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EFFECT OF CROP ROTATION ON THE CONTROL OF WEEDS IN WINTER CROPS IN NORTH DELTA

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Abstract

This study was carried out at Sakha Agricultural Experimental Farm to study the effect of crop rotation on weeds and inturn on wheat grain yield. The trial were initiated in 1992/93 winter season and completed in 1994/95 winter season where no weed control treatments were applied at the last season. Data indicate that canary grass (Phalaris spp.) dominated all weeds in the experimental area. The results of 2-year crop rotation ensure the benefits of berseem as a preceding winter crop to wheat where this crop greatly reduced number and fresh weight of canary grass assessed in wheat preceded by berseem. The grain yield produced from this sequence was significantly highercompared with that produced from faba bean/wheat and wheat/wheat sequence. The poorest weed control and the lowest wheat grain yield was recorded for the crop sequence wheat/wheat.

The 3-year crop rotation indicate that the lowest number and fresh weight of Phalaris spp. were recorded for the treatments of the crop sequenceberseem/berseem/wheat. There was no significant difference among all treatments in this sequence and yielded the highest wheat grain yield. The poorest weed control and the lowest wheat grain yield was found for the crop sequence wheat/wheat/wheat.

INTRODUCTION

Canary grass (Phalaris spp.) remains one of the most wide spread weeds in wheat fields in middle and north delta.This weed was planted in El-Karada state farm, Kafr El-Sheikh governorate in 1968, to feed the birds of Giza zoo in Cairo. The harvesting and threshing of this weed was some-what late and inturn the soil was highly infested. This weed began to spread and invade the surrounding cultivated area. It is no longer reasonable to think of rotation wholly in the context of cultural techniques. Therefore, the crop rotation system will not help as control techniqe in this case, even though, the principal of rotation is still widely accept-

ed. Wilson and Phipps (1985) stated tha crop rotation system using cutting crops i.e. barley for silage exhausted the reserve of wild oat through three years. Donovan (1988) reported that population of wild oats increased in wheat /wheat rotation (>200 plant/m2) by the fourth year whereas in canola/barely rotation, population increased only by 40 plants / m2 or less. Cussans (1967) emphasized the need for systematic long-term approach in which cropping, husbandry practices and herbicide use are integrated to keep the weed control at minimum cost, in addition of, keeping the ecosystem clean from pollution.

This study aims to investigate the efficiency of agricultural rotation against grassy weeds, especially, canary grass and inturn on wheat grain yield in contrast with the use of herbicides.

MATERIALS AND METHODS

I. Two-year crop rotation:

This trial was started in 1992/93 and completed throughout 1993/94 winter season to explore the efficiency of this system in reducing weed population. The site of the trial was naturally infested with winter anual weeds. In between 1992/93 and 1993/94 seasons the plots were hand hoed and planted with maize which was used as summer forage crop. The crop sequence of the winter crops was as shown in the following table:

Rotational season	
1 st	**2 nd**
1992/93	**1993/94**
Berseem	**Wheat**
Wheat	**Wheat**
Faba bean	**Wheat**

It is to be noted that all the seasonal preparation before planting was done manually. The statistical design was split plot design in nested classification with four replications. The crop roation system was randomly assigned to the main plots, while the weedcontrol treatments were randomized within each main plot as subplot. Plot size was 14m2.

The applied treatments of each crop of the first season were as follow:

1. Weedy check
2. Hand weeding or hand hoeing (according to the crop).
3. Herbicide treatment i.e. Arelon 50% FL (1.25 L/F) in wheat or Fusilade super 12.5%(1 L/F) in case of berseem and Igran 80% WP (1.25 kg/F) in case of faba bean.
4. Herbicide treatments (as in no.3) + one hand hoeing or hand weeding (once).

It is to be noted that no weed control treatment was carried out in 1993/94 season (i.e. the second season). The normal agricultural practices for each crop were carried out as commonly practiced in the region. Both number per m2 and fresh weight (g/m2) of annual weeds were recorded, 75 days after sowing. As well as,wheat grain yield of each plot, 14m2 was recorded and estimated as t/ha.

II. Three year crop rotation:

This study started in 1992/93 and finished in 1994/95 winter season to explore the efficacy of this system in reducing weed population. The crop sequence of the winter crops was as shown in the following table:

Rotational season		
1 st 1992 / 93	2 nd 1993 / 94	3 rd 1994 / 95
Wheat	Wheat	Wheat
Faba bean	Wheat	Wheat
Berseem	Berseem	Wheat
Berseem	Wheat	Wheat

The applied treatments for crops planted in 1992/93 and in 1993/94 were as follow:

1. Weedy check.
2. Hand weeding or hand hoeing twice.
3. Herbicide treatment i.e. Arelon 50% FL (1.25 L/F) in wheat or Fusilade super 12.5% (1 L/F) in case of berseem and Igran 80% WP (1.25 kg/F) in case of faba bean.

(Table 1) Effect of two-year crop rotation and some weed control treatments on number ,fresh weight of weeds and wheat yield

Crop sequence		Number of weeds / m2			Fresh weight of weeds g / m2			Wheat grain yield t / ha
1992/93	1993/94	Canary grass	Broadleaf weeds	Total weeds	Canary grass	Broadleaf weeds	Total weeds	
Wheat :	Wheat :							
Weedy check	Untreated	177	32	209	1009	206	1215	1.196
Handweeding	Untreated	88	21	109	720	189	919	1.482
Arelon	Untreated	57	34	91	319	237	556	3.009
Arelon + HW *	Untreated	25	28	53	212	194	406	3.348
Mean		87	29	116	565	207	774	2.259
Fababean :	Wheat :							
Weedy check	Untreated	78	43	121	511	288	799	2.179
Handhoeing	Untreated	69	32	101	428	247	675	2.625
Igran	Untreated	32	70	102	375	249	624	3.804
Igran + HW	Untreated	32	26	58	225	174	399	4.188
Mean		53	43	96	385	240	624	3.199
Berseem :	Wheat :							
Weedy check	Untreated	19	29	48	175	249	424	4.982
Handweeding	Untreated	18	27	46	131	209	340	5.50
Fusilade super	Untreated	12	34	46	100	256	356	5.089
Fusilade + HW	Untreated	12	33	45	106	243	349	5.393
Mean		15	31	46	128	239	367	5.241
L.S.D (A) at 5%		32.8	10.53	34.22	N.S	N.S	306.4	0.898
L.S.D (A*B)		N.S	N.S	N.S	462.8	N.S	N.S	0.981

HW * = Handweeding, once

(Table 2) Effect of three-year crop rotation and some weed control treatments on number ,fresh weight of weeds and grain yield of wheat

Crop sequence			Number of weeds / m2			Fresh weight of weeds g / m2			Wheat grain yield t / ha
1992/93	1993/94	1994/95	Canary grass	Broadleaf weeds	Total weeds	Canary grass	Broadleaf weeds	Total weeds	
Wheat :	Wheat :	Wheat :							
Weedy check	Weedy check	Untreated	45	12	57	3275	988	4263	1.918
Handweeding	Handweeding	Untreated	18	2	20	2150	169	2319	2.62
Arelon	Arelon	Untreated	10	27	37	2175	575	2750	3.093
Arelon + HW	Arelon + HW	Untreated	6	6	12	850	469	1319	2.965
Mean			20	12	31	2113	550	2663	2.65
Fababean :	Wheat :	Wheat :							
Weedy check	Weedy check	Untreated	36	18	54	2563	1019	3581	2.528
Handhoeing	Handweeding	Untreated	23	9	31	1925	238	2163	2.825
Igran	Arelon	Untreated	6	15	22	975	313	1288	3.16
Igran + HW	Arelon + HW	Untreated	6	7	13	775	756	1481	3.813
Mean			18	12	30	1560	582	2128	3.08
Berseem :	Berseem :	Wheat :							
Weedy check	Weedy check	Untreated	5	9	14	1275	1250	2525	4
Handweeding	Handweeding	Untreated	5	6	11	700	663	1363	4.058
Fusilade super	Fusilade super	Untreated	3	14	16	194	519	713	4.09
Fusilade + HW	Fusilade + HW	Untreated	1	5	6	156	150	306	4.073
Mean			3	8	12	581	646	1227	4.06
Berseem :	Wheat :	Wheat :							
Weedy check	Weedy check	Untreated	12	19	31	1500	881	2381	2.857
Handweeding	Handweeding	Untreated	11	12	23	1100	219	1319	3.008
Fusilade super	Arelon	Untreated	9	26	35	1306	763	2069	3.795
Fusilade + HW	Arelon + HW	Untreated	5	24	28	525	888	1413	3.47
Mean			9	20	29	1108	688	1796	3.28
L.S.D at 5%			13.10	N.S	24.81	1425	N.S	1885	0.827

4. Herbicide treatment (as in no. 3) + one hand hoeing or hand weeding (once).

The crops of the second and third seasons were planted in the manually hoed plots previously laid out in 1992/93 season (the first one). It is to be noted that no chemical weed control treatments was carried out in 1994/95 season (i.e. the third season). All agricultural practices for each crop were followed as normal. Both number per m2 and fresh weight (g/m2) of annual weeds were recorded, 75 days after sowing. Wheat grain yield of each plot, 14m2 recorded and estimated as t/ha. Data of both studies were subjected to the proper statistical analysis according to "F" test and the mean values were compared by least significant difference (L.S.D.) at 5% level (Snedcor and Chochran, 1967).

RESULTS AND DISCUSSION

I. Two year crop rotation:

Data revealed that canary grass (*Phalaris spp.*) was the dominant weed species at both seasons. At the started season (1992/93), the fresh weight of *Phalaris* spp recorded were 4626, 3450 and 7250 g/m2 in the weedy check plots of berseem, wheat and faba bean, respectively. The weedy check plots recorded 175 g/m2 of *Phalaris spp* in wheat preceded by berseem compared to 4626 g/m2 in berseem at started season. This sequence, berseem/wheat resulted in the highest reduction in canary grass (Phalaris spp.) followed by faba bean/wheat and wheat/wheat sequences which recorded 93, 83 and 64% respectively in weedy check plots. Generally, at all sequences weed control treatments reduced both number and fresh weight of annual weeds as compared to the weedy check plots. It is observable that the sequences berseem/wheat had the lowest number and fresh weight of canary grass and total annual weeds followed by faba bean/wheat and wheat/wheat sequences (table 1). This reduction in annual weeds biomass resulted in an increase in wheat grain yield. The superiority of berseem/wheat sequence in the reduction of weed biomass resulted in the highest grain yield of wheat even in the weedy check plots, where, the highest grain yield was obtained from the sequence berseem/wheat, 5.241 t/ha (14.67 Arab/F) while wheat/wheat sequence yielded the lowest one, 2.259 t/ha (6.33 Ardab/F). Similar results were reported by Wilson and Phipps (1985) as they stated that crop rotation system using cutting crops i.e. barley for silage exhausted the reserve of wild oat through three years. On the other hand, Donovan (1988) found that populations of wild oat was increased in whea/wheat.

II. Three-year crop rotation:

At the started seaon (1992/93), the fresh weight of *Phalaris spp* recorded were 2635, 6225 and 3400 g/m2 in the weedy check plots of wheat, faba bean and berseem, respectively. Data in the table (2) revealed that canary grass recorded the highest number and fresh weight g/m2 especially in the sequences wheat/ wheat/wheat and faba bean/wheat/wheat, whereas the sequences, berseem/ berseem/wheat and berseem/wheat/wheat recorded the lowest number and fresh weight of canary grass. This means that grassy weeds were more dominant under wheat/wheat and faba bean/wheat/wheat sequence. Data recorded at table (2) denoted that, at all sequences, weed control treatments reduced both number and fresh weight of annual weeds as compared to the weedy check plots.

Data revealed that the sequences wheat/wheat/wheat and faba bean/wheat recorded higher number and fresh weight of canary grass than those recorded at the sequences involved berseem crop over all mean of the treated plots. These reduction in annual weeds biomass resulted in increasing wheat grain yield.

This highest reduction in number and fresh weight of weeds resulted in the highest wheat grain yield. Concerning wheat grain yield, the sequence berseem/ berseem/wheat recorded the highest wheat grain yield, 4.06 t/ha (11.37 Ardab/F). This may be due to both the suppressive effect of this sequence to weeds throughout the repeated cuttingin winter season 1992/93 and 1993/94 and the accumulation of N fixed by the leguminous crop e.g. berseem as mentioned by Hesterman et al, 1986. So it is recommend to plant wheat after berseem in winter season.

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دراسة تأثير التعاقب المحصولى على مكافحة الحشائش فى محصول القمح فى شمال الدلتا

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أقيمت عدة تجارب حقلية بالمزرعة البحثية لمحطة بحوث سخا لدراسة كفاءة كل من الدورة الثنائية والثلاثية على مكافحة الحشائش وبالتالى على محصول الحبوب فى القمح. بدأت الدراسة فى الموسم الشتوى ٩٢ / ١٩٩٣ وانتهت فى الموسم الزراعى ٩٤ / ١٩٩٥مع الأخذ فى الأعتبار أنه لم تضف أى معاملات لمكافحة الحشائش فى الموسم الأخير من الدراسة سواء فى الدورة الثنائية والثلاثية.

وقد أوضحت التجارب أن الحشيشة السائدة فى جميع التجارب على مدار سنوات الدراسة كانت حشيشة الفلارس، وقد أظهرت نتائج الدورة الثنائية فائدة زراعة القمح بعد البرسيم كمحصول سابق حيث تسبب البرسيم بصورة واضحة فى تقليل أعداد حشيشة الفلارس كما تفوق محصول الحبوب للقمح معنويا على المحصول الناتج من التتابعات فول / قمح أو قمح / قمح.

وقد أوضحت النتائج المتحصل عليها من الدورة الثلاثية أن التتابع برسيم / برسيم / قمح قد سجل أقل عدد ووزن لحشيشة الفلارس وبالتالى الحصول على أكبر حاصل للحبوب من القمح ولم يلاحظ أى فروق معنوية بين المعاملات فى هذا التتابع حتى فى معاملة المقارنة ولقد سجل التتابع قمح / قمح / قمح أقل مكافحة للحشائش وبالتالى أقل إنتاج لمحصول القمح.