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EFFECT OF PRECEDING SUMMER CROPS AND IRRIGATION SYSTEMS ON FABA BEAN PLANTED AT DIFFERENT RIDGES WIDTH

Ibrahim, E. M.
Crop Intensification Res. Dept. Field crop Res. Inst. ARC. Giza, Egypt.

ABSTRACT

Field experiments were conducted at Tag El-Ezz Agric, Res. Station, Dakahlia Province Egypt, during the two successive winter seasons of 2008/2009 and 2009/2010 to study the effect of two preceding summer crops (rice and maize) and five irrigation systems i,e. full irrigation every 30 days (control), irrigation every 40 days and skipping of 1st, 3rd and 4th irrigation at 30, 90 and 120 days on growth and yield of faba bean (sakha 1) planting at 60, 120 and 180 cm ridges width.

Preceding summer crops, irrigation systems and ridge width had significant effect on all studied characters in both seasons. Seed yield of faba bean grown after maize attained an increase of 15.9 % (average of two seasons) compared after rice. Irrigation of faba bean every 30 day recorded the highest values in all studied characters in both seasons. Seed yield under full irrigation increased by 4.5, 28.5, 43.9 and 19.2 % (average of two seasons) compared to every 40 days and skipping of 1st, 3rd and 4th irrigation, respectively. Planting faba bean on ridge at 120 cm width gave the highest values in all studied characters in both seasons except straw yield, at which seed yield recorded up 5.0 and 14.5 % increment compared with 60 and 180 Cm width, respectively. Faba bean planting after maize on ridge 60 cm width with full irrigation gave the highest seed yield (14.5 ardab/fad). On the other hand faba bean planting after rice on ridge of 120 cm width with irrigation every 40 days attained the highest seed yield (13.8 ardab/fad) as average of two seasons.

The simple correlation co-efficient cleared significant positive correlation between seed yield ardab/fad and each of individual studied characters, also cleared that there were significant positive correlations among all studied characters and each other. Multiple regression analysis indicated that the relative contribution for all characters were 89.81 % from the total variation for yield. Analysis of stepwise regression revealed that five out of seven variables contributed by 89.81 % in the total variation for yield. These variables were seed yield/plant, 100-seed weight, plant duration, plant height and no. of pods/plant.

The present investigation recommended cultivation of faba bean after maize at 60 Cm ridge width with full irrigation (4 irrigations, 30 days interval) or after rice at 120 Cm ridge width with (3 irrigations, 40 days interval) were the effective treatments for improving faba bean productivity under El-Dakhlia region condition.

Keywords*: preceding crops, irrigation systems, Faba bean, ridges width, skipping. irrigation*

INTRODUCTION

Faba bean *(Vicia faba L.)* is one of the most important pulse crop grown not only due to its importance in preparing diverse popular dishes and as a major plant protein source for human consumption, but also due to its role in crop rotation which it has the ability to improve soil fertility and save N-fertilizer (roszak, 1973). Total production is still limited and fails to face the national consumption. So, increasing faba bean production at national level is one of

the major targets of the agricultural policy. Preceding crops is limited factor in faba bean productivity. In this respect, Shafshak *et al*. (1984), Salama and El-Hawary (1994), Metwally (1997) and Ibrahim and Abbas (2004) reported that faba bean yield and its components were surpassed when preceded by cotton, maize and rice.

Soil moisture availability is the main limiting factor for growing crops, water supply is the most critical environmental factor affecting faba bean growth. Irrigation is necessary to save the water requirements of the different crops. But increasing soil moisture encourage the activity of soil born fungi which causes root rot and wilt diseases causing harmful effects on faba bean yield (Bernier *et al*., 1993). Amer (1986) found that skipping one irrigation at pod-filling stage decreased plant height, pod number/plant, seed yield /plant, and straw yield/fad. Moreover, Abdallah, (1986), Mohamed *et al*. (1988) and Mwanamwenge *et al*. (1999) reported that pod-filling stage was the most water sensitive stage, due to the adverse limiting effect of water stress on availability of photosynthesis to the reproductive sinks. Amede *et al*. (1999) found that irrigation up to 75% of water holding capacity gave the highest values of plant height, no. of branches, leaves and pods/plant , whereas the lowest values resulted when reach up to 50% of water holding capacity. Balasio *et al*.(2004) found that irrigation intervals of 28 days during the vegetative stage and 14 days during the reproductive stage gave the highest grain yields. Longer intervals up to 28 days during the productive stage resulted 18 % reduction in grain yield

Xia (1994), Pliz- Balzer *et al*. (1995) and El-Far (1999) indicated that seed yield of fully irrigated faba bean increased by 45% than the un-irrigated yield. (Gendy *et al*., 1994 and Gendy *et al*., 1995) found that significant increase in plant height, number of branches and pods/plant, yields of seed and straw and seed protein as a result of increasing irrigation number up to 4. Teama (1994) reported that at branching or at pod-filling stage gave the highest seed yield with the same seed protein content at fully irrigated. Magdy (1996) reported that seed yield of some faba bean cultivars reacted differently to various watering regimes. El-Murshedy (2002) revealed that skipping 2nd, 3rd and 4th irrigation decreased faba bean yield/fad by 15.59, 37.62 and 2.60% respectively compared to full irrigation. Tayel and sabreen (2011) revealed that using more efficient irrigation methods decreased plant water consumption.

Change ridge width (as a new farming system) play a major role in faba bean production through optimum distribution. This leads to optimum density for crop plants per unit area. Minimum intra competition of plants subsequently light use efficiency of solar radiation utilized by faba bean plants, in turn high in the conversion of light energy to chemical energy and consequently high accumulation of dry matter (Gadallah *et al*., 2006). Several authors reported the significant effect of number of rows per ridge on faba bean yield and its components (Ageeb, . 1983, Saleh, 1985; El-Tohami and Hussein, 1986; Ali and Abd El-Mottaleb, 1997 and El-Douby *et al*. 2000).

The present study aimed to evaluate the proper preceding crop rotation under ridge width together with watering skipping method of field bean

MATERIAL AND METHODS

Field experiments were carried out at Tag El-Ezz Agric. Res. Station, Dakahlia Province, during 2008/09 and 2009/10 seasons to study the proper of preceding crops, irrigation systemstreatments and ridge width on growth and yield of faba bean.A combined experiment in split-plot design with three replicates was used. Each previous crop was evaluated in a separate experiment. The main plots were occupied at random with irrigation treatments:

1- Full irrigation, in which four irrigation were applied at 30 day intervals.
2- Irrigation every 40 day intervals in which three irrigation were applied.
3-Skipping the 1st irrigation at 30 day age (vegatitive growth and branching stage).
4- Skipping the 3rd irrigation at 90 day age(flowering and initiation of pod stages).
5- Skipping the 4th irrigation at 120 day age (pod – filling stage).

Each irrigation treatment surrounded by deep channels to prevent any lateral movement of water from treatment to other.

The sub-plots were assigned to the ridge width:

1- Ridge of 60 cm width.
2- Ridge of 120 cm width.
3- Ridge of 180 cm width.

Agricultural practices:

The experimental filed was well prepared, calcium super phosphate (15.5 % P_2O_5) at 150 kg/fad and potassium sulphate (48 % K_2O) at the rate of 24 kg /fad were applied during soil preparation. Leveling and then divided into the experimental unit 5 m. width and 7.20 m. length occupied an area of 36 m^2 . Faba bean (Skha 1 cv.) was sown on 10th and 15th of Nov., during 2008/09 and 2009/10 seasons respectively. All cultural practices were performed as recommended.

Soil analysis:

Samples of soil were collected from the surface layer (0-30 Cm) after harvesting summer crops in the two growing seasons. The samples were analyzed for nitrogen according to Kieldahl method as described by Jakson (1958), available P according to Olsen *et al*. (1954) and K was determined by flame photometrical using E.E.L flame photometer as mentioned by Richards (1945). The soil was clayay in texture and available N, P, K and pH are presented in Table (1).

Table 1 : Available N, P, K (ppm) and pH of soil after rice, maize durig 2008/09 and 2009/10 seasons.

Preceding crop	2008/09				2009/10			
	Avalible nutrients (ppm)			pH	Avalible nutrients (ppm)			pH
	N	P	K		N	P	K	
Rice	24.0	9.6	186	8.0	26.0	11.7	192	7.9
Maize	28.0	11.7	193	7.8	31.0	12.5	204	7.8

The studied characters:

At harvest, samples of 10 plants was chosen at random, from inner of experimental unit, for determination of Plant height (cm), number of branches and pods/plant, no.of seeds/pod, seed yield/plant (g) and100-seed weight (g).

The plants in two inner ridges of each experimental unit were harvested, collected together, labeled, thrashed and the seed were separated. The seed and straw yields were recorded in kg/square meter, then it converted to record seed yield in ardab/fad and straw yield in t/fad. Duration period (the number of days from sowing to maturity) was recorded. .

Statistical analysis:

The collected data were statistically analyzed according to the technique of analysis of variance for combined in a split plot design by means of "MSTAT-C Computer software package, the least significant difference (LSD) method was used to test the differences between treatment means at 5% probability, as published by Gomez and Gomez (1984). The relationships among dependent and independent variables through calculate simple correlation coefficient by Snedecor and Cochran (1989) was estimated by means of the correlation coefficient (r) between each of dependent and independent variable, multiple regression analysis according to Draper and Smith (1987) to calculate the coefficient of determination (R^2) and to estimate relative contribution of independent variables for each dependent variable and to get the prediction equations and stepwise multiple regression analysis to determine the variables accounting for the majority of the total variability independent character as described by Draper and Smith (1987). Dependent variables for rice t/fad (Y) and the independent variables (X) were presented in Table 2.

Table 2: Independent variables that were related with seed yield ardab/fad (Y) of faba bean

Independent variables	
Plant duration.	X1
Plant height (cm).	X2
Number of branches/plant.	X3
Number of pods/plant.	X4
Number of seeds/pod.	X5
Seed yield/plant	X6
100-seed weight (g)	X7

RESULTS AND DISCUSSION

Effect of preceding crops:

Data presented in Table (3) show that the preceding summer crops had a significant effect on all studied characters in both seasons. Faba bean preceded by maize was superior in all studied characters compared with those preceded by rice in both seasons. Faba bean yield after maize recorded 10.53 and 11.36 ardab/fad in the first and second seasons, respectively, whereas gave 8.89 and 9.53 ardab/fad after rice. The superiority of faba bean yield and its components grown after maize may be due to bulk density of soil after maize which tends to be lower than after rice, that

improves soil physical condition as well as reduces its compactness and improves mechanical disturbance of soil (Ibrahim and Abbas, 2004). Additionally increasing soil microbial biomass which led to increase organic materials that improved soil physical properties such as availability of soil moisture to plant and good airing. This in turn leads to good rooting depth, and also increasing the vital processes for plant and free energy which necessary for different vital function of metabolism, regularly role in nutritional balance uptake and consequently improving growth and vigor which reflect on quantity and quality of the yield. (Shafshak *et al*., 1984, Salama and El-Hawary, 1994 and Metwally, 1997).

Effect of irrigation system:

Data in Table 3 showed significant decrease in the plant duration by skipping of any irrigation, this decrease reached its maximum when the 4th irrigation was skipped. This result may be attributed to the decrease in photosynthesis process, also deficiency of soil moisture that was accompanied with the increase of air temperature causing leaves wilting and pores closing leading to the abscission leaves and flowers, which could limit growth and promote maturity (El-Morshedy, 2002).

Skipping an irrigation in vegetative stage had a significantly decreased the plant height and no. of branches/plant as in Table 3. The lowest values of plant height and number of branches/plant were observed when the 1st irrigation was skipped . The same result recorded by El-Morshedy (2002). Decrease plant height is due to the depressing effects of drought stress on cell division and elongation and its effects on meristimatic activity (Khader *et al*., 1994 and Tayel and sabreen 2011). Whereas the decrease in number of branches/plant may be due to the higher respiration rate and disturbance in metabolic processes i.e. ionic and hormone balance and water absorption (Abd El-Hai, 2001) and inhibition of lateral shoot development by decreasing ethylene production (El-Saht, 1994 and Alderfasi and Alghamdi, 2010).

Yield and its components significantly affected by skipping an irrigation at any growth stage. The highest number of pods/plant and seeds/pod, 100-seed weight and seed yield/plant as well as seed and straw yields/fad were obtained from the full irrigation system followed by irrigation every 40 day. While the lowest values of these traits were recorded with skipping the third irrigation (90 day after sowing). The full irrigation (every 30 day) treatment significantly increased seed yield/fad over irrigation every 40 days, skipping of 1st , 3rd and 4th by 4.5, 28.5, 43.9 and 19.2 % (average of two seasons) respectively. Results clearly indicate that skipping the 3rd irrigation (flowering and early pod filling stage) gave the most significant decrease of seed yield/fad. This decrease may be due to the decrease in the rate of photosynthetic pigments, mineral constituents, cytokinin content and lateral bud development (Zaidi and Singh, 1998). In addition to the low translation and accumulation of assimilates from leaves and stems to the sink, this is turn unfavorably influenced no. of pods/plant, 100-seed weight and finally seed yield/plant and consequently per faddan (French 2009). This in turn leads to decrease of nodules numbers which are the active sites for symbiotically gaseous N fixation (Amer, 1986, Gendy *et al*., 1994, Teama, 1994, Gendy *et al*.,1995, El-Morshedy, 2002 and Tayel and Sabreen, 2011).

3

Effect of ridge width:

Data in Table (3) indicate that ridge width had significantly effect on all studied characters in both seasons. Plant height increased by reducing ridge width in both seasons, this is may be due to high computation between plants for light intercepted to stem elongate resulting longer internodes (El-Douby *et al*., 1996 and El-Douby *et al*., 2000 and Farghaly *et al*., 2003).

Results revealed that yield components i.e number branches and pods/plant, number of seeds/pod, seed yield/plant and 100-seed weight gave the highest values when planting on ridge of 120 cm width compared to 60 and 180 cm in both seasons. This is due to the optimum distribution which led to reduction in intra-specific competition between plants for light intercepted by foliage as well as to minerals and water absorbed by the root system, consequently, increase in photosynthesis ability during seed filling stage which led to the increase in metabolites quantity which translocated and stored in seed. Finally gave an increase in 100-seed weight, so, increase the seed yield/plant. (El-Douby *et al*., 1996, Ali and Abd El-mottaleb, 1997 and El-Douby *et al*., 2000).

Seed yield of faba bean increased markedly (10.50 and11.07 ardab/fad) with ridge of 120 cm width compared to 9.77 and 10.70 ardab/fad with 60 cm and 8.87 and 9.57 ardab/fad with 180 cm in the first and second seasons, respectively. The increment in seed yield/fad which is associated with the sowing on ridge of 120 cm width may be due to superiority in yield components (Selim and El-Seesy, 1991, El-Douby *et al*., 1996, Ali and Abd El-mottaleb, 1997, El-Douby *et al*., 2000 and Sharaan *et al*., 2005).

Effect of Interaction:

The interaction among studied factors had a significant effect on studied characters. Preceding crops interacted with irrigation systems gave the highest values of number of pods/plant (17.7 and 18.9), seed yield/plant (24.6 and 26.0 g) and 100-seed weight (68.2 and 70.4 g) in both seasons when planting faba bean after maize with full irrigation, while after rice the previous characters attained the highest values with irrigation every 40 day (Table 4). Preceding crops interacted with ridge width gave the highest values of number of branches/plant(4.5 and 5.3), number of pods/plant (15.8 and 16.9), seed yield/plant (22.0 and 23.6 g), 100-seed weight (64.3 and 67.0 g) and seed yield/fad (11.8 and 12.7 ardab) in both seasons when planting faba bean on ridge of 60 cm width after maize. On the other side after rice the previous characters attained the highest values on ridge of 120 Cm width (Table 5). The interaction between irrigation systems and ridge width gave the highest values of number of branches/plant (5.2 and 6.3), 100-seed weight (66.7 and 68.3 g) and seed yield/fad (13.0 and 14.0 ardab) were obtained when planting faba bean on ridge 120cm width with full irrigation in both seasons (Table 6). The interaction among Preceding crops, irrigation systems and ridge width gave the highest values of seed yield/plant (26.0 and 27.3 g) and seed yield/fad (14.0 and 15.0 ardab) when planting faba bean after maize on ridge of 60 Cm width with full irrigation while after rice the previous characters attained the highest values on ridge of 120 Cm with irrigation every 40 day Tables (7 & 8).

4-5-6

The relationship between grain yield and its attributing variables:

Three statistical procedures, i.e. simple correlation, multiple linear regression and stepwise regression were used in this study.

Correlation coefficient :

The results of correlation coefficient (r) among seed yield/fad and each of its attributing variables shows that seed yield/fad was positively and high significantly associated with plant duration, plant height, no. of branches/plant, no. of pods/plant, no. of seeds/pod, seed yield/plant, 100-seed weight and seed yield/fad Table (9). Also cleared that there was highly significant positive correlation among all studied characters and each of other.

Table 7: Mean of seed yield /plant as affected by the interaction between preceding crops, irrigation systems and ridge width during 2008/09 and 2009/10 seasons.

Char.	Seed yield/plant (g)											
Seas.	2008/2009						2009/2010					
A	Rice			Maize			Rice			Maize		
B C	60	120	180	60	120	180	60	120	180	60	120	180
Control (30day)	20.3	22.3	19.3	26.0	24.3	23.3	22.0	23.7	2.0	27.3	26.0	24.7
Every 40 day	21.0	23.0	20.3	23.3	22.3	21.0	22.7	24.3	21.0	25.0	23.3	22.0
Skiping 1st	18.3	19.7	16.7	20.0	18.3	17.7	19.3	21.0	17.7	21.7	2.0	19.0
Skiping 3 rd	15.3	17.3	14	18.7	17.7	16.7	16.3	18.3	14.7	20.0	18.3	17.3
Skiping 4th	19.3	20.7	18.3	22.0	21.0	20.3	20.0	21.3	18.7	24.0	23.0	22.0
F-test	*						*					
LSD 5%	0.9						1.2					

Table 8: Means of seed yield/fad as affected by the interaction between preceding crops, irrigation system and ridge width during 2008/09 and 2009/10 seasons.

Char.	Seed yield (ardab /fad)											
Seas.	2008/2009						2009/2010					
A	Rice			Maize			Rice			Maize		
B C	60	120	180	60	120	180	60	120	180	60	120	180
Control (30day)	10.0	13.0	10.0	14.0	13.0	12.0	11.0	13..7	11.0	15.0	14.3	12.7
Every 40 day	9.7	13.3	10.3	13.0	11.7	10.7	10.7	14.3	12.0	14.3	13.0	11.1
Skiping 1st	6.3	8.7	7.3	10.7	10.0	8.0	7.7	9.3	8.3	11.3	10.3	9.0
Skiping 3 rd	5.0	7.0	6.0	9.0	7.3	5.7	5.3	7.3	6.3	10.3	8.0	6.7
Skiping 4th	7.7	10.0	9.0	12.3	11.0	9.7	8.3	10.3	9.0	12.7	11.3	9.7
F-test	*						*					
LSD 5%	0.9						1.0					

Table 9: Simple correlation coefficient among faba bean characters (average of two seasons).

	X1	X2	X3	X4	X5	X6	X7
X 1-Plant duration.							
X2- Plant height (cm).	0.78**						
X3-No. of branches/plaft	0.61 *	0.86**					
X4-No.of pods/plant	0.71*	0.86**	0.84**				
X5-No. of seed/pod	0.72 *	0.85**	0.76**	0.88**			
X6-seed yield/plant(g)	0.74**	0.89**	0.78**	0.90**	0.84**		
X7-100-seed weight (g)	0.58*	0.73**	0.70**	0.84**	0.70**	0.84**	
X8-Seed yield (ardab/fad)	0.72*	0.79**	0.71*	0.86**	0.80**	0.92**	0.87**

Table 10: Multiple regression and stepwise regression analysis for grain yield t/fad (Y) as affected by all studied characters in faba bean.

Prediction equation according to multiple regressions.	
Y= a+ b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + b7x7 Y= -9.081 + 0.043 x1 - 0.083 x2 -.099 x3 + 0.141 x4 + 0.181 x5 + 0.478 x6 + 0.142x7.	
Relative contribution (R^2) for all variables according to full model regression	89.81%
Prediction equation according to stepwise	
Y= a + b6x6 + b7x7+ b1x1 + b2x2 + b4 x4 Y= -8.985 + 0.494 x6 +0.136 x7 + 0.046 x1 - 0.090 x2+0.153 x4	
Relative contribution (R^2) for each of accepted variables according to stepwise regression	
X6-seed yield/plant(g).	84.96%
X7-100-seed weight (g).	2.97%
X1-Plant duration.	0.58%
X2- Plant height (cm).	0.73%
X4-No.of pods/plant.	0.57%
The total relative contribution (R^2) for all accepted variables according to stepwise regression	89.81
The relative contribution (R^2) for all removed variables according to stepwise regression	0.0
The relative contribution (R^2) for residual variables according to stepwise regression	11.19%
Total effect (accepted, removed and residual)	100%

Multiple regression:

Results of multiple regression analysis recorded in Table 10, it cleared that the relative contribution R2 for all variables in the total variation of grain yield was 89.81%. On the other hand, the residual value was 11.19%, which indicates that the most characters were included in this analysis.

Stepwise regression analysis:

Data in Table 10 also show that 5 variables out of the seven were accepted as significantly contributing variables to variation in rice grain yield . These variables were seed yield/plant, 100-seed weight, plant duration, plant height and no. of pods/plant. with R^2 being 84.96%, 2.97% , 0.58%, 0.73% and 0.57 according stepwise analysis, respectively. The results indicated that stepwise analysis develops a sequence of multiple regression equation by removing 2 from the full model equation with relative contribution of 0.0 %. In conclusion, it can be stated that seed yield/plant, 100-seed weight, Plant duration, Plant height and No. of pods/plant were the most important characters, since they have not only high significant positive associated with seed yield/fad, but also had high relative contributing towards seed yield/fad in the prediction equation. Therefore, maximum effort should be given to these characters for the improvement of faba bean seed yield by selection through breeding programs.

Recommendations

From this study, it may be recommended to:

a) Plant faba bean on ridge of 60 cm width with full irrigation (4 irrigations, 30 days intervals) when preceded by maize.
b) Plant faba bean on ridge of 120 cm width with 3 irrigations, 40 day intervals when preceded by rice. to maximizing yield of faba bean.

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تأثيرالمحاصيل الصيفية السابقة ونظم الرى على الفول البلدى المنزرع على خطوط مختلفة العرض

الغريب محمد ابراهيم

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

أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بتاج العز بمحافظة الدقهلية خلال الموسمين ٢٠٠٨/ ٢٠٠٩ و ٢٠٠٩/٢٠١٠ لدراسة مدى تأثر المحاصيل الصيفية السابقة (ارز- ذرة) ونظم رى مختلفة ١- رى كامل (٤ ريات كل ٣٠ يوم) ٢- الرى كل ٤٠ يوم. ٣- اسقاط الرية الاولى عند ٣٠ يوم من عمر النبات (مرحلة النمو الخضرى والتفريع) ٤- اسقاط الرية الثالثة عند٩٠ يوم من عمر النبات (مرحلة النمو الزهرى وبداية تكوين القرون). ٥- اسقاط الرية الرابعة عند١٢٠يوم من عمر النبات (مرحلة امتلاء القرون) على نمو ومحصول الفول البلدى (سخا ١) المنزرع على خطوط عرض ٦٠و ١٢٠ و١٨٠ سم حيث نفذت

التجربة باقامة تجربة مستقلة لكل محصول سابق وصممت كل تجربة مستقلة بنظام القطع المنشقة مرة واحدة فى ثلاث مكررات

وتتلخص أهم النتائج فيما يلى:

١- أوضحت النتائج تفوق الفول البلدى المنزرع بعد الذرة فى كل الصفات المدروسة خلال عامى الدراسة بالمقارنة بالفول المنزرع بعدالارز حيث حقق زيادة فى انتاجية المحصول بلغت ١٥,٩ % كمتوسط لموسمى الزراعة .

٢- أظهرت النتائج تفوق نظام الرى الكامل(٤ ريات كل ٣٠ يوم) فى كل الصفات المدروسة خلال عامى الدراسة مسجلة زيادة بلغت ٤,٥ و ٢٨,٥ و ٤٣,٩ و ١٩,٢ % كمتوسط لموسمى الزراعة فى انتاجية المحصول بالمقارنة بنظم الرى كل ٤٠ يوم و اسقاط الرية الاولى و اسقاط الرية الثالثة و اسقاط الرية الرابعة على الترتيب.

٣- تفوقت الزراعة على خطوط عرض ١٢٠ سم لجميع الصفات المدروسة بلغت الزيادة فى انتاجية المحصول ٥,٠ و١٤,٥ % كمتوسط لموسمى الزراعة بالمقارنة بالزراعة على ٦٠ و ١٨٠ على الترتيب .

٤- أشارت نتائج التفاعل بين عوامل الدراسة المختلفة أن اعلى محصول من بذورالفول بلغ ١٤,٠ و ١٥,٠ اردب للفدان فى السنة الاولى والثانية على الترتيب تم الحصول عليه بزراعةالفول بعد الذرة على خط عرض ٦٠سم باستخدام الرى الكامل ٤ ريات كل ٣٠ يوم (توصية وزارة الزراعة) وأن زراعة الفول البلدى بعد الارز تحت ظروف هذه التوصية أعطت محصول ١٠ و ١١ أردب للفدان فى السنة الاولى والثانية على الترتيب فى حين اظهرت النتائج المتحصل عليها ان اعلى محصول للفول عقب الارز ١٣,٣ و ١٤,٣ اردب٠ للفدان فى السنة الاولى والثانية على الترتيب عند الزراعة على خطوط عرض ١٢٠سم والرى كل ٤٠ يوم (٣ ريات) وهذا ماتوصى به الدراسة حيث يزيد المحصول عن التوصية العامة لوزارة الزراعة ٢٤,٨ و ٢٣,١ % فى السنة الاولى والثانية على الترتيب تحت الظروف التجريبية.

٥- أظهرت النتائج المتحصل عليها وجود ارتباط موجب عالى المعنوية بين المحصول و جميع الصفات المدروسة وايضا جميع الصفات فيما بينها. كما اظهرت نتيجة تحليل الانحدار المتعدد ان المساهمة النسبية لكل الصفات كمتغيرات مستقلة مجتمعة هو٨٩,٨١ % فى تباين المحصول (طن/ فدان). كما اظهرت نتيجة تحليل الانحدار المتعدد المرحلى ان ٥ عوامل من ٧ عوامل تساهم بنسبة٨٩,٨١ % فى التباين الكلى للمحصول طن/فدان وهذه العوامل هى محصول النبات بالجرام (٨٤,٩٦%) و وزن ١٠٠ حبة (٢,٩٧%) و فترة حياة النبات (٠,٥٨%) و طول النبات (٠,٧٣%) و عدد القرون على النبات (٠,٥٧%)على الترتيب مما يوضح ان هذه الصفات الخمسة لها علاقة بالمحصول وساهمت بنسبية عالية فى التباين الكلى للمحصول ٨٩,٨١ % مما يجعل هذه الصفات تساهم مساهمة مباشرة وعالية فى برامج التربية لزيادة انتاجية محصول الفول البلدى.

٦- توصى الدراسة بالاتى: ١- زراعة الفول البلدى بعد الذرة على خطوط عرض ٦٠ سم مع الرى الكامل للمحصول أربع ريات كل ٣٠ يوم. ٢- زراعة الفول البلدى بعد الارز على خطوط عرض ١٢٠ سم مع الرى كل ٤٠ يوم (٣ ريات). حيث ان هذه المعاملات كانت الافضل فى الحصول على اعلى انتاجية لمحصول الفول البلدى تحت ظروف محافظة الدقهلية.

قام بتحكيم البحث

أ.د / عادل عبد الجواد سلامه — كلية الزراعة – جامعة المنصورة

أ.د / ابراهيم عثمان السيد — مركز البحوث الزراعية

Table 3 : Yield and yiled attributes of faba bean as affected by preceding crops, irrigation systems and row width during 2008/09 and 2009/10 seasons.

Characters	Field duration		Plant height (cm)		NO. of branches/plant		NO, of pods/plant		NO. of seeds/pod		Seed yield/plant(g)		100-seed weight (gm)		Seed yield (ardab/fad)		Straw yield(ton/fad)	
Seasons	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**	**2008/9**	**2009/10**
Treatments																		
A-Preceding crops																		
Rice	159.1	161.7	97.6	100.5	3.6	4.3	12.5	14.0	2.9	3.4	19.1	20.1	58.4	61.1	8.89	9.53	1.25	1.40
Maize	162.9	165.8	101.8	104.5	4.1	4.8	14.1	15.3	3.3	3.8	20.8	22.2	62.9	65.3	10.53	11.36	1.39	1.54
F test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
B- Irrigation system																		
Full irrigi.	168.8	171.4	104.8	107.5	4.8	6.1	15.9	17.1	4.6	3.9	22.6	23.9	65.1	67.6	12.00	12.94	1.88	1.94
Every 40 d.	162.9	168.0	102.5	105.6	4.5	5.4	15.7	17.1	3.9	3.9	21.7	23.1	64.0	66.1	11.44	12.39	1.44	1.59
Skaping 1st irrigation	161.0	162.9	94.1	97.2	2.5	2.8	11.7	12.7	3.1	3.1	18.4	19.8	58.7	61.7	8.50	9.33	0.94	1.08
Skaping 3rd irrigation	158.0	160.9	97.6	99.5	3.4	3.9	9.5	11.5	2.7	2.8	16.7	17.5	55.0	56.8	6.67	7.33	1.11	1.30
Skaping 4th irrigation	153.0	155.4	99.6	102.7	3.9	4.4	13.8	14.8	3.5	3.5	20.3	21.5	60.6	63.9	9.94	10.22	1.24	1.44
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 5%	0.7	1.0	0.5	0.7	0.3	0.3	05	0.3	0.4	0.4	0.4	0.5	1.0	0.9	0.39	0.40	0.05	0.05
C-Ridge width																		
60 cm	162.2	165.0	100.7	103.5	3.8	4.5	13.3	14.6	3.6	3.4	20.4	21.8	60.3	63.2	9.77	10.70	1.39	1.54
120 cm	163.9	166.7	101.8	104.6	4.1	4.8	14.0	15.4	3.8	3.7	20.6	21.9	61.8	64.0	10.50	11.07	1.37	1.53
180 cm	156.9	159.5	96.7	99.4	3.6	4.4	12.3	13.7	2.3	3.2	18.8	19.7	59.9	62.1	8.87	9.57	1.21	1.34
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 5%	0.5	0.8	0.4	0.6	0.2	0.3	0.4	0.2	0.3	0.3	0.3	0.7	0.8	0.7	0.30	0.31	0.04	0.04
D- Interaction																		
AB	*	NS	*	*	*	*	*	*	*	NS	*	*	*	*	NS	*	*	*
AC	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BC	*	*	*	*	*	*	*	*	*	*	*	*	NS	*	*	*	*	*
ABC	*	*	*	*	*	NS	*	*	*	*	*	*	NS	NS	*	*	*	NS
CV.	0.6%	0.9%	0.8%	1.0%	10.3%	8.3%	5.3%	5.4%	15.2%	15.7%	2.7%	3.2%	1.6%	2.0%	5.7%	4.7%	4.5%	5.4%

Table 4: Means of no.of pods, seed yield/ plant and 100-seed weight as affected by the interaction between preceding crops and irrigation systemss during 2008/2009 and 2009/2010 seasons.

Character		No. of pods/plant				Seed Yield/plant (g)				100-seed weight(g)			
Seasons		2008/2009		2009/2010		2008/2009		2009/2010		2008/2009		2009/2010	
B	A	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize
Control(30 day)		14.1	17.7	15.3	18.9	20.7	24.6	21.9	26.0	61.9	68.2	64.2	70.4
Irrigation every 40 day		16.0	15.4	17.3	16.9	21.4	22.1	22.7	23.4	63.1	64.9	65.4	66.8
Skipping 1st irrigation		10.8	12.7	12.0	13.4	18.2	18.7	19.3	20.2	56.8	60.6	60.0	63.3
Skipping 3rd irrigation		8.8	10.2	11.3	11.7	15.6	17.7	16.4	18.6	52.2	57.8	53.4	60.2
Skipping 4th irrigation		12.9	14.7	14.1	15.4	19.4	21.1	20.0	23.0	58.1	63.1	62.2	65.7
F-test		*		*		*		*		*		*	
LSD 5%		0.7		0.4		0.5		0.7		1.4		1.2	

Table 5: Means of no.of branch, pods and seed yield/plant, 100-seed weight and seed yield/fad as affected by the interaction between preceding crops and ridge width during 2008/09 and 2009/2010 seasons.

Character		No. of branches/plant				No. of pods/plant				Seed Yield/plant (g)				100-seed weight (g)				Seed yield (ardab/fad)			
Seasons		2008/2009		2009/2010		2008/2009		2009/2010		2008/2009		2009/2010		2008/2009		2009/2010		2008/2009		2009/2010	
C	A	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize	Rice	Maize
60cm width		3.0	4.5	3.7	5.3	11.1	15.8	12.4	16.9	18.9	22.0	20.1	23.6	56.3	64.3	59.3	67.0	7.7	11.8	8.7	12.7
120cm width		4.1	4.1	4.9	4.7	14.1	14.2	15.7	15.1	20.6	20.7	21.7	22.1	60.6	62.9	62.9	65.3	10.4	10.6	11.0	11.4
180 cm width		3.6	3.6	4.4	4.3	12.4	12.4	13.9	13.8	17.7	19.8	18.4	21.0	58.3	61.5	61.0	63.5	8.5	9.2	9.3	9.8
F-test		*		*		*		*		*		*		*		*		*		*	
LSD 5%		0.3		0.3		0.5		0.6		0.7		0.7		0.9		1.1		0.4		0.4	

Table 6: Means of no.of branches/plant, 100-seed weight and seed yield/fad as affected by the interaction between irrigation system and ridge width during 2008/2009 and 2009/2010 seasons.

Character		No. of branches/plant						100-seed weight (g)						Seed yield (ardab/fad)					
Seasons		2008/2009			2009/2010			2008/2009			2009/2010			2008/2009			2009/2010		
B	C	60	120	180	60	120	180	60	120	180	60	120	180	60	120	180	60	120	180
Control(30 day)		4.7	5.2	4.5	6.2	6.3	5.8	64.3	66.7	64.2	67.6	68.3	66.0	12.0	13.0	11	13.0	14.0	11.8
Irrigation every 40 day		4.5	4.8	4.2	5.3	5.5	5.3	63.5	65.0	63.5	66.0	67.0	65.3	11.33	12.5	10.5	12.7	13.0	11.5
Skipping 1st irrigation		2.5	2.7	2.3	2.8	3.0	2.7	58.2	59.7	58.2	61.7	62.5	60.8	8.5	9.3	7.7	9.5	9.8	8.7
Skipping 3rd irrigation		3.3	3.7	3.3	3.7	4.3	3.7	55.0	55.8	54.2	57.0	57.7	55.8	7.0	7.2	5.8	7.8	7.7	6.5
Skipping 4th irrigation		3.8	4.2	3.7	4.3	4.7	4.3	60.5	61.7	59.7	63.8	64.8	63.2	10.0	10.5	9.3	10.5	10.8	9.3
F-test		*			*			*			*			*			*		
LSD 5%		0.3			0.3			1.7			1.5			0.7			0.7		