

## Effect of Weed Control and Other Agronomic Factors on Grain Yield of Wheat at Desert Irrigated Sites of Libya

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### Abstract

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Two 2<sup>5</sup>-factorial trials were conducted at two locations (Sebha, Sarir) south of Libya to determine the importance of major agronomic factors including weed control on cereal production in Libya. The factors studied were: Date of sowing (D), Seeding rate (S), Fertilizers (F), Varieties (V) and Weed control (W). Each factor was at two levels of application (low, high). The experiments were designed in split plot with one replication. There was highly significant main effect of sowing date on grain yield at both locations, and interaction between sowing date and weed control in Sebha. Early sowing date increased grain yield by 2.2 ton/ha at Sebha and by 1.38 ton/ha at Sarir. In Sebha, at early date of sowing, response of grain yield to weed control treatment was very high, while at late date of sowing no differences were observed. There was significant response of grain yield to weed control in Sebha with no response at Sarir due to low weed infestation level in that site. High fertilizer level affected significantly the grain yield at Sebha without any positive effect at Sarir. Weed control should be considered as an integral part of other agronomic factors such as: sowing date, proper seeding rate and fertilizer application. Only when weeds are properly controlled can farmers recognize the economic benefits of packages of improved agronomic factors.

**Keywords:** Weed control, wheat, yield, agronomic factors

### Introduction

Although some modern technology has become part of new farming methods in North Africa, weed control is still lacking behind and it is not regarded as an important factor for increasing cereal production.

Most of the farmers consider improved variety and high level of fertilizers as sufficient for high level of crop production. However, this is an underestimation of the importance of other factors especially weed control, which is regarded as one of the factors necessary for maximizing cereal production in Libya. With the improved growing practices such as the use of higher rate of fertilizers and irrigation, the weed problems are intensified because those two factors help not only the crop but the weeds to grow better. If weeds are not controlled properly and early enough, the effect of weeds on yield is greater under high soil-fertility conditions (9, 11). There is a considerable number of evidence that omitting weed control from the package of improved agronomic practices for higher yields will reduce most the benefits provided by the rest of the package. In other words, without weed control the added soil moisture and fertility may simply lead to produce more weeds, rather than to increase crop yields (8, 9, 11).

Not all cultural practices are equally effective in weed control, although some of these practices i.e. tillage, sowing date, seeding rate, row spacing, reduce weed growth and increase crop yield (2, 5, 6, 8, 13).

Delaying sowing date had been considered by many researchers (5, 11, 13) as a significant tool for good weed control. Late sowing (after rain or irrigation) allows weeds to be controlled by pre-sowing tillage, but the resulting yields are often substantially smaller than at early sowing.

Early sowing (before the rain or irrigation) increases yield but also requires effective weed control. However, it is becoming clear from several research works that the advantages in yield and the cost of herbicides used on early sown wheat make this option to be the preferred one. Unfortunately, many farmers in rainfed areas underestimate this due to lack of herbicides or poor knowledge on their use. Even though some cereal varieties could be more

competitive to weeds than others, but this cannot be considered as a totally effective tool for weed control (12). New improved varieties are usually higher yielding but less competitive to weeds. Weed control should be regarded as an integral part of other agronomic factors such as tillage, sowing date, proper seeding rate and fertilizer applications.

In order to identify the most significant factors leading to increased cereal production in Libya, a number of different variables and their interactions with and without chemical weed control were tested in field trials.

### Materials and Methods

A series of 2<sup>5</sup>-factorial trials were conducted at two locations in Libya (Sebha, Sarir) to assess the relative importance of major agronomic variables and their interactions including weed control on grain yield of wheat. The factors studied were: Date of sowing (D), Seeding rate (S), Fertilizers NPK (F), Variety (V) and Weed control (W). Each factor was studied at two levels of application (Table 1).

**Table 1.** Management practices in wheat agronomic factors trial at two locations in desert, irrigation projects, south of Libya.

Management		Location	
		Sebha	Sarir
Date of sowing (D)	Early	29 October	29 October
	Late	15 November	15 November
Seeding rate (S)	Low	80 kg/ha	80 kg/ha
	High	150 kg/ha	150 kg/ha
Fertilizers NPK (F)	Low	150:60:0 kg/ha	150: 60: 0 kg/ha
	High	200:80:0 kg/ha	200:60: 0 kg/ha
Variety (V)	Local	Kufra I	Yavares
	Improved	Yecora	Karim
Weed control (W)	No	-	-
	Chemical	Bromoxynil + diclofop-methyl	bromoxynil + diclofop-methyl

The experiments were laid out in split plot with one replication. The seeds were drilled in plots 3 x 10 m, with ammonium phosphate fertilizer and one half of the required nitrogen applied as top-dressing at tillering stage. Weed control was achieved with a single spray of bromoxynil + diclofop-methyl at the 4-leaf stage at the rate of 0,5 + 1,0 kg (a.i.) /ha. At anthesis, weed species and weed control were visually evaluated. At maturity, crops were harvested by hand, threshed with a threshing machine, and the grain yield was recorded. Analysis of variance was applied to the data from each location.

To highlight important factors and their interactions, discussion will be focused on grain yield.

## Results and Discussion

The weed infestation level in Sebha was high with the following weed species being dominant: *Avena sterilis*, *Lolium* spp., *Bromus* spp., *Chenopodium opulifolium*, *Sonchus oleraceus*, *Brassica deserti*, *Polygonum* spp., *Galium tricorne*.

The visual estimation of weed control (in percent) showed that nearly 100 % of all weed species had been controlled with herbicide application as compared to non-treated plots at both dates of sowing. Diclofop-methyl was equally effective on all grassy weed species.

In Sarir, weed infestation level was very low with the following weed species being prevalent: *Lolium rigidum*, *Avena sterilis*, *Bromus rigidus*, *Silene conoidea*, *Alopecurus pratensis*, *Chenopodium album*, *Galium tricorne*.

Effect of sowing date: The main effect and interaction of sowing date across the two locations is summarized in Table 2. Significant responses of grain yield to early sowing date were obtained at both locations. There was no significant interaction between the date of sowing and the seeding rate. At both dates of sowing there was a tendency for increases in yield with a higher seeding rate. At Sarir the yield response to increased seeding rate was higher than in Sebha. This is very difficult to explain however the different environmental conditions and low differences between applied factors could cause such effect. Similar results were obtained by other authors (1, 3, 7).

No significant interaction between the date of sowing and the high fertilizer rate was observed at both locations. However, the yield response due to high fertilizer rate was very high at Sebha at both dates of sowing, while at Sarir it was very low. There was a significant response of varieties to the date of sowing at both locations. At the early date of sowing both varieties, local and improved, gave similar, while delaying of sowing date allowed the local variety to outyield the improved one at both locations. This was probably due to better adoption of the local variety to such a factor, however it did not appear in the interaction. Great response of grain yield to date of sowing and weed control was obtained in Sebha, where at the early date of sowing the yield increase with chemical weed control was very high, while at late date of sowing there were no differences in yield between weed control treatments. This can be

explained by the fact that weed infestation at early date of sowing was generally higher than at a later date, when the germinated weeds can be controlled by pre-sowing soil preparation. The results of experiments conducted by other authors (9, 10, 11) confirm that early sowing can be very effective when weed control was provided. This refers to the sites with high weed infestation level.

In Sarir there was no yield response to chemical weed control at both dates of sowing, because of very low weed infestation level as indicated in the text dealing with weed description.

Effect of seeding rate: The main effect and interaction of seeding rate with other agronomic factors are summarized in Table 3. There was neither significant main effect nor interaction of the seeding rate with other factors on the grain yield at both locations. High level of fertilizer application increased the yield at both seeding rates at Sebha, but there was no response at Sarir. The local variety yielded higher than the improved one at lower seeding rate at Sebha with no difference in yield at the high seeding rate, while at Sarir it was exactly the opposite; the local variety yielded higher at high seeding rate with no difference between varieties at the low seeding rate. There was great response in yield to weed control at both seeding rates, with no difference at high seeding rate at Sebha and low response at low seeding rate at Sarir.

There was significant response to high fertilizer rate at Sebha (Table 4) and no significant interactions of fertilizers to other factors, with significant increase in yield with weed control treatments at high fertilizers level than with weed control of low fertilizer level. Application of fertilizers without weed control can lead to better yield of weeds instead of crop (1, 4, 11, 14, 15).

Neither significant main effect nor interaction of fertilizers with other factors on grain yield was recorded at Sarir. There was neither significant main effect nor interaction (Table 5) of varieties with weed control on the grain yield at both locations.

Data on the main effect of weed control on grain yield are presented in Table 6. There was significant response to weed control at Sebha with no response at Sarir, where the weed infestation level was very low, as mentioned before.

From the results obtained in this study it is concluded that: 1) Dates of sowing, fertilization and weed control were the basic factors affecting wheat production in Libya irrigated projects; 2) Early sowing date (2 weeks before irrigation) integrated with chemical weed control and fertilizers increased significantly the yield of wheat; 3) Weed control in dry areas should be an integral part of the improved crop production packages. Only then may the full advantages of irrigation and fertilization be achieved; 4) There was different effect of investigated factors at both locations, which is most likely due to variable environmental conditions

**Table 2.** Main effect of sowing date and interaction with other agronomic factors on wheat yield (ton/ha) at two locations in South Libya.

Effect				Grain yield (ton/ha)			
				Sebha		Sarir	
Main effect				Date of sowing			
				early	late	early	late
				5.36**	2.16	3.82*	2.44
	Date of sowing x Seeding rate	Seeding rate	Low	5.11	2.17	3.50	2.23
			High	5.58	2.36	4.15	2.66
Interaction	Date of sowing x Fertilizers	Fertilizer	Low	4.61	1.83	3.73	2.37
			High	6.07	2.70	3.91	2.50
	Date of sowing x Variety	Variety	Local	5.20	3.07*	3.79	2.85*
			Improved	5.48	2.38	3.86	2.01
	Date of sowing x Weed control	Weed control	No	4.70	2.45	3.86	2.24
			Chemical	6.03*	2.87	3.79	2.62

\*\* Main effect or interaction significance at P = 0.01

\* Main effect or interaction significance at P = 0.05

**Table 3.** Main effect and interactions of seeding rate on wheat yield (ton/ha) at two locations.

Effect				Wheat yield (ton/ha)			
				Sebha		Sarir	
Main effect				Seeding rate			
				low	high	low	high
				3.74	3.85	2.87	3.44
	Seeding rate x Fertilizer	Fertilizer	Low	3.63	3.65	2.74	3.43
			High	4.50	4.78	3.00	3.44
Interaction	Seeding rate x Variety	Variety	Local	3.68	4.46	2.87	3.80
			Improved	3.06	4.45	2.87	3.06
	Seeding rate x Weed control	Weed control	No	3.11	3.04	2.67	3.51
			Chemical	4.25	4.65	3.07	3.36

**Table 4.** Main effect and interaction of fertilizers with other factors on grain yield (ton/ha) at two locations

Effect				Grain yield (ton/ha)			
				Sebha		Sarir	
Main effect				Fertilizer			
				low	high	low	high
				3.34	4.19*	3.07	3.22
Interaction	Fertilizer x Variety	Variety	Local	3.66	4.08	3.20	3.27
			Improved	3.44	3.87	3.04	3.11
	Fertilizer x Weed control	Weed control	No	2.62	2.53	3.10	3.17
			Chemical	4.06	4.84*	3.14	3.21

\* Significance at P = 0.05

**Table 5.** Main effect and interaction of varieties with weed control on grain yield (ton/ha) at two locations.

Effect				Grain yield (ton/ha)			
				Sebha		Sarir	
Main effect				Variety			
				local	improved	local	improved
				3.98	3.55	3.33	3.01
Interaction	Variety x Weed control	Weed control	No	3.52	3.31	3.23	3.07
			Chemical	4.21	3.90	3.27	3.11

**Table 6.** Main effect of weed control on grain yield (ton/ha) at two locations

Main effect		Grain yield (ton/ha)	
		Sebha	Sarir
Weed control	No	3.07	3.13
	Chemical	4.45*	3.21

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## المخلص

كوكولا، س.ت. 1999. تأثير العوامل الزراعية في المحصول الحبي للقمح في المواقع الصحراوية المروية من ليبيا. مجلة وقاية النبات العربية. 120-117:(2)17

تم تنفيذ تجربتين عاملتين، بخمسة عوامل، في منطقتي "سبها" و "سرير" اللببيتين، لتحديد أهمية العوامل الزراعية الرئيسية، بما في ذلك مكافحة الأعشاب، في إنتاجية القمح في ليبيا. وكانت العوامل المدروسة: موعد الزراعة (D)، معدل البذار (S)، التسميد (F)، الأصناف (V)، ومكافحة الأعشاب (W). واستخدم كل عامل بمستويين (عالٍ ومنخفض). واتبع في التجربة تصميم القطع المنشقة وبمكرر واحد فقط. أظهرت النتائج تأثيراً عالياً للمعوية لموعد الزراعة في الإنتاج الحبي للقمح في كلا الموقعين، وتأثيراً مابين موعد الزراعة ومكافحة الأعشاب في "سبها". وقد أدى الموعد المبكر إلى زيادة الإنتاج الحبي بما يعادل 2.2 طن/هـ في "سبها" و 1.38 طن/هـ في "سرير". وفي "سبها"، كانت استجابة الإنتاج الحبي لمعاملة التعشيب عالية في الموعد المبكر، في حين لم تكن هناك فروقات في الموعد المتأخر. كما لوحظ رد فعل معنوي للتعشيب في الإنتاج الحبي للقمح في "سبها"، في حين لم تلاحظ مثل هذه الاستجابة في "سرير" نظراً للمستوى المنخفض من الأعشاب في هذا الموقع. وأثر المستوى العالي من التسميد معنوياً في الإنتاج الحبي للقمح في موقع "سبها" ولكن التأثير لم يكن إيجابياً في "سرير". وعليه يجب اعتبار مكافحة الأعشاب مكوناً مكملاً للعوامل الزراعية الأخرى مثل موعد الزراعة والمعدلات المناسبة من البذار والأسمدة. والخلاصة أن المزارع يستطيع لمس الفوائد الاقتصادية للخدمة المحسنة من العوامل الزراعية شريطة مكافحة الأعشاب على نحو مناسب.

**كلمات مفتاحية:** مكافحة أعشاب، القمح، الإنتاج، العوامل الزراعية.

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