Egypt. J. Agric. Res., 78 (1) ,2000.

EFFECT OF SUGAR BEET INTERFERENCE ON SOME GROWTH TRAITS OF THE COMMON ASSOCIATED WEEDS

M.T.B. FAYED[1] I.H. EL-GEDDAWY [2] AND MAHA M. EL-ZENY[2]

1 Fac. of Agric. Agron. Depart. Ain Shams Univ. Egypt.

2 Sugar Crops Res. Institute., Agric. Res. Cent., Giza, Egypt.

(Manuscript received 13 October 1998)

Abstract

Two pot trials were conducted in Sugar Crops Research Institute, Giza Research Station, ARC, Egypt in the two successive seasons of 1992/93 and 1993/94. The purpose of this work was to assess the effect of sugar beet interference (1 sugar beet: 5 weed plants ratio) on growth characteristics of above and sub-soil parts some common associated weed species.

Sugar beet exerted a noticeable reductions in height, number of branches and leaves ,fresh and dry weights of foliage and underground parts/plant of existing weed species after 105, 135 and 180 days from sowing. The extent of reductions was mainly depenent on the neighbouring weed species.

Shoot growth reduction was more striking with bindweed (*Convolvulus arvensis*, L.), followed by wild beet (*Beta vulgaris*, L.). Sugar beet interference decreased the number of branches and leaves and fresh and dry weights of aerial parts of bindweed plant than the control after 135 days from sowing by 61.4, 63.2, 78.3 and 74.7% respectively. Contrarily, canarygrass (Phalaris minor Retz) can withstand competition of sugar beet without any significant reductions in its shoot growth. Other weed species: dock weed (Rumex dentatus L.); lambsquarters (*Chenopodium murale* L.); tooth pick (*Ammi majus* L.) and bermuda-grass (*Cynodon dactylon* (L.) Pers.) were in-between.

Hazardous impact of beet interference on underground parts of weeds was more pronounced with dock weed followed by wild beet and lambsquarters, whereas tooth pick was the only non affected weed by sub-soil competition.

INTRODUCTION

Competition stress between crop plants and associated weeds is a critical factor affecting growth of field crops and their productivity. Accordingly, the deleterious reciprocal impacts between sugar beet plant associated weed species on growth of both and productivity of crop plant were important and interesting.

A lot of published papers threw the lights on the effect of weed interference on sugar beet, whereas few ones discussed the antagonistic impact of sugar beet interference on growth of weeds.

The competitive effect of crops and weeds on each other may depend on when and how fast each starts growing in relation to the other. The relative speed of germination, establishment at early growth are therefore important in determining the outcome of competition (Zimdahl 1993).

Weed species materiality differ in their tolerance to beet interference (Dawson 1965, Weatherspoon and Schweizer 1997 and Iotz *et al* 1992). Sugar beet competition delays maximum LAI for one month in *Amaranthus retroflexus* and reduced LAI but not growth rate in *Chenopodium album*. Therefore, sugar beet proved more competitive than *A. retroflexus* (Pozsgai 1988). In addition, Dawson (1965) pointed out that full-season competition from the beets reduced bermuda-grass yield 70% but lambsquarters only 13%.

The main target of this investigation was to detect the antagonistic effect of sugar beet interference on growth characteristics of its associated weed species.

MATERIALS AND METHODS

Two pot trials were conducted in Sugar Crops Research Institute, Giza Research Station, Agricultural Research Center in the two successive seasons of 1992/93 and 1993/94. Associated sugar beet weeds under investigation include: wild beet *"Beta vulgaris* L. dock weed "*Rumex dentatus* L."; Lambquarters "*Chenopodium murale* L. tooth pick" *Ammi majus* L."; canarygrass *"Phalaris minor* Retz"; bindweed *"Convolvulus arvensis* L. and bermuda-grass *"Cynodon dactylon* (L.) Pers". Suitable number of sugar beet and individual weed species seeds were sown on 15th November for the two seasons in pots 50 cm in diameter and 42 cm in height and filled with 20 kg/pot of loamy dry and clean soil. A commercial sugar beet variety viz "Ras Poly" was used in both seasons. One week after sugar beet emergence, crop and weeds were thinned for each pot to maintain one plant of sugar beet against five plants of each of the previous 7 weed species. Number of weeds/pot (0.2 m2) represent 1/4 of the normal density of weeds in unweeded plots of sugar beet fields of Sakha Research Station (Abd El-Aal 1995). Each experiment was consisted of 14 treatments which include the seven weed species accompaned with sugar beet and the seven treatments of weeds alone. Treatments were layed out in complete ran-

domized design in 9 replications.

Pots were watered as needed and fertilized with the recommended rate of nitrogen and potassium (70 kg N and 50 kg K2O/fed., respectively). Data recorded after 105, 135 and 180 days (at harvest) from planting (3 pots for each) on the following weed growth criteria: plant height (cm); no. of branches/plant ; no. of leaves/plant and fresh and dry weights of above and under ground parts (g.)/plant. Data weres statistically analyzed as described by Snedecor and Cochran (1967).

Calculated values of T at 0.05 were used to compare growth criteria measure ments of weeds with and without sugar beet. Combined analysis of the two seasons data were followed, since the same general trends of results were noticed.

RESULTS

1. Height and number of branches and leaves of weed plants:

Data presented in Table 1 indicate that sugar beet interference had no significant impact on height and number of branches/plant of associated weeds. These results were true after 105 and 180 day old and of bindweed at the three assessments. Sugar beet interference reduced number of branches of wild beet plant 105 and 180 days old than those free of crop by 49.5 and 22.6%, respectively. Reduction percentages in the same trait for bindweed at 105, 135 and 180 days old were 47.9, 61.4 and 51.7%, respectively. Meaningly, branching initiations in wild beet and bindweed plants were more seriously affected by shadding and other interference elements of sugar beet plant.

The significant effect of sugar beet interference on number of leaves per weed obvious. This finding was true at the two sampling periods and for all weed species except canarygrass. It is worthy to notice that most of leaves of all weed plants were enescenced and died at the third assessment (180 days from sowing) thereby, data of such sample were excluded. Sugar beet interference reduced significantly number of leaves/weed plant than those free of crop plant after 105 and 135 days by 29.8 and 59.3% for wild beet; 55.3 and 25.4% for lambsquarters; 31.6 and 32.7% for dock weed; 23.4 and 40.4% for tooth pick; 47.3 and 6.2% for bindweed and 26.3 and 54.9% for bermuda-grass, respectively. Apparently, bindweed followed by wild beet (135 days old) were the more damaged species in this respect. Senitivity of bindweed and wild beet to sugar beet interference reduced number of

Table 1. Effect of sugar beet plant interference on height (cm), number of branches and number of leaves of studied weeds. (Combined analysis of 1992/93 and 1993/94 experiments).

Growth characteristics	Days after sowing	Wild beet			Lambsquarters			Dock weed			Tooth pick			Canarygrass			Bindweed			Bermuda-grass		
		With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value
Plant height (cm)	105	38.8	41.7	N.S	30.5	36.8	N.S	30.0	36.5	N.S	23.5	30.0	N.S	38.5	41.8	N.S	20.8	22.2	N.S	23.5	26.5	N.S
	135	77.2	86.5	N.S	37.0	47.5	N.S	52.7	70.7	N.S	54.8	64.0	N.S	65.5	76.0	N.S	26.8	39.0	N.S	46.5	57.0	N.S
	180	82.2	93.0	N.S	39.0	52.0	N.S	56.5	75.2	N.S	60.0	71.5	N.S	71.3	79.5	N.S	37.3	45.8	N.S	49.0	67.5	N.S
Number of branches / plant	105	5.2	10.3	4.23	7.5	11.8	N.S	0.0	0.0	0.0	4.7	5.8	N.S	13.0	18.2	N.S	2.5	4.8	4.06	8.2	10.2	N.S
	135	10.8	13.5	N.S	9.8	12.5	N.S	9.3	11.0	N.S	5.5	8.0	N.S	15.0	19.7	N.S	2.7	7.0	4.24	14.2	17.3	N.S
	180	16.8	21.7	8.76	12.7	14.8	N.S	10.5	12.3	N.S	6.8	9.2	N.S	17.8	22.0	N.S	4.2	8.7	5.49	15.8	19.3	N.S
Number of leaves/plant	105	42.5	60.5	2.29	66.5	148.8	2.94	26.0	38.0	3.17	37.3	48.7	2.95	69.7	73.7	N.S	19.5	37.0	3.46	48.3	65.5	2.86
	135	118.5	454.8	5.97	185.8	249.0	3.54	153.5	228.0	4.53	151.0	253.5	3.47	96.3	113.2	N.S	27.5	74.8	5.62	290.2	643.0	4.74

branching and this inturn decreased the number of their leaves/plant.

2- Fresh and dry weights of vegetative parts:

Sugar beet interference decreased significantly fresh and dry weights of vegetative parts of associated weeds after 105, 135 and 180 days. This finding was true for all weed species under investigation except for canaryass at the three assessments, lambsquarters at the 3rd sample and tooth pick at the 2nd one (Table 2).

Fresh weight of vegetative parts of weeds after 105, 135 and 180 days from sowing was considerably greater for crop free pots than for those in which the weeds were subjected to normal competition from the sugar beet plant. Such increases amounted to 57.1, 111.2 and 267.3% for wild beet, 160.2, 102.4 and 25.3% for lambsquarters; 56.2, 102.7 and 62.9% for dock weed; 166.7, 26.3 and 55.8% for tooth pick; 154.5, 361.1 and 266.7% for bindweed and 59.5, 124.3 and 106.3% for bermuda-grass, respectively. In the same trend dry weights of foliage parts of weeds were reduced in presence of sugar beet interference than in those cropfree by 53.9, 69.1 and 67.5% for wild beet; 66.7, 38.9 and 25.6% for lambsquarters; 30.3, 50.7 and 39.9% for dock weed; 56.6, 36.8 and 27.3% for tooth pick; 61.4, 74.7 and 72.5% for bindweed and 47.9, 57.2 and 50.9% for bermudagrass after 105, 135 and 180 days from sowing, respectively. These results sustatined tht bindweed followed by wild beet were the more susceptible weeds to sugar beet interference whereas canarygrass was not significantly affected by such stress. The rest of weed species were in-between. Reduction in fresh and dry weights of vegetative parts of weeds herein could be attributed to the obvious reduction in the number of leaves and branches/plant of such weed species (Table 1).

3. Fresh and dry weights of underground parts:

Fresh and dry weights of underground parts of weeds were considerably lower under sugar beet interference condition than under crop-free one. These results were true for all weed species under investigation at the three assessments except for canarygrass and bermuda-grass at the 1st sample and tooth pick at the three assessmentst (Table 3).

Sugar beet interference decreased fresh weight of sub-soil parts of associated weeds than those of crop-free weeds after 105, 135 and 180 days from sowing by 32.8, 45.3 and 57.9% for wild beet; 58.3, 46.2 and 30.8% for lambsquarters; 63.5, 50.5 and 49.0% for dock weed; 28.3, 49.7 and 39.4% for canarygrass; 57.1,

64.0 and 15.2 for bindweed and 41.2, 44.0 and 32.9% for bermuda-grass, respectively. Finding values revealed that roots of dock weed followed by wild beet followed by wild beet and lambsquarters were the most sensitive weeds for sugar beet interference, whereas tooth pick was the only non affected weed by such competition.

It could concluded that under the conditions of the experiment, sugar- cane showed higher competitive abilities for the soybean and sorghum insicating that sugar- -cane could be considered a good components when intercropping with soybean or sorghum, in other words sugar-cane crop was dominant in the three intercropping patterns.

DISCUSSION

The forementioned results demonstrated that sugar beet exerted a drastic reduction in height, number of branches and number leaves and fresh and dry weights of shoot and root parts weed plant of existing weed species. However, the extent of reduction was mainly dependent on the neighbouring weed species. The hazardous impact of sugar beet interference on growth criteria of aerial parts (no. of branches and leaves and fresh and dry weights of shoots/plant) of weeds were more pronounced with bindweed followed by wild beet, whereas canarygrass was less sensitive in this regard. Meaningly, the fitness of shoot competition of sugar beet on bindweed is striking, whereas canarygrass can withstand competion of sugar beet without any significant reductions in its shoot growth.

On the other side the reduction in fresh and dry weights of roots were more pronounced with dock weed, wild beet and lambsquaretrs, whereas tooth pick root was not statistically harmed by such interference.

High sensitivity of aerial parts of bindweed to sugar beet interference could be attributed to the larger vigorosity of crop plant expressed in height and leaf area per sugar beet plant ability to intercept light is higher and have a competitive advantage for light bindweed. In this respect Lotz et al. (1991) suggested that competition for light is the main factor explaining the observed crop effects on the population dynamics of the weeds.

Accordingly a heavily shaded plants (bindweed) suffers reduced photosynthesis, leading to poor growth. On the contrary, growth criteria of vegatative parts of

Table 2. Effect of sugar beet plant interference on fresh and dry weights (g/plant) of vegetative parts of studied weeds.
[Combined analysis of 1992/93 and 1993/94 experiments].

Growth characteristics	Days after sowing	Wild beet			Lambsquarters			Dock weed			Tooth pick			Canarygrass			Bindweed			Bermuda-grass		
		With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value
Fresh weight (g/plant)	105	52.4	82.3	2.93	14.8	38.5	4.36	35.6	55.6	2.82	8.4	22.4	4.79	22.7	33.2	N.S	1.1	2.8	5.26	4.2	6.7	4.12
	135	84.2	177.8	4.55	25.4	51.4	5.43	86.6	175.5	6.21	21.7	27.4	N.S	53.4	81.9	N.S	1.8	8.3	6.71	20.2	45.3	4.3
	180	36.4	133.7	6.40	7.9	9.9	N.S	46.3	75.4	3.08	4.3	6.7	3.88	29.5	36.8	N.S	2.7	9.9	7.19	23.9	49.3	4.61
Dry weight (g/plant)	105	15.5	33.6	3.57	2.3	6.9	4.36	4.6	6.6	2.83	2.3	5.3	3.89	3.6	4.0	N.S	0.22	0.57	5.26	0.73	1.4	3.11
	135	29.1	94.2	4.52	4.4	7.2	5.15	20.9	42.4	3.07	3.6	5.7	N.S	20.5	24.4	N.S	0.48	1.9	6.71	5.9	13.8	4.29
	180	34.7	106.9	6.41	5.8	7.8	N.S	38.4	63.9	6.21	6.4	8.8	4.79	27.7	35.3	N.S	1.4	5.1	7.19	18.1	36.9	4.6

canarygrass was not materiality affected by sugar beet interference. Superiority of canarygrass in plant height, tillering, relative growth rate and aggressivity Zimdahl (1993) could be interpretate this findings.

Noticeable sensitivity of dock weed, lambsquarters and wild beet roots to sugar beet interference may be attributed to some advantages in rooting deepth, feeding diameter and feeding area per plant of sugar beet than weeds. In addition, similarity in root system between sugar beet and each of dock weed, lambsquartrs and wild beet as dicotyledonous tap root plants must be also considered. In this respect Muzik (1970) indicated that severe competition occurs if roots of crops and weeds are concentrated in the same soil areas. Confirmed results on the importance of root competition were reported by Wilson (1988) who found that in 33 out of 47 species interactions, root competition had a greater effect than shoot competition but, interestingly, the exceptions typically involved crop-weed interactions.

Results on the variation between weed species in their tolerance to crop interference are in close agreement with those reported by Dawson (1965); Black et al (1969); Weatherspoon and Schweizer (1971) and Lotz et al. (1991).

Competition impacts of crop interference on growth indices of certain weeds can be utilized in weed management programs. Sensitive weed species can easily suppressed by their neighbouring rotational competitive crops. Such method can be integrated with mechanical and chemical weed control methods to achieve a suitable and effective strategies for weed control in field crops.

Table 3. Effect of sugar beet plant interference on fresh and dry weights (g/plant) of underground parts of studied weeds. [Combined analysis of 1992/93 and 1993/94 experiments].

Growth characteristics	Days after sowing	Wild beet			Lambsquarters			Dock weed			Tooth pick			Canarygrass			Bindweed			Bermuda-grass		
		With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value	With sugar beet	Alone	T value
Fresh weight (g/plant)	105	8.2	12.2	3.01	1.0	2.4	3.73	2.7	7.5	4.02	1.1	1.6	N.S	5.6	7.1	N.S	0.2	0.4	3.28	0.4	0.5	N.S
	135	10.5	19.2	3.76	1.4	2.6	4.37	7.7	14.9	4.17	2.2	2.5	N.S	6.2	11.9	3.96	0.5	0.6	5.32	0.9	1.4	3.1
	180	11.5	27.3	4.7	0.9	1.3	3.54	4.5	9.6	4.07	1.6	1.9	N.S	4.3	7.0	2.74	2.2	2.6	5.7	1.6	2.1	5.39
Dry weight (g/plant)	105	1.9	2.8	2.51	0.27	0.55	2.74	0.62	1.7	4.32	0.22	0.32	N.S	1.65	2.3	N.S	0.03	0.07	3.59	0.1	0.17	N.S
	135	3.2	5.4	3.31	0.32	0.67	3.46	2.02	4.08	4.62	0.42	0.5	N.S	2.39	4.75	3.53	0.09	0.25	4.07	0.42	0.75	3.17
	180	8.6	18.9	4.63	0.53	0.85	4.86	2.92	5.72	5.18	1.05	1.27	N.S	3.74	6.17	4.51	0.95	1.12	4.24	0.86	1.13	3.76

REFERENCES

1. Abd El-Aal, A.M. 1995. Integrated weed control in sugar beet with relation to yield and quality. M.Sc. Thesis Fac. of Agric. Ain Shams Univ.

2. Black, C.C.; T.M. Chen and R.H. Brown. 1969. Biochemical basis for plant competition. Weed Sci. 17:338-344.

3. Dawson, J.H. 1965. Competition between irrigated sugar beets and annual weeds. Weeds 13:245-249.

4. Lotz, L.A.P; R.M.W. Groeneveld; B. Habekotte and H.Van Oene. 1991. Reduction of growth and reproduction of *Cyperus esculentus* by specific crops. Weed Res. 31 (3) 153-160.

5. Lotz, L.A.P; M.J. Kropff; B.Bos and J. Wallinga. 1992. Prediction of yield loss based on relative leaf cover of weeds. Weed Sci. Society of Victoria, 2:290-292.

6. Muzik, T.J. 1970. "Weed Biology and Control". Mc Grow-Hill Book Comp.p.p 60:62.

7. Pozsgai, J. 1988. Growth analysis of *Amaranthus retroflexus* L. and Chenopodium album L. in the presence of sugarbeet as a competitor plant. Ecologie et al Systematique des Mauvaises Herbes. Paris, France, A.N. P.P. vol. 2: 619-269. C.F. Weed Abst 30, 2108, 1990.

8. Snedecor, G.W. and W.G. Cochran. 1967. Statistical Methods. 6th Ed., Iowa State Univ Press, Ames., Iowa, USA.

9. Weatherspoon, D.M. and E.E. Schweizer. 1971. Competition between sugar beets and five densities of kochia. Weed Sci. 19 (2): 125-128.

10. Wilson, J.B. 1988. Shoot competition and root competition. J. of Applied Ecol. 25:279-296.

11. Zimdahl, R.L. 1993. "Fundamentals of Weed Science". Academic Pres. Inc. San DiegoBoston p:p 147:156.

تأثير تداخل بنجر السكر علي بعض صفات النمو لبعض الحشائش المصاحبة

محمد طاهر بهجت فايد[١]، إبراهيم حنفي الجداوي[٢]،
مها محمد الزيني[٢]

١ قسم المحاصيل - جامعة عين شمس - شبرا الخيمة - القاهرة - ج.م.ع.
٢ قسم المعاملات الزراعية - معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية.

أجريت تجربتي اصص بمعهد بحوث المحاصيل السكرية بالجيزة في موسمي ٩٢ / ٩٣ ، ٩٣ / ١٩٩٤ بهدف دراسة تأثير تداخل بنجر السكر (بكثافة نبات واحد من بنجر السكر : ٥ نباتات من الحشيشة) علي بعض صفات نمو الاجزاء الهوائية والارضية لسبعة أنواع من الحشائش شائعة الانتشار في حقول بنجر السكر في مصر.

أحدث تداخل بنجر السكر انخفاضا في قيم الارتفاع، عدد الاوراق، الوزن الغض والجاف للمجموع الخضري والمجموع الجذري لنباتات الحشائش تحت الدراسة بعد ١٠٥ ، ١٣٥ ، ١٨٠ يوم من الزراعة مقارنة بالحشائش المنزرعة منفردة دون بنجر السكر وارتبط مقدار هذا الانخفاض اساسا بنوع الحشيشة المصاحبة لبنجر السكر.

كما تأثر نمو المجموع الخضري لحشيشة العليق بشكل واضح عن غيره من الحشائش بمنافسة البنجر وتلتها حشيشة السلق حيث احدث تداخل بنجر السكر انخفاضا في قيم عدد الافرع، عدد الاوراق، الوزن الغض والوزن الجاف للمجموع الهوائي لحشيشة العليق بعد ١٣٥ يوم من الزراعة مقداره ، ٦١,٤ ٪، ٦٣,٢٪، ٧٨,٣٪، ٧٤,٧٪ علي الترتيب مقارنة بقيم هذه الصفات للحشيشة نفسها في غياب محصول البنجر، وعلي العكس من ذلك فقد قاومت حشيشة الفلارس منافسة بنجر السكر دون حدث أي نقص معنوي في قيم قياسات نمو اجزائها الهوائية علي حين توسطت بقية الحشائش تحت الدراسة وهي الحميض، الزربيج الخلة، النجيل في تأثرها بهذا التداخل.

ظهر تأثير ضرر التنافس الجذري لبنجر السكر علي نمو جذور انواع الحشائش المصاحبة بصورة أوضح علي حشيشة الحميض وتليها حشيشة السلق والزربيج بينما لم تتأثر جذور الخلة وحدها بهذا النوع من التنافس.