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Weed interference and control in sugar beet (*Beta vulgaris* L.)

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ABSTRACT:

Two filed experiments were carried out at Tamya Agricultural Research Station, Agricultural Research Center, El-Fayoum Governorate (Middle Egypt) in both successive winter growing seasons of 2016/17 and 2017/18 to determine the effect of some weed control treatments on yield, yield components, quality of sugar beet (and its associated weeds. The randomized complete blocks design with four replications was used in these experiments. The major weed species associated sugar beet crop in field experiments in both seasons were *Avena* spp., *Phalaris* spp. as annual grassy weeds, *Brassica nigra* L., *Chenopodium* sp., *Sonchus oleraceus* L., *Medicago polymorpha* L., *Melilotus indica* L., *Anagallus arvensis*, *Ammi majus* L., *Euphorbia helioscopia* and *Rumex dentatus* L. as annual broad-leaved weeds. All weed control treatments statistically significant reduced dry weight of weeds (g/m^2) in both seasons at 75 and 105 days after planting (DAP). Hand hoeing three times recorded the lowest value of dry weight of weeds in both seasons.

KEYWORDS: Weed, sugar beet, yield components, *Avena* spp., *Phalaris* spp.

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1.INTRODUCTION:

Sugar beet (*Beta vulgaris* L.) is considered as an important sugar crop in Egypt and it is considered the second crop after sugarcane for sugar production. It can be grown in northern regions of the country and in the new reclaimed area. Recently, the contribution of sugar beet to sugar production increased to reach about 48.1% of the total sugar production in 2019 season. Sugar beet is cultivated in Egypt 598 thousand fed. High yield and quality of sugar beet is the end product of many factors including weed control treatments.

Weed competition is considered one of the major obstacles in preventing the achievement of maximum sugar beet yield. Weeds not only compete with sugar beet for the necessary elements of growth such as light, water and nutrients, but also harbor insects and increase the incidence of diseases and harvest losses. **Mirshekari et al. (2010), r**eported that the decreased root yield of sugar beet from 75 t/ha to 58 t/ha when 16 redroot pigweed/m of row allowed to interfere for whole season, compared to weed free for whole season as well as increased sugar yield losses. **Odero *et al.* (2010),** found that the wild buckwheat had greater interference on sugar beet. It had a negative effect on root and sucrose yields of sugar beet this may be due to wild buckwheat strength competitive ability with sugar beet. The critical period of weed control under infestation by wild buckwheat was 32 and 48 days after sugar beet emergence DAE to avoid 5 and 10% root yield losses, respectively.

Chetin et al. (2008), showed that good control for *Salvia reflexa* in sugar beet with Betanal Expert OF [ethofumesate + desmedipham + phenmedipham] (1.7-2.1 l/ha.) + Caribo [triflusulfuron] (40-50 g/ha) + Lontrel Grand [clopyralid] (0-80 g/ha). **Deveikyte and Seibutis (2008),** recorded that all herbicide treatments (phenmedipham + desmedipham + ethofumesate, metamitron and triflusulfuron-methyl) gave more consistent control of *Chenopodium album* L., *Tripleurospermum perforatum* (Merat), *Polygonum aviculare* L. and *Thlaspi arvense* L. in sugar beet. **Olsson (2008),** concluded that in sugar beet using the normal dose (0.65 l/ha. Goltix [metamitron], 1.0 Betanal [desmedipham]) gives the best weed control without significant reduction in sugar yield. **Rapparini (2008),** cleared that Betaren Extra [desmedipham + phenmedipham + ethofumesate] proved to be a very wide spectrum herbicide, highly effective against annual dicotyledonous weeds, giving 95.1-95.8% control at doses of 3-4 liters/ha, a triple application (1 + 1 + 1 l/ha.) was particularly effective for weed control. **Jursik and Holec (2009),** stated that high efficacy on *Euphorbia helioscopia* can be reached by using herbicides with active ingredients quinmerac, triflusulfuron, and in early growth stages also desmedipham. **Zargar et al. (2010),** showed that times of mechanical control and

herbicides have the most reduction on density and weeds biomass of (*Chenopodium album* and *Amaranthusretroflexus*) best results were achieved in mechanical control at 4-6 leaves stage or using herbicide was Goltix + Betanal progress. **Abo El-Hassan Rasha (2010),** reported that weed control treatments significantly decreased the dry weight of weeds as compared with unweeded after 60 and 90 days from planting in both seasons. She added that decreasing the rate of Betanal Progress when applied twice at rate of (135 g a.i. / fed.) followed by Fusilade Super at (94.75 g a.i. / fed.) in tank mixed with vegetable oils showed good results on total annual weeds as compared to Betanal Progress when applied twice at rate of (135 g a.i. / fed.) followed by Fusilade Super to (94.75 g a.i./fed.) tank mixed with mineral oils in both seasons. **Abo El-Hassan Rasha (2010),** found that root length, root diameter, root weight, top fresh weight, top yield, root yield, sucrose percentage, sugar yield of sugar beet plant had significantly affected by weed control treatments in both growing seasons, where as T.S.S. % and purity % did not significantly affect by weed control treatments.

2.MATERIALS AND METHODS:

Two filed experiments were carried out at Tamya Agricultural Research Station, Agricultural Research Center, El-Fayoum Governorate (Middle Egypt) in both successive winter growing seasons of 2016/17 and 2017/18 to determine the effect of some weed control treatments on yield, yield components, quality of sugar beet and its associated weeds.

Weed control treatments were used as follows:

1. Control (without any weed control treatment).
2. Acetochlor(2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl) acetamide known commercially as Harness 84 % EC at the rate of 750 cm^3/fed. applied pre-planting.
3. Metamitron (4-amino- 4,5- dihydro -3- methyl -6-pheny l-1,2,4- triazin-5-one;4-amino-3-methyl-6-phenyl-1,2,4-triazin-5(4H)-one) known commercially as Goltix 70% SC at the rate of 1.5L /fad. applied post emergence (4 true leaves of sugar beet)
4. Harness 84 % EC at the rate of 750 cm^3/fed. applied pre-planting followed by Goltix 70% SC at the rate of 1.5L /fad. applied post emergence (4 true leaves of sugar beet)
5. Harness 84 % EC at the rate of 750 cm^3/fed. applied pre-planting followed by one hoeing after one month rom application
6. Goltix 70% SC at the rate of 1.5L /fad. applied post emergence (4 true leaves of sugar beet) followed by one hoeing after one month rom application
7. Hoeing three times at 4, 8 and 12 weeks from sowing.

The randomized complete block design with four replicates was used in these experiments. Plot area was 10.5 m^2 (1/400 fed.), include 5 rows and the row length was 3.5 m and wide 60 cm apart between the ridge.

Sugar beet cultivar "Kwamera" (*Beta vulgaris* L.) was sown on 15th and 20th of October in 2016/17 and 2017/18, respectively, on one ridge in

hill and 15 cm apart between the hills. Harvested on 14st and 17 th of May in 2016/17 and 2017/18, respectively. The preceding summer crop was maize (*Zea mays* L.) in both seasons.

Phosphorus fertilizer was added at land preparation with the rate of 31 kg/fed P_2O_5 in the form of calcium super phosphate (15.5% P_2O_5,) Nitrogen fertilizer was applied in the form of urea (46.5 % N) at rate of 80 kg N /fed, in two equal portions, the first dose before the first irrigation and the second dose before the second irrigation. Potassium was added with first of nitrogen dose at the rate of 50 kg K_2O/fed in the form of potassium sulfate (48% K_2O,) the other normal agricultural practices of sugar beet cultivation were done as recommended.

All herbicides treatments were sprayed with a knapsack sprayer equipped with one nozzle boom and the water volume was 200 L/fed.

Data recorded:

During the growing seasons, the following data were recorded:-

Effect of weed control treatments on weeds:

Weeds were hand pulled from one square meter chosen at random in each plot after 75 and 105 days After planting, identified and classified to annual broad and narrow leaved weeds to record the following traits:-

1- Dry weight of annual grassy weeds (g/m^2).

2- Dry weight of annual broad-leaved weeds (g/m^2).

3- Dry weight of total annual weeds (g/m^2).

Weeds were air-dried and then were oven dried at 70º C for 48 hr, until a constant weight was reached. Dry weight of weeds for each group (g/m^2) was recorded.

All data were statistically analyzed according to technique of analysis of variance (ANOVA) for the randomized complete block design with four replications as mentioned by **Gomez and Gomez (1984)** by means of "SAS" computer software package Duncan multiple range test was used for compare among treatment means **Duncan (1955).**

3.RESULTS AND DISCUSSION:

I. Effect of weed control treatments on weeds:

The major weed species associated sugar beet crop in field experiments in both seasons were *Avena* spp., *Phalaris* spp. as aaqnnual grassy weeds, *Brassica nigra* L., *Chenopodium* sp., *Sonchus oleraceus* L., *Medicago polymorpha* L., *Melilotus indica* L., *Anagallus arvensis*, *Ammi majus* L., *Euphorbia helioscopia* and *Rumex dentatus* L. as annual broad-leaved weeds.

1 – Dry weight of annual grassy weight (g/m^2):

Results in Table (1) reported that all weed control treatments significantly reduced dry weight of annual grassy weeds (g/m^2) in both seasons at 75 and 105 days after planting (DAP) than the control. Hand hoeing three times recorded the lowest value of dry weight of annual grassy weeds in both seasons and different surveys time (75 and 105 DAP), followed by Goltex plus one hoeing, Harnes plus one hoeing and Harnes followed by Goltex, however, the

highest value of dry weight of annual grassy weeds were resulted from unweeded check plots.

Reduction percentage in annual grassy weeds at 75 & 105 DAP due to the using of hand hoeing thrice, Goltex plus one hoeing, Harnes plus one hoeing, Harnes followed by Goltex and Goltix as will as Harnes were 98.5, 95.2; 96.3, 93.6; 94.6, 94.1; 92.3, 92.1; 67.2, 63.3 and 46.3, 35, respectively, in the first season. Whereas, in the second season the reduction percentages were 97.2, 94.5; 96.3, 93.5; 95.3, 89.2; 67.9, 63.3 and 9.8, 46., respectively, compared with unweeded check plots. Similar results recorded by **Gabibullaev (1996), Gonik and Val'ko (1996), Tyla and Petroviene (1996), Deveikyte (1997b), Tezuka *et al.* (1997) and Deveikyte (2005).**

Table. (1). Effect of weed control treatments on dry weight of annual grassy weeds (g/m^2) at 75 and 105 days after planting in 2016/17 and 2017/18 winter seasons.

Treatments	75 DAP(1)	% control	105 105DAP	% control
		2016/17		
Harness	204.6 b	**46.3**	459.2 b	**35.0**
Goltix	125.0 c	**67.2**	259.3 c	**63.3**
Harness followed by Goltix	29.4 d	**92.3**	55.8 d	**92.1**
Harness + one hoeing	20.6 d	**94.6**	41.9 e	**94.1**
Goltix+ one hoeing	14.1 e	**96.3**	45.5 e	**93.6**
Hoeing three times	5.7 f	**98.5**	33.9 f	**95.2**
Unweeded (control)	381 .0 a	**0.0**	706.5 a	**0.0**
		2017/18		
Harness	247.0 b	**35.2**	459.2 b	**51.6**
Goltix	157.9 c	**58.6**	259.3 c	**72.7**
Harness followed by Goltix	23.1 e	**93.9**	55.8 d	**94.1**
Harness + one hoeing	33.5 d	**91.2**	41.9 e	**95.6**
Goltix+ one hoeing	18.2 f	**95.2**	61.3 d	**93.5**
Hoeing three times	5.7 g	**98.5**	33.9 f	**96.4**
Unweeded (control)	381 .0 a	**0.0**	949.5 a	**0.0**

(1) DAP = Days After Planting

2 – **Dry weight of annual broad-leaved weeds (g/m^2):**

Results in Table (2) showed that the effect of weed control treatments on annual broad-leaved in sugar beet at 75 and 105 DAPS.

Results revealed that weed control treatments had a significant effect on dry weight of annual broad-leaved weeds (g/m^2) in both seasons at 75 and 105 DAP. In both seasons the lowest values of dry weight of annual broad-leaved weeds were obtained from hand hoeing thrice follow by Harness + one hoeing, Goltix+ one hoeing, Harness followed by Goltix, Harness alone and Golrtix alone.

The highest weed control percentage at 75 DAP, 98.1 & 97.2 was resulted from hand hoeing thrice thrice follow by Harness + one hoeing, Goltix+ one hoeing, Harness followed by Goltix, Harness alone and Golrtix alone compared with unweeded check. These results are in agreement with those obtained by **Gamuev et al. (1994), Yukhin and Absatrov (1996), Bosak and Janos (1997), Rapparini (1997), Montemurro et al. (1998), Chetin et al. (2008) and Abo El-Hassan, Rasha (2010).**

Table. (2). Effect of weed control treatments on dry weight of annual broad-leaved weeds (g/m^2) at 75 and 105 DAP in 2009/10 and 2010/11 winter seasons.

Treatments	75 DAP(1)	% control	105 DAP	% control
		2016/17		
Harness	269.3 c	**61.2**	670.7 c	**58.6**
Goltix	387.3 b	**44.2**	950.9 b	**41.3**
Harness followed by Goltix	261.6 c	**62.3**	526.5 d	**67.5**
Harness + one hoeing	111.7 e	**83.9**	320.8 f	**80.2**
Goltix+ one hoeing	138.1 d	**80.1**	383.9 e	**76.3**
Hoeing three times	13.2 f	**98.1**	35.6 g	i**97.8**
Unweeded (control)	694.0 a	**0.0**	1620.0 a	**0.0**
		2017/18		
Harness	216.1 b	**58.2**	717.2 b	**44.6**
Goltix	271.4 b	**47.5**	565.7 c	**56.3**
Harness followed by Goltix	177.8 d	**65.6**	287.4 d	**77.8**
Harness + one hoeing	96.2 c	fg**81.4**	264.1 e	**79.6**
Goltix+ one hoeing	111.2 c	**78.5**	402.6 f	**68.9**
Hoeing three times	14.5 e	**97.2**	52.0 g	**96.0**
Unweeded (control)	517.0 a	**0.0**	1294.5 a	**0.0**

3– Dry weight of total annual weeds (g/m^2):

Data in Table (3) showed that the effects of weed control treatments on total annual weeds.

Results clearly indicated that the dry weight of total annual weeds (g/m^2) significantly affected weed control treatments in both seasons at 75 and 105 DAP.

Hand hoeing three times recorded the lowest values of dry weight of total annual weeds at different surveys time (75 and 105 DAP) in both seasons followed by Goltix+ one hoeing, Harnees + one hoeing and Harness + Goltix .

The highest reduction percentages in total annual weeds at 75 & 105 DAP due to hand hoeing thrice follow by Harness + one hoeing, Goltix+ one hoeing, Harness followed by Goltix, Harness alone and Golrtix alone compared with unweeded check, respectively,

From the above results it could be concluded that adding one hoeing with Harness or Goltix as broad-leaved herbicides enhanced toxicity for total annual weeds, as will as, using two herbicides together which one for controlling annual broad-leaved and grass weeds and other for controlling annual broad-leaved weeds can be increasing effectiveness for control total annual weeds due to increased reduction in dry weight of annual broad-leaved weeds. These results are in agreement with the findings of **Deveikyte (1996), Deveikyte (1997a), Ievlev et al. (1997), El-Zouky (1998), Tyr et al. (1999), Farzin and Hossein (2004) and Deveikyte (2005).**

Sugar beet crop weak growth in the first stage and plants are weak to compete with weeds such as weed species which appear with the emergence of sugar beet **Deveikyte and Seibutis (2006)** and this requires the maintenance of the sugar beet crop free from weeds for at least four to six weeks after emergence as 55 - 60 days after sowing, so used one herbicide during the period of growing sugar beet did not enough for over come on weeds problems, so must be using two herbicides or herbicide with one or two hand hoeing for conducted high productivity.

Table (3): Effect of weed control treatments on dry weight of total annual weeds (g/m^2) at 75 and 105 days after planting in 2009/10 and 2010/11 winter seasons

Treatments	75 DAP(1)	% control	105 DAP	% control
		2016/17		
Harness	591.8 b	**44.9**	1410.1 b	**39.4**
Goltix	394.2 c	**63.3**	785.8 c	**66.2**
Harness followed by Goltix	282.2 d	**73.7**	726.5 d	**68.8**
Harness + one hoeing	152.2 e	**85.8**	417.8 e	**82.0**
Goltix+ one hoeing	141.1 f	**86.9**	362.7 f	**84.4**
Hoeing three times	18.9 g	**98.2**	81.1 g	**96.5**
Unweeded (control)	1075.0 a	**0.0**	2326.5 a	**0.0**
		2017/18		
Harness	518.4 b	**48.6**	1229.9 b	**45.2**
Goltix	335.8 c	**66.7**	751.1 c	**66.5**
Harness followed by Goltix	239.2 d	**76.3**	668.2 d	**70.2**
Harness + one hoeing	144.6 e	**84.7**	349.5 e	**84.4**
Goltix+ one hoeing	114.4 f	**88.7**	339.2 e	**84.9**
Hoeing three times	28.3 g	**97.2**	113.3 f	**95.0**
Unweeded (control)	1009.0 a	**0.0**	2244.0 a	**0.0**

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تداخل الأعشاب الضارة ومكافحتها في بنجر السكرBeta vulgaris(L)

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خالد عزام عبدالرحمن عزام باحث مساعد بمعهد بحوث المحاصيل السكرية- مركزالبحوث الزراعية

أجريت تجربتان حقليتان فى محطة البحوث الزراعية مركز البحوث الزراعية ،محافظة الفيوم فى موسمى الزراعة الشتوي المتتاليين ٢٠١٦ / ١٧ و ٢٠١٧/ ١٨ لتحديد تأثير بعض معاملات مكافحة الحشائش على المحصول ،مكونات المحصول ،جودة بنجر السكر(والحشائش المصاحبة له)،تم استخدام تصميم المربعات العشوائية الكاملة بأربعة مكررات في القطاعات لهذه التجارب ،وكانت أهم أنواع الحشائش المصاحبة لمحصول بنجر السكر فى التجارب الحقلية فى كلا الموسمين هى الزمير. ، الفلارس. كأعشاب ضيقة سنوية ، كبر.، الزربيح .، جعضيض.، النفل.، الحندقوق.، زغلنت(عين القط) ، الخلة.، أم لبن (لبن الحماره) ، الحميض. كأعشاب عريضة الأوراق سنوية، جميع معاملات مكافحة الحشائش ذات دلالة إحصائية أدت إلى إنخفاض الوزن الجاف للأعشاب (جم/م٢) فى كلا الموسمين بعد ٧٥ و ١٠٥ يوما بعد الزراعة وسجل العزق اليدوي ثلاث مرات أقل قيمة للوزن الجاف من الحشائش فى كلا الموسمين .