SUCCESSION OF MAIZE WITH SOME WINTER CROPS 2 – EFFECTS ON MAIZE AND WINTER CROP CHARACTERS

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ABSTRACT

The experiments were conducted during two fall season and two winters (2010 and 2012), at Grdarash Research Station in Erbil, Kurdistan Region of Iraq. Four winter crops were chosen Wheat, Canola, Pea, Broad bean as well as Fallow plot. These crops were planted in Randomized Complete Block Design with three replications during both winter seasons. Maize was planted during the fall seasons succeeded by winter crops. Some field characters were recorded for each winter and fall maize crops during the four growing seasons. The result revealed that all the characters value of winter crops were decreased. The reduction were in 2011-2012 season about 58.92% in wheat number of tillers 45.20% and 57.67% in plant height and yield in broad bean respectively, and 39.60% in pea yield. Fall season 2011 maize showed significant differences for the characters ear height, 250 kernel weight and yield. While in fall season 2012 only ear height and ear length had significant differences.

Key word: succession, maize, (*Zea mays* L.), winter crops.

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تعاقب الذرة الصفراء مع بعض المحاصيل الشتوية
2 – تأثيرها على صفات الذرة الصفراء والمحاصيل الشتوية

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المستخلص

اجريت الدراسة في محطة ابحاث كردةرةش – كلية الزراعة – اربيل خلال السنوات 2010– 2012 . وتضمنت اربعة مواسم موسمين خريفيين وموسمين شتويين وتم اختيار اربعة محاصيل شتوية وهي الحنطة، السلجم، البزاليا والباقلاء اضافة الى معاملة البور. زرعت المحاصيل الشتوية وفق تصميم القطاعات الكاملة المعشاة في ثلاث مكررات خلال الموسمين الشتويين. وتم زراعة الذرة الصفراء بالتعاقب مع هذه المحاصيل في الموسمين الخريفين. أظهرت النتائج انخفاض في بعض صفات المحاصيل الشتوية في الموسم 2011–2012 عن الموسم الشتوي 2010–2011 وكان الانخفاض بنسبة 58,92% في تفرعات الحنطة و 45,20 % و 57,67% في ارتفاع النبات والحاصل في الباقلاء و 39,60% في حاصل البزاليا. في الموسم الخريفي 2011 حصلت اختلافات معنوية بين صفات ارتفاع النبات ووزن 250 حبة والحاصل، بينما في الموسم الخريفي 2012 كان لارتفاع العرنوص وطول العرنوص فروقات معنوية بالتعاقب مع المحاصيل الشتوية.

كلمات مفتاحية: التعاقب، الذرة الصفراء، المحاصيل الحقلية الشتوية.

INTRODUCTION

In favorite condition for the crops could be causes increase the yield of cultivated crops in crop rotation, when compare to monoculture (2) (5) (7). Many of agriculture rotation factors responsible for increased yield as increased nitrogen supply, improved in soil water and nutrient availability (8).. To determine corn yield response to six crop rotation in long-term study 35-year, first year corn yield increased from 79 to 100 kg/ha^{-1}, indicating that alfalfa crop produced the N required by first year corn. Tollenaar (13) and Vyn (14) reported that type of preceding crop could influence maize productivity, despite the benefit of crop rotation that includes legumes. Feizabady *et al* (6) observed highest yield for wheat. Wheat-wheat, wheat-rapeseed-wheat and lowest yield was for wheat monoculture. Najafinezhed *et al* (9) studied twelve crop plants (four cereals, five legumes and three oil seed) and found that all produced chemicals which significantly reduced the early growth of wheat under controlled and field conditions. Karlen (8), Carter (3) and Chalk (4) reported that crop rotation enhances crop yield productivity and restores fertility if legumes are included. Arshed *et al* (1) found that canola and field pea were more beneficial than wheat as previous-crop for wheat production 3 years of crop rotation including a legumes as wheat-faba bean and wheat-chickpea had marked effect on wheat quality. Berzenji *et al* (2) confirmed positive effect of rotation of maize on wheat yield, the different crops rotation of wheat with other crops especially rapeseed improved yield and yield component compared to monoculture. The role of preceding spring rapeseed in increasing of wheat yield and its components (12). The aim of this research to found a suitable rotation system in Kurdistan region for the main winter crops and maize crop as fall season crop.

MATERIALS AND METHODS

The field experiments were carried out at Grdarash Research Station during four seasons in 2010 and 2012 (two fall seasons and two winter seasons). Four winter crops were chosen: wheat (*Triticum aestivum* L.), canola (*Brassica napus* L.), pea (*Pisum sativum* L.), broad bean (*Vicia faba* L.) as well as a Fallow plot. During the winter seasons 2010-2011 the crops were sown using randomized complete block design (RCBD) with three replications. Each replication consisted of five plots (3 × 3) m. For each crop all the recommended cultural practices were performed including planting date, plant density, fertilization and irrigation if it was necessary. After the harvesting took place of all crops in the spring of 2011, the plots were ploughed separately and manually to avoid soil mixture among plots in order to be prepared for the fall season of 2011 (Table 1). Then, the maize was cultivated in all plots using (Talar) variety exactly on July 19th. The maize was planted in rows of 3 m length, 0.75cm between rows and 0.25cm within rows between the individual plants. All recommended cultural practices were performed during the growing period.Data of characters for each crop in all seasons were recorded. The differences as percentage among both winter crops characters were estimated and date of both fall season maize were subjected to analysis of variance (11).

Table 1. Succession crops plane during for growing season.

Winter 2010-2011	Fall 2011	Winter 2011-2012	Fall 2012
Wheat	Maize	Wheat	Maize
Rapeseed	Maize	Rapeseed	Maize
Broad bean	Maize	Broad bean	Maize
Pea	Maize	Pea	Maize
Fallow	Maize	Fallow	Maize

RESULT& DISCUSSION

The results in the table 2 revealed that all the characters value of winter crops (2010-2011) were higher than the other winter season (2011-2012). There were reductions for all characters, the ratio of number of tillers decline about -58.92% in wheat. The plant height, number of pods/ plant and yield were declined -45.20%, -60%, -57.67% respectively, and pea yield 39.60%..This reduction decline in all characters value due to preceding maize crop because maize is exhausted plant and consumed high amount of soil fertilizer found that after each season of maize the soil analysis showed high decline in soil fertilizer and organic matter (10).The results of fall seasons 2011 and 2012 revealed that there were significant differences among studied characters of maize crop, (Table 3 and

4). In fall season 2011the maximum plant height, ear height and grain yield was found in maize succession the fallow treatment 183.7 cm, 101.48 cm and 8.52ton/ha^{-1} respectively, while the 250 kernel, weight 74.64g was found in maize succession canola (Table 3). In fall season 2012, only ear height and ear length showed significant differences at maize succession fallow treatment which were (95.3cm and 21.9cm) respectively (Table 4).The results in the table (5) represents the differences % in maize characters between two fall season (2011 and 2012). There were different responses of maize characters to the maize succession with different crops. Plant height was increased 2.9% only when maize succession broad bean while maize succession other crops plant height was decreased. Ear height increased about 4.3% when maize succession wheat, ear length and weight of 250 kernel were increased when maize succession all crops. The higher value of ear length was recorded when maize succession fallow treatment it was 24.2% and higher weight of 250 kernels recorded after wheat and pea were 25.4% and 23.1%. Kernel yield increased 1.7% only when maize succession pea and decreased after other crops. In general the yield decrease in 2012 due to the effect of very high temperature during pollination period which lead to lowest seed set.

Table 2. Characters mean of winter crops and differences estimation among two winter season.

Wheat (*Triticum durum* L.)						
Years	**Plant height (cm)**	**No. of tiller**	**Spike length cm**	**No. of seed / spike**	**1000 grain weight (g)**	**Yield ton/ha**
2010-2011	**81.9**	**5.6**	**6.4**	**45.06**	**48.9**	**5.78**
2011-2012 % difference	**69.3 -15.38**	**2.3 -58.92**	**6.11 -5.41**	**43.3 -3.90**	**47.5 -2.86**	**5.22 -9.76**
Broad bean (*Vicia faba* L.)						
	Plant height (cm)	**No. of branches**	**No. of pods/ 5 plant**	**100 seed weight**	**Yield ton/ ha**	
2010-2011	**95.7**	**4.0**	**56.0**	**165.97**	**8.40**	
2011-2012 % difference	**52.46- 45.20**	**2.9 - 27.5**	**5.0 * - 61**	**140.66 - 15.24**	**2.04 - 57.67**	
Pea (*Pisum sativum* L.)						
	Plant length (cm)	**No. of pods/ 5 plant**	**100 seed weight**	**Yield ton/ha**		
2010-2011	**53.3**	**7.0**	**19.85**	**1.20**		
2011-2012 % difference	**51.01 -4.35**	**6.5 - 7.14**	**17.67 - 10.98**	**0.72 - 39.60**		
Rapeseed (Brassica napus L.)						
	Plant height (cm)	**No. of primary branch**	**No. of secondary branch**	**No. of pods/ plant**	**No. of seed/ pod**	**1000 seed weight**
2010-2011	**140.3**	**7.00**	**4.0**	**260.5**	**23.3**	**48**
2011-2012**						

*** Decrease in no. of pods / plant in broad bean caused by freezing at early stage of growing.**
**** The Rapeseed in second season 2011-2012 was completely damage because of birds**.

Table 3. Maize characters mean for two growing season fall season 2011

rotation	Plant height (cm)	Ear height (cm)	Ear length (cm)	250 kernel weight (g)	Yield (ton/ha)
Wheat – Maize	180.90	84.13	16.41	71.43	7.03
Rapeseed – Maize	178.73	87.83	16.24	74.64	7.3
Broad bean Maize	174.13	94.733	18.1	72.63	7.57
Pea – Maize	172.2	89.7	16.45	67.73	6.69
Fallow – Maize	183.73	101.43	16.6	73.06	8.52
LSD	N.S	13.45	N.S	6.68	1.69

Table 4. maize characters mean for fall season 2012.

rotation	Plant height (cm)	Ear height (cm)	Ear length (cm)	250 kernel weight (g)	Yield (ton/ha)
Wheat – Maize	169.33	87.99	19.52	95.83	6.36
Rapeseed –Maize	176.16	86.9	19.622	90.09	6.80
Broad bean Maize	179.36	85.9	20.53	87.67	6.30
Pea – Maize	167.56	81.06	19.93	88.14	6.84
Fallow – Maize	183.53	95.3	21.9	88.8	6.08
LSD	N.S	12.77	1.31	N.S	N.S

Table 5. The differences in Maize characters between two fall seasons 2011 and 2012

characters	season	treatment				
		wheat	canola	Broad bean	Pea	Fallow
Plant height (cm)	2011	180.07	178.73	174.13	172.20	183.73
	2012	169.33	176.16	179.36	167.56	183.53
	% difference	-6.3	-1.4	2.9	-2.1	0.1
Ear height (cm)	2011	84.13	87.83	94.73	89.70	101.43
	2012	87.99	86.90	85.90	81.06	95.30
	% difference	4.3	-1.06	-9.3	-9.6	-6.04
Ear length (cm)	2011	16.41	16.24	81.10	16.45	16.6
	2012	19.52	19.62	20.53	19.93	21.9
	% difference	15.9	17.2	11.8	17.4	24.2
250 kernel weight (g)	2011	71.43	74.64	72.63	67.73	73.06
	2012	95.83	90.09	87.67	88.14	88.8
	% difference	25.4	17.1	17.1	23.1	17.7
Yield* (ton/ha)	2011	7.03	7.30	7.57	6.69	8.52
	2012	6.36	6.80	6.30	6.84	6.08
	% difference	-9.5	-6.7	-16.6	1.7	-28.5

***Yield decrease in 2012 caused by the effect of temperature during pollination period which lead to low seed set**

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