V x I	9	15.75**	7.67	57.55	52.11	0.09	0.06	2.94	0.68
Error "b"	36	0.93	7.33	34.92	98.46	0.06	0.28	5.35	3.40

*and ** are significant at 0.05 and 0.01 levels of probability, respectively.

Table 2: Cont.

SOV	DF	Traits							
		Yield and its components							
		No. of seeds pod $^{-1}$		Weight of seeds plant $^{-1}$ (g)		100- seed weight (g)		Seed yield ton ha^{-1}	
		2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011
Replications	3	0.78	0.41	35.10	23.86	2.00	10.07	0.06	1.16**
Wheat varieties (V)	3	2.06	1.39	6.56	24.27	1.71	1.72	0.07	0.26
Error "a"	9	0.75	0.42	12.65	14.60	1.66	5.28	0.34	0.29
Intercropping patterns (I)	3	8.84**	8.38**	139.89**	165.86**	11.74**	17.74**	2.05**	3.24**
V x I	9	0.10	0.06	0.93	3.74	0.21	0.28	0.01	0.06
Error "b"	36	0.25	0.22	4.69	7.34	1.30	1.24	0.09	0.17

** = significant at 0.01 level of probability.

Table 3: Means of growth characteristics of faba bean as affected by wheat varieties and intercropping patterns (I) in 2009/2010 and 2010/2011 winter growing seasons.

Traits	Season	Wheat varieties(V)				Intercropping patterns(I)				Mean
		Giza 168	Sakha 94	Gemmiz9	Sids 1	F_1W_0	F_1W_L	F_1W_m	F_1W_h	
No. of days to maturity (day)	2009/2010	137.81[(1)]d	139.00c	141.00b	143.00a	145.81a	140.75b	138.25c	136.00d	140.20
	2010/2011	134.25b	134.50b	136.75a	137.00a	141.00a	137.50b	133.75c	130.25d	135.63
Plant height (cm)	2009/2010	93.75a	91.75a	88.75a	88.75a	83.50d	87.75c	93.50b	98.25a	90.75
	2010/2011	95.75a	93.00a	89.00a	88.75a	78.50c	89.75b	95.75b	102.50a	91.63
No. of branches plant $^{-1}$	2009/2010	2.80a	2.83a	3.18a	3.30a	3.75a	3.18b	2.83c	2.35d	3.03
	2010/2011	2.83a	3.05a	3.23a	3.33a	3.93a	3.30b	2.78c	2.43c	3.11

F_1W_0= Faba bean sole cropping.
F_1W_L=Intercropping of faba bean with wheat seeded at a rate of 300 grains m^{-2}.
F_1W_m= Intercropping of faba bean with wheat seeded at a rate of 350 grains m^{-2}.
F_1W_h=Intercropping of faba bean with wheat seeded at a rate of 400 grains m^{-2}.
(1)Means followed by the same letter (s), within each row for each factor, are not significantly different at 0.05 level of probability.

Table 4: Means of faba bean seed yield (ton ha^{-1}) and yield components, as affected by wheat varieties and intercropping patterns (I) in 2009/2010 and 2010/2011 winter growing seasons.

Traits	Season	Wheat varieties(V)				Intercropping patterns(I)				Mean
		Giza 168	Sakha 94	Gemmiz9	Sids 1	F_1W_0	F_1W_L	F_1W_m	F_1W_h	
No. of pods plant^{-1}	2009/2010	18.38$^{(1)}$ c	19.23bc	19.98ab	20.53a	24.70a	19.73b	17.75c	15.93d	19.53
	2010/2011	17.35a	17.75a	19.00a	19.45a	23.50a	18.63b	16.70c	14.73d	18.39
No. of seeds pod^{-1}	2009/2010	3.10a	3.40a	3.63a	3.95a	4.43a	3.70b	3.30c	2.65d	3.52
	2010/2011	3.06a	3.23a	3.50a	3.73a	4.25a	3.59b	3.13c	2.54d	3.38
Weight of seeds plant^{-1} (g)	2009/2010	15.70a	15.88a	16.75a	17.00a	20.00a	17.25b	14.88c	13.20d	16.33
	2010/2011	15.38a	16.38a	17.66a	18.08a	21.13a	17.25b	15.58b	13.53c	16.87
100- seed weight (g)	2009/2010	72.15a	72.53a	72.65a	72.88a	73.75a	72.59b	72.15b	71.78b	72.57
	2010/2011	72.55a	72.63a	72.90a	73.28a	74.23a	72.95b	72.45b	71.73b	72.84
Seed yield ton ha^{-1}	2009/2010	2.30a	2.36a	2.43a	2.28a	2.83a	2.36b	2.18bc	2.00c	2.34
	2010/2011	2.52a	2.61a	2.70a	2.82a	3.21a	2.82b	2.45c	2.17c	2.66

F_1W_0= Faba bean sole cropping.
F_1W_L=Intercropping of faba bean with wheat seeded at a rate of 300 grains m^{-2}.
F_1W_m= Intercropping of faba bean with wheat seeded at a rate of 350 grains m^{-2}.
F_1W_h=Intercropping of faba bean with wheat seeded at a rate of 400 grains m^{-2}. 5 l
(1) Means followed by the same letter (s), within each row for each factor, are not significantly different at 0.0evel of probability