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Competition Effect of *Chenopodium album* L. for Potassium and Grain Yield in Wheat (*Triticum aestivum* L.)

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التأثير التنافسي للجينيوبوديوم ألبم على البوتاسيوم وإنتاجية الحبوب في القمح

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خلاصة: تم إجراء تجربة حقلية لتقدير نسبة البوتاسيوم ومعدل الخسارة في الإنتاجية نتيجة لوجود الجينيوبوديوم ألبم في محصول القمح خلال فترات تنافس مختلفة. تكونت التجربة من المعدلات الآتية: دون منافسة، ومنافسة لمدة ٣ و ٤ و ٥ و ٦ و ٧ و ٨ أسابيع بعد ظهور البادارات وكذلك لفترة موسم كامل. كان أعلى مستوى لتركيز البوتاسيوم في الجينيوبوديوم ألبم (٤,٩١%) عندما سمح بتنافس الجينيوبوديوم ألبم مع القمح لمدة ستة أسابيع بعد ظهور البادرات. نتج عند التنافس لمدة موسم كامل الى إمتصاص عالي للبوتاسيوم وقدره ٨,٢٢ كجم للهكتار. كان أعلى معدل للبوتاسيوم (٩٨,٤٠ كجم للهكتار) لفترة التنافس للموسم الكلي. كانت هناك زيادة خطية للوزن الجاف الجينيوبوديوم ألبم مع زيادة طول فترة التنافس. أنخفض معدل الإنتاجية بصورة ملحوظة لما بعد ٣-٤ أسابيع بعد ظهور البادرات وكان أعلى معدل لانخفاض إنتاجية الحبوب (٢٥,٢٩%) خلال فترة التنافس للموسم الكلي.

ABSTRACT: A field experiment was conducted to estimate potassium (K) and yield losses by *Chenopodium album* in wheat under different competition periods. The study consisted of zero competition, competition for 3,4,5,6,7,8 weeks after emergence (WAE), and for full season. Potassium concentration in *C. album* was maximum (4.91%) when it was allowed to compete with wheat for 6 WAE. Full season competition resulted in a maximum K uptake (8.22 kg ha^{-1}) by *C. album*. Maximum K concentration (4.39 %) in wheat was recorded in 4 WAE competition period whereas maximum K uptake (98.40 kg ha^{-1}) by wheat was in full season competition period. There was a linear increase in dry wheat of *C. album* with increase in competition period. Grain yield decreased significantly beyond 3-4 WAE competition periods and maximum decrease (25.59 %) in grain yield was observed in full season competition.

Keywords: competition, wheat, *Chenopodium album*, potassium uptake, grain yield.

Unchecked growth of weeds in a wheat field results in a significant decrease in grain yield, and moisture and nutrient contents of soil. Control of weeds can avoid the drain of a large amount of nutrients, which otherwise can be utilized efficiently by crop plants for better growth, development and higher grain yield. Due to rapid growth, high seed production potential and competitive ability, *Chenopodium album* is considered one of the most problematic weeds for wheat. Many studies have revealed nutrient and yield losses by *Chenopodium album* in wheat (Shahi, 1978).

A higher concentration of K in *Chenopodium album* than in wheat was noted by Shahi (1978). Pandey and Singh (1983) reported that K_2O uptake of wheat, kept free of weeds up to harvest, was 83.75 kg ha^{-1} as compared to 78.63 kg ha^{-1} in crops competing with weeds up to harvest. Kundra and Singh (1985) recorded a loss of 37.8 kg K_2O ha^{-1} and 29.5 kg K_2O ha^{-1} in 1980-81 and 1981-82, respectively, on account of unchecked growth of weeds. Maximum uptake of K_2O (30.8%) by wheat was observed with 1.6 kg metoxuron ha^{-1}. Yadav *et al.* (1985) reported a depletion of 77.7 and 54.6 kg K_2O ha^{-1}

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TABLE 1

***Effect of competition period on dry weight (kg ha^{-1}) of* C. album.**

Treatment	1992-93	1993-94
Competition periods		
Zero competition	0.00g	0.00f
3 WAE	20.75f	45.75f
4 WAE	37.25e	68.13ef
5 WAE	47.12de	86.25de
6 WAE	53.75d	110.38d
7 WAE	103.75c	191.13c
8 WAE	130.62b	250.38b
Full season competition	253.12a	354.50a
S.E.	4.67	11.27
LSD 5%	13.33	32.16
Significance	**	**

Means sharing a same letter in a column did not differ significantly at P = 0.05.

in 1978-80 and 1980-81, respectively when weeds were allowed to compete with the crop up to harvest. Yadav *et al.* (1986) revealed that uptake of K_2O by *Phalaris minor* Retz. at 85 days after sowing was considerably greater than *C. album* L. and *Vicia sativa* L. in wheat field.

The present study was undertaken to estimate K and grain losses in wheat by *Chenopodium album* under different competition periods.

Materials and Methods

Experiments were conducted for two successive years with "Pasban-90" as the test cultivar of wheat. A randomized complete block design with four replications was used for the layout of the experiment. Crop was sown in rows 25 cm apart with a single row hand drill at 100 kg ha^{-1}, into 1.5 by 7 m plots. Soil contained 0.045 % N, 4 ppm available P, 181 ppm exchangeable K and 0.72 % organic matter. In the next growing season the values were 0.038 % N, 6.5 ppm available P, 149 ppm exchangeable K and 0.45 % organic matter. Fertilizer was applied at 115 kg N ha^{-1} and 115 kg P_2O_5 ha^{-1}. All P and half of N was applied at sowing and the remainder N was applied with first irrigation. The experimental plots consisted of eight competition periods; zero competition, full season competition, competition for 3,4,5,6,7 and 8 weeks after emergence. Oven dried samples of *C. album* taken from a one square meter area and wheat from a 0.25 m long row at the end of each prescribed competition period, were ground and the K concentration was determined as suggested by Williams (1984). K uptake was determined by multiplying the K concentration by the dry weight of plants. Fisher's analysis of variance was used to analyze the data and the treatment means were compared using least significance difference test (Steel and Torrie, 1984).

Results and Discussion

DRY WEIGHT IN WEEDS: Among competition periods, maximum dry weight was recorded in full season competition between wheat and *C. album*. It was followed by 8 weeks competition during 1992/93 and 1993/94. An increase in competition period resulted in increased dry weight of *C. album* (Table 1).

The progressive increase of *C. album* dry weight with increasing competition period may be due to the absorption of water, nutrients and light for a longer period. This resulted in better growth and development of both the weeds. Comparatively less dry weight of *C. album* in 1992/93 was due to less number of weeds per unit area. Similar results were reported by Sarwar (1994). He recorded a linear increase in weed biomass with increase in weedy duration from 3 weeks after emergence to full season competition. Full season competition gave significantly higher biomass.

POTASSIUM CONCENTRATION OF *C. ALBUM* AND WHEAT: Data presented in Table 2 show that K concentration of *C. album* was significantly affected by competition period. Among the competition periods K concentration of *C. album* was maximum at 3 WAE. It was statistically equal to K concentration at 6 WAE. The difference between 4 and 6 WAE was also not significant in 1992-93. Whereas in 1993-94 K concentration of *C. album* at 6, 7, and 8 WAE was statistically similar and higher than other competition periods. K concentration was minimum in full season competition during both years. An increase in K concentrations in *C. album* and wheat at 6 WAE in the first growing season, and 7 and 8 WAE in the second growing season may be due to increased water supplies at these stages as a results of irrigation or rain. This enhanced the availability and absorption of K.

TABLE 2

Effect of competition period on K concentration (%) in* C. album *and wheat.

Treatments	K Concentration			
	C. album		Wheat	
	1992-93	1993-94	1992-93	1993-94
Competition periods				
Zero competition				
3 WAE	4.99a	2.14bc	4.30a	1.62d
4 WAE	4.75b	2.13bc	4.39a	1.98b
5 WAE	4.34c	1.72d	3.88b	2.32a
6 WAE	4.91ab	2.47a	4.31a	1.79c
7 WAE	4.11cd	2.33ab	3.46c	2.05b
8 WAE	3.93d	2.54a	3.62c	2.27a
Full season competition	3.15e	2.06c	0.83d	1.76c
S.E.	0.08	0.08	0.06	0.04
LSD 5%	0.23	0.24	0.17	0.12
Significance	**	**	**	**

Means sharing a same letter in a column did not differ significantly at P = 0.05.

TABLE 3

Effect of competition period on K uptake (kg ha^{-1}) by C. album and wheat.

Treatments	K Uptake			
	C. album		Wheat	
	1992-93	1993-94	1992-93	1993-94
Competition periods				
Zero competition	-	-	-	-
3 WAE	1.05f	0.98d	17.69e	17.58f
4 WAE	1.79ef	1.47d	22.80d	11.00e
5 WAE	2.06de	1.48d	31.74c	13.64d
6 WAE	2.65d	2.73c	49.85b	14.70d
7 WAE	4.30c	4.54b	47.59b	29.24c
8 WAE	5.14b	7.18a	59.07a	41.88b
Full season competition	8.22a	7.30a	56.08	98.40a
S.E.	0.26	0.20	1.49	0.62
LSD 5%	0.75	0.59	4.28	1.78
Significance	**	**	**	**

Means sharing a same letter in a column did not differ significantly at P = 0.05.

In the first growing season, the weed competition periods of 3, 4 and 6 weeks were statistically similar in respect of K concentration in wheat, whereas in the next growing season the competition of 5 and 8 weeks had statistically similar K concentration in wheat. The K concentration in *C. album* and wheat in full season competition during both growing seasons was minimum. This may be the result dilution of K along with more plant growth.

Potassium concentration values in *C. album* at all competition periods were higher than wheat. It means that *C. album* was more efficient in K absorption than wheat. More K in *C. album* and wheat in the first growing season than in the second may be due to differences in fertility status of the soil. These results are quite inline with those of Shahi (1978) who reported better removal of K by *C. album* than by wheat.

POTASSIUM UPTAKE BY *C. ALBUM* AND WHEAT: K uptake by *C. album* and wheat, increased significantly with increasing competition periods, in both growing seasons. However, the competition periods of 8 WAE and full season competition in second growing season did not vary significantly in respect of K uptake (Table 3). The increasing trend in K uptake by *C. album* and wheat, with increasing competition period, may be the result of differences in dry weights at different competition periods. Maximum K losses due to *C. album* occurred from 8 weeks to full season competition. Higher K concentration of *C. album* and wheat in 1992/93 resulted in greater K uptake. Lower uptake by wheat in full season competition during 1992/93 was due to its low K concentration. Similar similar results were reported by Pandey and Singh (1983) who noted 5.12 kg K_2O ha^{-1} uptake by weeds up to harvest.

TABLE 4

Effect of competition period on grain yield (kg ha^{-1}) of wheat competition with C. album.

Treatments	Grain Yield			
	1992-93		1993-94	
Competition periods				
Zero competition	5435.62	-	4465.50a	-
3 WAE	5356.75a	(1.45)	4418.38a	(1.05)
4 WAE	5289.25a	(2.69)	4117.13b	(7.80)
5 WAE	4722.62b	(13.11)	4035.25bc	(9.63)
6 WAE	592.87bc	(15.50)	4010.75bc	(10.18)
7 WAE	519.12bc	(16.86)	3995.13bc	(10.53)
8 WAE	4460.87c	(17.93)	3913.00cd	(12.37)
Full season competition	4014.37d	(25.59)	3499.25d	(21.63)
S.E.	82.62		61.58	
LSD 5%	333.47		175.75	
Significance	**		**	

Means sharing a same letter in a column did not differ significantly at P = 0.05.
Figures in parenthesis represent decrease in yield over zero competition.

GRAIN YIELD: *C. album* competition grain yield in wheat was statistically similar in no competition and in competition for 3 and 4 WAE in 1992/93 (Table 4). It was followed by grain yield attained after 5 weeks competition. In 1993/94 no competition and competition for 3 weeks were statistically similar in respect of grain yield. These were followed by 4 weeks competition. During both the years full season competition yielded significantly the lowest grain yield.

There was a minimum decrease in grain yield in early competition. But with an increase in competition duration beyond 4 weeks, there was a progressive decrease in grain yield due to more competition of weeds with wheat for growth factors. Nayyer *et al.* (1994) stated that allowing weeds to grow beyond 4 weeks till maturity resulted a significant decrease in grain yield. They also reported 4-6 weeks as the most critical period for weed control.

On the basis of our study, it can be concluded that the period 3-4 weeks after crop emergence is a crucial for weed control. *Chenopodium album* infestation should be controlled within that period to avoid potassium and yield losses.

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