The Correlation Study and Competition Degree From Inter Cropping System with Barley and Broad Bean

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ABSTRACT

Two field experiments were conducted during growing seasons first 2004/2005 and second 2005/2006 at agricultural research station in Mokhtaar University at a heavy soil its optical density was 1.63,1.71 gm/cm^3, soil pH 7.83,7.91 with total nitrogen at 23, 0.26 ppm and organic matters 2.87, 2.96% situated in latitude 21° 43¨ north, 32° 46¨ east and altitude 590 m and annual rain rate 288, 307 mm to investigate the competitive ability to inter cropping Systems i.e barley with faba bean comparing to sole cropping. Higel variety of barley sowing by 60 kg/ha broadcasting in lines 5 m long and 0.20 m apart and in rows 5 m long and 0.5 m apart in a system 3:3 this study build up on area 46% in rates zero, 40, 60 and 80 kg/ha. The experiments desigred in split plot with 4 replicates randomized by systematic design (Relay cropping, sale cropping)in main plot and nitrogen fertilizer in subplot.

The results reveal that, a decease in partial land equivalent ratio (La, Lb), proportion of relay cropping yield of both barley and faba bean, comparing to sole cropping. Meanwhile, an increase in land equivalent ratio (LER); effective land equivalent ratio (ELER), system production Index (SPI); competitive ratio (CR) and a positive correlation between yield and its components except that with seed index in both seasons.

INTRODUCTION

Barley and faba bean were an important crops as a source of portions, carbohydrates and essential minerals in food and feed beyond weed competition and supplementary physical and chemical soil characteristics (Heissan 2005; FAO 2006). An area occupied by barley and faba bean in Libya was 240000, 35000 ha for both, respectively.

Because Relay cropping is often used to describe asitution in which one crop closely follows another, with possibly some brief overlap on the same piece of land to maximize the average yield of unit area (Mead and Riley, 1981). The objectives of this research were to evaluate the effect of relay cropping of barley and faba bean its relationship with different levels of nitrogen fertilizer.

MATERIALS AND METHODS

Two field experiments carried out in El-Mokhtaar University during the growing season 1st 2004, 2005 and 2nd 2005, 2006 to evaluated effect of competition between the 2 crops (barley and broad bean) when relayed 3:3 under different levels of nitrogen Zero, 40, 60 and 80 kg/ha in the from of urea 46%. The two crops seeded at mid of November, Higel variety of barley in seeding rates 60 kg/ha broadcasted in lines 5 m long and 0.2 m apart and 170 kg/ha of local variety of faba bean planted in rows 5 m long and 0.2 m between plant in the raw and 0.5 m between rows. Three samples of sole taken to study the physical and chemical characteristics before planting for each season, Table (1). Data of weather for both season from Shahaat station were presented in Table (2). The experiments designed in split plot by 4 replicates distributed system of cropping in main plots while rate of nitrogen fertilizer in subplots. All the agricultural practices except that under study were conducted as recommended in the area of this trail.

Data recorded:

1. Land Equivalent Ratio (LER):

That proposed by Mead and Willey, 1980 to be relative land area required by sole crops to produce the same yield as relay crops to clarify the LER because the relay cropping consists of two component crops barley (a) and faba bean (b), therefore the partial LER from a (La)=Ya / Sa and (Lb)= Yb / Sb where:

Sa and **Sb** = yield/unit of area of barley and Broad bean as a sole crops

Ya and **Yb** = yield/unit area of both crops as a relay cropping and LER = La + Lb

The proportion of the total relay cropping yield from each crop are:

Pa = La / LER, Pb = 1- Pa.

2. System Productivity Index (SPI):

SPI = Sa / Sb Yb + Ya as mention by Odo 1991.

3. Competitive Ratio (CR):

CR = (La / Lb) (Za / Zb) where: Za, Zb are the sown proportion of barley and broad bean (Reddy and Chetty, 1984).

4. Simple correlation analysis to describe the relationship between crop yield and other crop components (Roger, 1994).

5. The effect of cropping systems in the production.

The data obtained were subjected to the proper statistical analysis of variance (Snedecor and Cochoran, 1980). The treatments means were compared using the least significant difference L.S.D test at 5% level of Probability.

RESULTS AND DISCUSSIONS

I. Effects of cropping systems and nitrogen levels:

1. in yield:

Data expressed in figures of (Grain and seed yield; straw yield and biological yield).Results of Grain and seed yield of both seasons are depicted in tables (3). It is note worthy to mention that it was significantly affected by cropping systems, The highest 1.16 , 1.25 from barley and 3.6 , 4.13 t/ha broad bean as sole yield comparing to relay cropping yield 1.00,1.10 in barley; 2.10, 2.10 t/ha in faba bean in both seasons, respectively. The sole cropping increased by 16, 13.64 % in barley and by 71.43, 86.88 % in faba bean comparing to relaycropping in 1st and 2nd seasons, respectively. This increase in yield was a result of negative effect of plants orientations. In this connection similar results was indicated by Andrews 1972; Sayed and Metwally 1982; Sayed 1984; West and Griffith 1992 and Chengei *et al* 2004, Meanwhile, opposite results was obtained by Compiglia *et al* 1991.

It is clear from same data presented in table (3) that this character was significantly affected during the both seasons because of applied nitrogen levels 80 kg N/ha recorded the highest yield 1.40 , 1.58 t/ha in both seasons. This results and may be due to the increase in number of both tillers and spikes/m^2 as a response to nitrogen fertilization levels similar findings were recorded by Morgan 1988, Selman 1993 as well as Mossadaq and smith 1994.

From table (3) it could be noticed that cropping system X N – level interaction was not significant in both growing seasons due to acted independently.

2. Competitive analysis:

Data depicted in table (4) of both seasons 2004 / 2005 and 2005 / 2006 showed a variance effect of:

i. System Productivity Index (SPI) the data in this table (4) showed that the yield of faba bean in both seasons was 1.68,1.73 in the term of barley crop

compared to sole cropping of faba bean. The environmental conditions may play an important role in this variances. This result was in accordance with that obtained by Shibles and Green 1979.

ii. Land equivalent ratio (LER):

The relation land area required by barley crop in sole form to produce the same yield in relay cropping was 2 while 1.08 in faba bean that mean the system give abenfite for barley only, similar discussion was showed by Mead and Willey 1980.

iii. Effective land equivalent ratio (ELER):

Data presented in table (4) showed the biological efficiency of the combined sole barley and broed bean and comparing yield in relay cropping the difference for barley crop was 0.6 while highly different between two systems by 1.97 in case of faba bean. The difference may be attributed to the increase in growing season. This finding was similar to that obtained by Odo 1991.

vi. Partial land equivalent ratio :

It is clear from table (4) that barley was more efficient than faba bean and this character was the highest in 2nd season 1.14 in case of barley and in 1st season 0.58 incase of broad bean. Pertaining this trait, results showed that barley land equivalent ratio mean 1.00 was the double of faba bean 0.54 and this finding could be due to a dynamical pertaining of assimilates and response of the partitioning pattern to changing environmental conditions. This result was in agreement with Willey 1979a.

v. Proportion of relay cropping yield:

The relaying system of cropping provides greater yield from a given land area than does a sole form in barley 0.57 in 2nd season, mean while 0.54 in 1st season in case of bread bean, table (4), regarding of proportion of yield it may attributed to favorable filling period for grain and seed result automatically in better realization of yield potential. Similar performance was displayed by Mead and Riley 1981.

iv. Competitive ratio (CR):

In this respect this character was presented in table (4) and it is clear from its data that barley was about 0.52 and 0.80 in both seasons,

respectively and with a mean 0.66 as competitive as faba bean in this relay cropping. It could be attributed to the greater crop growth with low competitive degree and high potential yield regulation and uniform

distribution of assimilates to different barley plant organs. Similar speculation was indicated by Willy and Rao 1980.

II: Simple correlation relationships:

The data tabulated during both season 2004 / 2005 and 2005 / 2006 was presented in tables 5, 6 and showed the correlation between yield of barley and broad bean and yield components which revealed in general that, either barley grain or faba bean seed yield was positively and significantly with all yield components except that for seed index in both season. It was postulated that the growth of these components led to increase in crops yield. In this connection similar results were recorded by Mnbage 1980.

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Table 1: Physical and chemical soil properties of the experimental field during 2004/2005 and 2005/2006 seasons.

Season	Soil PH	EC (dSm)	Total nitrogen (%)	Organic matter (%)	CaCO (%)	Particle size distribution				
						coarse	silt %	clay %	sand %	Textures
2004/2005	7.12	1.38	0.2155	3.06	13.7	1.10	39.09	45.11	8.64	clay loam
2005/2006	7.24	1.30	0.2180	3.01	12.3	1.76	38.06	47.05	8.51	soil
	P	Fe^{+2}	Cu^{+}	Zn^{+}	Mn^{+}					
	ppm	ppm	ppm	ppm	ppm					
2004/2005	9.25	6.39	1.94	2.50	16.76					
2005/2006	6.00	6.85	1.99	2.43	18.76					

Table 2: Average monthly Temperature, Rain-fall and % of humidity for the experimental area during the two growing seasons.

Month	Temperature °C		Rain-fall ml		% -Humidity %	
	2004/2005	2005/2006	2004/2005	2005/2006	2004/2005	2005/2006
Oct	22.5	23.8	58.6	-	51	57
Nov	15.9	17.8	122.4	128.5	70	69
Dec	11.6	15.3	266.9	89.9	78	77
Jan	10.4	10.6	55.7	209.9	77	80
Feb	11.5	9.1	15.8	53.4	70	67
Mar	14.4	12.8	23.9	91.9	64	64
Apr	16.6	15.0	-	10.0	55	56
May	19.6	20.5	-	-	48	47

Table 3: Analysis of competitive degree from Relay cropping system with barley and broad bean 2004/05 and 2005/06 seasons.

SPI		Partial LER from barley	Partial LER from faba bean	land equivalent ratio		Proportion of relay crop for barley	Proportion of relay crop from faba bean	Effective land equivalent ratio ELER		CR
				barley	faba bean			barley	faba bean	
First season	1.68	0.86	0.58	2.0	1.08	0.43	0.54	0.6	1.97	0.52
Second season	1.73	1.14	0.50			0.57	0.46			0.80
Mean	1.71	1.00	0.54	-		0.50	0.50	-		0.66

Table 4: Crop yield correlation with component in barley and faba bean crops during both season 2004/2005 and 2005/2006.

Barley crop	Crop yield t/ha		Plant height cm		Spikes in m²		Spike length cm		Grains/spike		Spike grains		Seed index		% of grain protein	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Crop yield t/ha	-	-														
Plant height Cm	0.92**	0.99**	-	-												
Spikes in m²	0.94**	0.97**	0.87*	0.72	-	-										
Spike length cm	0.99**	0.99**	0.95**	0.99**	0.96**	0.81*	-	-								
Grains/spike	1.00**	0.99**	0.91*	0.99**	0.95**	0.81*	0.99**	0.99**	-	-						
Spike grains	1.00**	0.98**	0.91*	0.96**	0.96**	0.88*	0.99**	0.99**	1.00**	0.99**	-	-				
Seed index	-0.78	0.94**	-0.54	0.90*-	-0.89*	-0.91**	-0.77	- 0.95**	-0.80	-0.93**	-0.81*	-0.97**	-	-		
% of grain protein	0.91*	0.99**	0.96**	0.99**	0.94**	0.72	0.95**	0.99**	0.92**	0.99**	0.91*	0.96**	-0.68	- 0.92**	-	-

Broad bean crop	Crop yield t/ha		Plant height Cm		Branches/ plant		Pods/plant		Plant seed weight (gr)		Seed index		% of grain protein	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Crop yield t/ha	-	-												
Plant height Cm	0.82*	0.91*	-	-										
Branches/plant	0.75	0.94*	0.99**	0.99**	-	-								
Pods/plant	0.70	0.99**	0.98**	0.97**	0.99**	0.98**	-	-						
Plant seed weight (gr)	0.87*	0.93*	0.99**	0.96**	0.98**	0.96**	0.94**	0.97**	-	-				
Seed index	-0.78	-0.96**	-0.99**	-0.98**	-0.99**	-0.99**	-0.99**	-0.99**	-0.97**	-0.99**	-	-		
% of grain protein	0.81*	0.95**	0.99**	0.99**	0.99**	0.99**	0.98**	0.99**	0.98**	0.96**	0.99**	-0.99**	-	-

S: Sole crop
R: Relay crop

*:Significant
**: Highly Significant

الملخص العربى

دراسة العلاقة الإرتباطية ودرجة التنافس من تحميل محصولي الشعير والفول

طيب فرج حسين

أستاذ بقسم المحاصيل - كلية الزراعة - جامعة عمر المختار - ليبيا

تجربتين حقليتين نفذتا خلال موسمي الزراعة الأول ٢٠٠٤ / ٢٠٠٥ والثاني ٢٠٠٥ / ٢٠٠٦ بمحطة أبحاث جامعة عمر المختار بتربة طينية ثقيلة كثافتها الظاهرية للموسمين ١,٦٣ ,١,٧١ جم/سم^3 ورقم حموضة ٧,٨٣, ٧,٩١ وذات محتوى نتروجيني ٠,٢٣, ٠,٣٦ جزيء في المليون ومادة عضوية شكلت نحو ٢,٨٧, ٢,٩٦% وواقعة بخطي العرض "43 °21 شمالاً, "43 °21 شرقا وترتفع ٥٩٠ متر فوق سطح البحر وبمعدل هطول سنوي ٢٨٨ ,٣٠٧ ملم لدراسة قابلية التنافس من تحميل المحصولين مقارنة بالزراعة النقية (الفردية) ومدى علاقة التسميد النتروجيني بذلك ومعرفة درجة إرتباط المحصول الإقتصادي بخصائص المحصول تحت هذه الأنظمة.

زرع الصنف Higel أحد الأصناف المستوردة من الشعير عالية الإنتاجية ذو حاجة لكميات عالية من النيتروجين بمعدل ٦٠ كجم / حد في خطوط طولها ٥ متر والمسافة بينها ٢٠ سم بالنثر داخل الخطوط والفول الصنف المحلي بمعدل ١٧٠ كجم / حد في جور داخل صفوف طولها ٥ متر والمسافة بينها ٥٠ سم مع إضافة النيتروجين في شكل يوريا ٤٦% بالمستويات (٠, ٤٠, ٦٠, ٨٠ كجم / حد) بحيث أتبع نظام تبادل ٣ : ٣ لكل من المحصولين تحت الدراسة. صممت الدراسة بالقطع المنشقة بأربعة مكررات مثلت نظم الزراعة (تحميل, نقية القطع الرئيسية) ومستويات النتروجين المضاف القطع الثانوية. وأظهرت النتائج درجة من إنخفاض المكافئ الجزئي للأرض والإنتاج الجزئي الناتج من التحميل في كلا محصولي الدراسة بالموسمين الأول والثاني غير أنة من جهة أخرى لوحظ إرتفاع في المكافئ الكلي, الفعال لاستخدام الأرض, دليل نظام الإنتاج ومعدل التنافس كما لوحظ علاقة أن هناك علاقة أرتباطية معنوية موجبة بين مكونات المحصول والمحصول الإقتصادي بإستثناء من ذلك المحصول البذور ولكلا موسمي الدراسة.