ENHANCEMENT THE BIOLOGICAL ACTIVITY OF SUGAR BEET POST EMERGENCE HERBICIDE BY SOME ADDITIVES.

Journal

J. Biol. Chem. Environ. Sci., 2010, Vol. 5(3): 367-384
www.acepsag.org

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ABSTRACT

The present work was conducted to develop a new approach namely micro-rates program of betanal progress herbicide used in sugar beets for weed control under field condition by tank added additives in binary mixture. Betanal used at three rate 1 Liter/ 4200 m^{-2} (half rate) and 1.5 liter/ Feddan or (3 quarters) from the full rate (2 Liter /4200 m^{-2}) plus seven additives for selective weed control in sugar beet (3-4 leaf stage) with split applications into 7-day intervals. *Chenopodium album* and *Emex spinosum* had chosen as domain weeds in sugar beet crop at Banger El-socar region, Borg El-Arab city, Egypt.

Betanal at 3 quarters from the full rate (1.5 Liter/4200 m^{-2}) plus nonyl phenyl polyethylene oxide and arabic gum mixture caused the highest reduction in *C. album* dry weight by 74.54 and 71.46% respectively. Otherwise, the highest reduction in *E. spinosum* dry weight was recording from adding betanal at 1.5 Liters/ 4200 m^{-2} to petroleum oil by (76.63%) than untreated control. The most potentiation effect was achieved from nonionic surfactant (nonyl phenyl polyethylene oxide) and petroleum oil mix with betanal at 1.5 liter/4200 m^{-2} followed with arabic gum. Nonionic surfactant followed with arabic gum and petroleum oil has been found to promote the performance of betanal than methylated vegetable oil. Slightly foliage distortion and chlorophyll content alteration on the sugar beet may occur following treatment with betanal and recovery after few weeks. Among the seven tested additives, arabic gum mixtures with betanal showed slightly decrease in sucrose percentage by (6.76%), compared with betanal at the recommended dose caused reduction in sucrose percentage by (14.23%), than the untreated control. The addition of additives to betanal reduced the necessary application rate to 1.5 liter/ 4200 m^{-2} to control sugar beet weeds, while adding such additives to 1 liter /4200 m^{-2} is not enough to sugar beet weed control.

Key words: Sugar beet, weeds, betanal, methylated seed oil, additives.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) growing area is nearly 7 million hectares in the world (Draycott, 2006). Sugar beet plants have advantage of growing in the newly reclaimed lands in Egypt including some saline and calcareous soil. The sugar beet cultivated area across Egypt about 248.308 thousand acres in 2007 -2008 season. The total production approximately 5,458 million tons, with productivity average is 21.98tons (Refat and Abdul Ghaffar, 2010). Sugar beet could not be grown economically without weed control because the rate of initial sugar beet growth is so very slow, that the crop is unable to compete effectively with weeds. Otherwise, controlling weeds is one of the most important practices to achieve the maximum sugar beet productivity. Weed control in sugar beet methods have been changing with the requirements of each time (Schweizer and May, 1993). Annually, one third of sugar beet production cost to weed control practices (Hatzios & Penner, 1985).On the other hand, methods of mechanical weed control, especially tractor hoes, were also developed. After several new types of tractor hoes were developed, trials were carried out to make their usage widespread (Miller and Fornstrom, 1989; Tugnoli *et al.,* 2002). Capanne *et al*., 1999).An enhanced herbicidal effect has been found with phenmedipham (Miller& Nalewaja, 1973). Application of phenmedipham alone was low efficiency on most of sugar beet weeds. Its lack of efficacy could be the consequence of the low foliar penetration of the active ingredient in the absence of additives (Serre *et al.,* 1993). Post emergence weed control is affected by environmental factors and additives (Hartzler & Foy, 1983; Hatzios & Penner, 1985). Adjuvants often increase herbicide efficacy by improving retention and absorption on the leaf (Hatzios & Penner, 1985). Urea, ammonium nitrate and crop oil concentrates (COC) are used for enhancing herbicide efficacy. Addition of a nonionic surfactant to the herbicides such as sulfonylurea herbicides often increases their efficacy. Addition of an adjuvant to the herbicide solution increases post emergence herbicide efficacy (Haet *et al*., 1992) and improves weed control. Phenmedipham applied alone did not kill *Galium aparine* even at the highest rates (162 g a.i. ha^{-1}). In contrast, addition of any alkyloleate to phenmedipham killed *Galium aparine* at 200-400 g a.i.ha^{-1} rates (Percival *et al.,* 1990). The use of adjuvants has become a useful tool for optimizing the efficacy of pesticides (Ruiter and de-Ruiter, 2002). Micro-rates system gives good results when all farming activities are carried out in accordance with conventional agricultural practice and in line with recommendations for split-reduced rates application (Woźnica *et al.* 2007; Domaradzki, 2007).

Objective of this study aimed to develop a new approach (micro-rates program) of betanal herbicides to control sugar beets weeds under the field condition by elucidating the enhancement effect of selected additives to increase the efficacy of betanal and its performance against sugar beet weeds for introduced to sugar beet farmers in new cultivated land.

MATERIALS AND METHODS

The field trials were conducted at Banger El-socar Region at Borg El-Arab City North Coast of Egypt through 2008, to evaluate the efficacy of betanal progress (phenmedipham plus desmedipham plus ethofumesate) 18% EC, supplied by Bayer Company with and without mixing with seven additives including nonionic, cationic surfactant, crop seed oil, petroleum oil (From KZ company) by 0.05% (v/v) and sticking agent by 0.5% (w/v), It were supplied from El-Gomhoria Medical Company. Application time was done at the 3-4 leaf stage from sugar beet age, with split application at 7-day intervals.

From the survey studies in sugar beet crop at Banger el soccer region, following weeds were found: *Chenopodium album, Emex spinosum, Convolvulus arvensis, Malva parvifoli, , Melilotus indicus, Medicago Hispida, Vicia sativa, Rumex dentatus,Cynodon dactylon, Setaria glauca, Phalaris minor*. Eleven weed species were recorded in sugar beet experimental field which *C. album* (lambs quarters) and *Emex spinosum* (neck) were the dominant weed species with density ranged from 3 to 4plants /m^{-2} approximately and chosen to evaluate betanal biological activity.

Physicochemical properties of spray tank were assessed on such as pH values: The solution (betanal additives mixtures) was shaked well to make homogeneous solution. The pH and (EC) value measured by pH/ISE meter, model 710A.), the EC measured in m mhos units. Viscosity: The cylinder was shaked well to make a homogeneous solution. A volume of 1ml water mixed with the treatment and taken to measure the viscosity of the solution. The viscosity measured by Brookfield programmable DV-11+Viscometer: 60RPM where m/ pouse are the unit of viscosity measurement (Anonymous, 1968). Surface tension: betanal adjuvant mixture solutions were shaking again to make a homogenous solution. A volume of about 10 ml were taken to measure the surface tension by droplet weight methods. Where dyne/cm is the unit of surface tension (Osipow 1964).

Field efficiency trials were conducted to compare the effect of herbicidal activity of betanal at 1 Liter/ Fadden= 4200 m^{-2} (½ or half rate) and 1.5 liter/ Fadden or (¾ or 3 quarter) from the full rate (2Liter / Fadden) plus seven additives in binary mixture against sugar beet weeds by the comparison with same rate without additives. Additives were added to the mixtures by 0.05 %(V/V) of the tank mixture except arabic gum at 0.5% (W/V) according to (Balah *et al*., 2006). Additives including three crop oil which methylated according to (Loury, 1967; Manthey *et al.,* 1989). Betanal mixtures were sprayed to the Sugar beet (Ras poly Var.) plants at their (3-4) leave stage. Weed fresh and dry weights were estimated after 3 weeks from the first application. Phytotoxicity of betanal and its additives were determined on sugar beet by measuring the change in chlorophyll content with chlorophyll meter after 3 weeks from the treatment and sucrose percentage were obtained after 150 days from sowing according to (Le Doce, 1972). Experimental design was a randomized complete block with three-herbicide concentrations and seven additives. Data were statistically analyzed by ANOVA, according to Snedecor and Cochran (1990) and treatment means were compared by LSD test at 5% level of probability.

RESULTS AND DISCUSSION

1- Physical and chemical properties of betanal-additives in their binary mixtures.

Data (Table.1) indicated that betanal at the full rate (2 liter/ 4200 m^{-2}) showed EC, pH, Viscosity and surface tension obtained values were 1.54 m mols /m (EC), 5.74 (pH), 12.21 cm/pouse (viscosity) and 57.92 dyn/cm (surface tension). The obtained value for betanal at 3 quarters rate alone from the full rate were 1.39 m mols /m (EC), 5.64 (pH), 12.43 cm/pouse (viscosity) and 59.28 dyn/cm (surface tension).The highest value of electric conductivity (EC) was recorded with mixing betanal with castor oil (1.61 m mols/m), while the EC values of the others mixtures ranged from (1.19 to 1.56 m mols /m). It was obviously to notice that betanal plus all the tested additives were characterized with acidic pH properties. The highest pH was recorded with betanal plus nonyl phenyl polyethylene oxide mixture (5.64), while the others mixtures, showed pH's ranged from (4.28 to 5.60). Data in the same table indicated that the highest viscosity values were recorded with the betanal herbicides plus arabic gum (12.43 cm/pouse), whereas the lowest value were found with betanal plus nonyl phenyl polyethylene oxide (9.81). The other additives mixture showed viscosity range from (11.26 to 10.25 cm/ pouse).

Concerning the surface tension shown in table 1; the highest value of this property with betanal mixtures was proved with arabic gum by (47.26) dyne/cm, However betanal mixture with surfactant nonyl phenyl polyethylene oxide caused the lowest values by (34.39 dyn/cm), the other additives showing almost approximate values of surface tension ranged from(34.94 to 46.09 dyn/cm).

As for the properties of betanal at half rate with additives in binary mixture. The obtained values for betanal at half rate were 1.38 m mols/m (EC), 5.56 (pH), 12.32 cm/pouse (viscosity) and 60.28 dyn/cm (surface tension).The highest electric conductivity (EC) was recorded with betanal-castor oil mixture (1.60 mmols/m), while the EC values of the others mixtures ranged from (1.19 to 1.54 m mols /m). The highest pH was recorded with betanal plus nonyl phenyl polyethylene oxide mixture by 5.68, while the others mixtures, showed pH's ranged from (4.35 to 5.53). Data in the same table indicated that the highest viscosity values were recorded with the mixtures of betanal plus the arabic gum (12.29 cm/pouse), however,

Table (1): Physical and chemical properties of betanal with and without additive.

Herbicide rate (liter/F*)	Treatments	Rate of additives	EC (m mols/m)	pH	Viscosity (cm/pouse)	Surface tension dyn/cm
Full rate (2 liter/F.)	Bet. at full rate alone		1.54±0.07	5.74±0.04	12.21±0.05	57.92±0.36
	Bet. at 3qarter rate alone		1.39±0.02	5.64±0.10	12.43±0.10	59.28±2.16
	Bet. + nonyl.	0.05% (v/v)	1.23±0.01	5.60±0.21	9.81±0.43	34.39±1.19
	Bet.+ cet.	0.05% (v/v)	1.19±0.04	5.45±0.09	9.89±0.26	34.94±2.61
	Bet. + methylated rape oil	0.5% (v/v)	1.51±0.05	4.36±0.27	10.89±0.58	43.46±0.66
	Bet. + methylated soybean soil	0.5% (v/v)	1.55±0.03	4.28±0.15	11.11±0.09	44.89±0.68
	Bet.+ methylated castors oil	0.5% (v/v)	1.61±0.07	3.35±0.16	11.26±0.09	46.09±1.38
3 quarters	Bet. + petroleum oil	0.5% (v/v)	1.33±0.10	5.28±0.10	10.25±0.16	37.72±1.45
(1.5 liter/F.)	Bet.+ arabic gum	0.5% (w/v)	1.56±0.02	5.48±0.12	12.14±0.30	47.26±0.62
	Bet. at half rate alone		1.38±0.03	5.56±0.07	12.32±0.09	60.28±2.70
	Bet. + nonyl.	0.05% (v/v)	1.21±0.06	5.68±0.12	9.47±0.47	33.72±2.31
	Bet. + cet.	0.05% (v/v)	1.18±0.08	5.53±0.12	9.73±0.19	34.61±1.52
	Bet. + methylated rape oil	0.5% (v/v)	1.51±0.07	4.35±0.28	11.05±0.27	36.13±2.08
Half	Bet. + methylated soybean oil	0.5% (v/v)	1.54±0.05	4.37±0.26	11.28±0.23	46.42±1.47
(1 liter/F.)	Bet. + methylated castors oil	0.5% (v/v)	1.60±0.08	3.36±0.22	11.13±0.10	46.42±1.47
	Bet. + petroleum oil	0.5% (v/v)	1.32±0.10	5.44±0.23	10.18±0.15	38.39±1.46
	Bet. + arabic gum	0.5% (w/v)	1.48±0.11	5.40±0.29	12.29±0.07	48.60±1.96
	LSD (0.05)		0.112	0.272	1.136	4.379

F: Fadden =4200 m^{-2} Bet: betanal Nonyl: nonyl phenyl polyethylene oxide

Cet. cetyl tri methyl benzene ammonium ±: slandered division the lowest value were found with nonyl phenyl polyethylene oxide (9.48). The other additive mixtures showed viscosity ranged from 11.28 to 9.73 cm/pouse. As for surface tension, the highest value of this property with mixing betanal with arabic gum (48.60) dyn/cm which the lowest value achieved from betanal mixture with surfactant nonyl phenyl polyethylene oxide by (33.72 dyn/cm), the other additives showed almost approximate values of surface tension ranged from (34.61 to 48.60 dyn/cm). Incorporation of surfactant increased the activity of betanal herbicide applied to sugar beet weeds with 0.05% conc. by means of others factor included reducing surface tension and contact area of spray drop on the leaf (Wyrill & brunside, 1977; Devendra *et al*., 2004).

2- Biological activity of betanal with and without additives on sugar beet weeds total biomass.

2.1. Response of lambs quarters *(C. album*) weeds total biomass.

The herbicidal activities of betanal appeared in *C. album* values of fresh and dry weights are shown in table 2. The reduction percent caused by betanal at 1.5 liter/ 4200 m^{-2} (Feddan) and the full rate 2.0 liter/ 4200 m^{-2} in dry weight of *C. album* weed, three weeks after treatment compared with the untreated reached (55.0 and 70.84%, respectively). The addition of all applied additives resulted in generally reduction in dry weight of *C. album* weeds after three weeks from the treatment than the untreated check. The highest reductions in dry weight recorded with betanal at 1.5 liter/ 4200 m^{-2} plus nonyl phenyl polyethylene oxide and arabic gum mixture showing (74.54 and 71.46% respectively).The second effect come with betanal plus petroleum oil, cetyl tri methyl benzene ammonium and rape seed oil decreased *C. album* dry weight by (69.12, 68.92 and 68.06% respectively). The lowest reduction occurred with betanal plus soybean oil and castor oil showed 66.68 and 67.89% respectively than the control. The control treatments used as a base line for comparison (100.0), the relative responses of herbicide additives mixture varied according to additives type. *C. album* dry weight, from betanal at 1 liter/ 4200 $m^{-2}$and full rate when used alone showed 54.43 and 70.84% respectively. The maximum decreasing effect in dry weight had recorded with betanal plus nonyl phenyl polyethylene oxide and petroleum oil mixture reached (63.027 and 60.84% respectively). A moderate reduction was with betanal plus arabic gum and castor oil by (59.14 and 59.09% respectively). The lowest reduction was occurred from betanal plus cetyl tri methyl benzene ammonium, soybean oil and rape seed oil by (58.23, 55.46 and 58.83% respectively), than untreated control, similar finding recoded by (De -Ruiter *et al.,* 1997; Manthey *et al.,* 1989).

2.2. Response of neck (*E. spinosum*) weeds total biomass.

Data in table (3) indicate that betanal concentration played considerable role the decreasing in *E. spinosum* dry weight was recording from betanal at 1.5 liters/ 4200 m^{-2} with petroleum oil mixture showing (76.63%). A moderate reduction had noticed from adding betanal to rape seed oil, soybean and castor oil by (73.59, 74.10 and 73.46 % respectively) as compared with the control. The lowest reduction occurred from betanal plus nonyl phenyl polyethylene, cetyl tri methyl ammonium and arabic gum by (69.08, 70.17 and 67.75% respectively) than untreated control.

Considering the applicability of using additives with betanal at 1 liter/ 4200 m^{-2} to control *E. spinosum* when used alone or in mixture with additives caused various rates of reduction according to the type of additives. Betanal at 1 liter/ 4200 m^{-2} and full rate caused reduction in dry weight of *E. spinosum* three weeks after treatment by (39.72 and 64.05% respectively), than the untreated. The addition of all applied additives resulted in general reduction of dry weight in *E. spinosum* weed three weeks after treatment than the untreated check. The highest reduction effect in dry weight had recorded with petroleum oil mixture with half rate of betanal, showing (53.73%). A fluctuated reduction was come with betanal plus nonyl phenyl polyethylene oxide and castor oil showing 50.14 and 48.69% reduction, respectively. The lowest relative reduction occurred with cetyl trimethyl benzene ammonium, rape seed oil, soybean oil, and arabic gum mixtures by (44.01, 44.36, 47.76and 45.88% respectively), than untreated control.In this respect, De-Ruiter *et al.,* 1997 indicate that the maximum increasing in betanal efficiency came from adding surfactant followed with sticking agent, and in the last the vegetative oil and petroleum oil. Rapeseed or emulsifier can serve as a substitute for mineral oil on enhancement the efficiency of betanal.

Table (2): Effect of betanal with and without additives on *C. album* weeds total biomass.

Herbicide Rate (liter/F.*)	Treatments	Rate of additives	Fresh weight			Dry weight		
			Means gm/ m^2	(+/-) D. % than the full rate	(+/-)D.% than the low rate	Means gm/ m^2	(+/-) D.% than the full rate	(+/-) D.% than the low rate
	Control		514.71±13.3			58.57±1.07		
Full rate (2 liter/F.)	Bet. at full rate alone		154.13±11.3	0.00	15.07	17.08±1.09	0.00	35.20
3 quarters (1.5 liter/F.)	Bet. at 3 quarter rate alone		188.14±4.51	-22.06	0.00	26.36±1.04	-54.31	0.00
	Bet. + nonyl.	0.05% (v/v)	126.24±0.94	18.09	30.43	14.91±0.71	12.70	43.42
	Bet.+ cet.	0.05% (v/v)	149.71±6.85	2.87	17.50	18.20±1.0	-6.57	30.94
	Bet. + methylated rape oil	0.5% (v/v)	174.80±11.34	-13.41	3.68	19.52±.058	-14.27	25.94
	Bet. + methylated soybean soil	0.5% (v/v)	138.91±1.64	9.88	23.45	18.81±1.70	-10.13	28.63
	Bet.+ methylated castors oil	0.5% (v/v)	141.38±4.30	8.27	22.09	18.71±1.65	-9.54	29.02
	Bet. + petroleum oil	0.5% (v/v)	159.24±8.61	-3.32	12.25	18.08±0.92	-5.88	31.38
	Bet.+ arabic gum	0.5% (w/v)	129.05±1.91	16.28	28.89	16.72±0.60	2.12	36.57
Half (1 liter/F.)	Bet. at half rate alone		201.81±4.42	-30.93	0.00	26.69±0.67	-56.26	0.00
	Bet. + nonyl.	0.05% (v/v)	148.3±1.09	3.80	26.52	21.66±1.21	-26.79	18.86
	Bet. + cet.	0.05% (v/v)	152.7±6.86	0.96	24.36	24.46±0.60	-43.24	8.33
	Bet. + methylated rape oil	0.5% (v/v)	154.3±6.13	-0.11	23.54	24.11±1.21	-41.18	9.65
	Bet. + methylated soybean oil	0.5% (v/v)	154.2±12.02	-0.01	23.61	26.07±1.03	-52.63	2.32
	Bet. + methylated castors oil	0.5% (v/v)	158.3±4.85	-2.72	21.55	23.96±0.69	-40.29	10.22
	Bet. + petroleum oil	0.5% (v/v)	154.5±2.87	-0.22	23.46	22.94±0.20	-34.28	14.06
	Bet. + arabic gum	0.5% (w/v)	148.4±1.11	3.74	26.48	23.93±1.64	-40.10	10.34
	LSD (0.05)		18.967			4.234		

(+/-) D. % than the full rate = differences percentage than the full rate

(+/-) D. % than the low rate=differences percentage than the half and 3 quarters from the full rate

Table (3): Effect of betanal with and without additives mixtures on *E. spinosum* total biomass.

Herbicide Rate (liter/F.*)	Treatments	Rate of additives	Fresh weight			Dry weight		
			Means gm/ m^2	(+/-) D. % than the full rate	(+/_)D.% than the low rate	Means gm/ m^2	(+/-) D. than the full rate	(+/-) D. than the low rate
	Control		88.97±2.20			18.57±1.35		
Full rate (2 liter/F.)	Bet. at full rate alone		19.80±1.07	0.00	44.17	6.68±0.43	0.00	26.28
3 quarters (1.5 liter/F.)	Bet. at 3qarter rate alone		35.47±2.45	-79.12	0.00	9.06±1.06	-35.66	0.00
	Bet. + nonyl.	0.05% (v/v)	16.91±1.56	14.59	52.32	5.74±0.36	14.02	36.62
	Bet.+ cet.	0.05% (v/v)	17.71±1.44	10.54	50.06	5.54±0.27	17.06	38.86
	Bet. + methylated rape oil	0.5% (v/v)	18.47±0.56	6.73	47.93	4.90±0.09	26.57	45.87
	Bet. + methylated soybean soil	0.5% (v/v)	19.24±1.05	2.81	45.74	4.81±0.03	28.00	46.92
	Bet.+ methylated castors oil	0.5% (v/v)	20.71±1.69	-4.61	41.60	4.93±0.23	26.21	45.61
	Bet. + petroleum oil	0.5% (v/v)	26.91±1.48	-35.91	24.12	4.34±0.15	35.03	52.10
	Bet.+ arabic gum	0.5% (w/v)	19.05±0.74	3.81	46.30	5.99±0.28	10.33	33.90
Half (1 liter/F.)	Bet. at half rate alone		63.14±2.29	-218.89	0.00	11.38±0.57	37.68	0.00
	Bet. + nonyl.	0.05% (v/v)	61.28±9.96	-209.49	2.95	9.43±0.14	21.49	-25.98
	Bet. + cet.	0.05% (v/v)	60.78±5.60	-206.95	3.74	10.40±0.83	29.54	-13.07
	Bet. + methylated rape oil	0.5% (v/v)	45.14±4.05	-127.98	28.51	10.33±0.55	29.01	-13.92
	Bet. + methylated soybean oil	0.5% (v/v)	48.53±7.93	-145.09	23.14	9.70±0.44	23.77	-22.32
	Bet. + methylated castors oil	0.5% (v/v)	49.74±5.05	-151.19	21.23	10.81±0.50	32.97	-7.56
	Bet. + petroleum oil	0.5% (v/v)	55.61±6.46	-180.87	11.92	8.59±0.05	14.56	-37.10
	Bet. + arabic gum	0.5% (w/v)	49.74±5.05	-151.19	21.23	10.05±0.45	26.67	-17.68
	LSD (0.05)		12.698			3.325		

3-Effect on leaves chlorophyll and tuber sucrose contents of sugar beet plant.

It is interesting to note the changes in chlorophyll content and sucrose % in sugar beet after treatment with betanal herbicides alone or with its mixtures. Data in table (4) clearly indicate that the untreated leaves were contained chlorophyll amount (37.84) by SPAD units in average, while treated leaves by betanal at full and 3qarters rate were 22.93 and 27.59 units, respectively. Betanal herbicides plus additives mixture caused differences in chlorophyll content ranged from 32.8 to 24.58 units. The highest reduction in chlorophyll content recorded with betanal plus nonyl phenyl polyethylene oxide mixture (35.05%), followed by its the mixtures with rape seed oil (34.51%), castor oil (30.40%), petroleum oil (30.35%), soybean oil (27.08 %) and cetyl tri methyl ammonium chloride (27.04%). However, the lowest reduction achieved from betanal plus arabic gum in sugar beet total chlorophyll by 13.14%, than untreated control. Based on the chlorophyll content, data in the same table showed that betanal alone at full and half rate caused reduction in chlorophyll content ranged from 6.11 to 31.68 % than the control. The reduction occurred with herbicide-additives mixture in chlorophyll content with betanal at half rate plus nonyl phenyl polyethylene oxide mixture (22.72%), followed by the mixtures with soybean seed oil (24.39%), castor oil (23.36%), petroleum oil (19.77%), rape seed oil (16.02 %) and cetyl tri methyl ammonium chloride (15.43%). However the lowest reduction comes with mixture arabic gum in sugar beet total chlorophyll by (11.38%), than untreated control.

From the previous data, betanal alone or with the tested additives caused slightly decrease in chlorophyll content 3 weeks after treatment. This may be explained by the deleterious role of this herbicide and its mixtures with tested additives on photosynthesis process. Addition of surfactant to betanal had some side effect on sugar beet after treatment with 3-4 days and the plants was recovered again, otherwise others additives slightly have some effect on sugar beet leaves. Concerning total sucrose % in sugar beet tubers in relation to herbicide treatment, the detection of sucrose% in normal untreated control after 150 days from sowing reached 16.94%, as shown in table 4. betanal when used alone caused the greatest reduction percentage in sucrose% i.e. 14.23 and 5.67% respectively with full and 3 quarters rate of betanal. In this study betanal with additive decreased sucrose

Table (4): Effect of betanal and its additives mixtures on chlorophyll content and sucrose percents in sugar beet.

Herbicide rate (liter/F.*)	Treatments	Rate of additives	Chlorophyll after 3 weeks.			Sucrose % after 150 from sowing days		
			Means	(+/-) D. than the full rate	(+/-) D. than the low rate	Means	(+/-) D. than the full rate	(+/-) D. than the low rate
	Control		37.84±1.69			16.94±0.91		
Full rate (2 liter/F.)	Bet. at full rate alone		22.93±1.51	0.00	16.91	14.53±0.37	0.00	-150.8
3 quarters (1.5 liter/F.)	Bet. at 3qarter rate alone		27.59±0.87	-20.35	0.00	15.98±0.66	-9.98	0.00
	Bet. + nonyl.	0.05% (v/v)	24.58±0.92	-7.20	10.93	15.37±0.40	-5.82	-62.96
	Bet.+ cet.	0.05% (v/v)	27.67±0.57	-20.67	-0.27	15.76±0.23	-8.52	-22.10
	Bet. + methylated rape oil	0.5% (v/v)	24.78±0.30	-8.10	10.18	15.43±0.56	-6.23	-56.78
	Bet. + methylated soybean soil	0.5% (v/v)	27.61±0.87	-20.43	-0.06	15.48±0.44	-6.57	-51.58
	Bet.+ methylated castors oil	0.5% (v/v)	26.34±1.72	-14.87	4.55	15.53±0.08	-6.89	-46.72
	Bet. + petroleum oil	0.5% (v/v)	26.36±1.02	-14.97	4.48	15.42±0.40	-6.13	-58.17
	Bet.+ arabic gum	0.5% (w/v)	32.87±1.37	-43.36	-19.12	15.79±0.30	-8.72	-19.11
Half (1 liter/F.)	Bet. at half rate alone		35.26±2.46	-36.38	0.00	16.15±0.65	-11.18	0.00
	Bet. + nonyl..	0.05% (v/v)	29.24±0.60	-13.12	17.06	15.66±0.10	-7.81	3.03
	Bet. + cet.	0.05% (v/v)	32.00±1.79	-23.78	9.25	15.98±0.21	-10.01	1.05
	Bet. + methylated rape oil	0.5% (v/v)	31.78±0.29	-22.92	9.88	15.89±0.40	-9.42	1.59
	Bet. + methylated soybean oil	0.5% (v/v)	28.61±1.15	-10.67	18.86	15.96±0.27	-9.85	1.20
	Bet. + methylated castors oil	0.5% (v/v)	29.00±0.89	-12.18	17.75	15.86±0.40	-9.16	1.82
	Bet. + petroleum oil	0.5% (v/v)	30.36±0.93	-17.42	13.90	15.60±0.10	-7.42	3.38
	Bet. + arabic gum	0.5% (w/v)	33.54±1.15	-29.71	4.89	16.36±0.21	-12.62	-1.29
	LSD (0.05)		4.342			0.693		

content ranged from 9.25% to 6.76%, than the untreated check. Among the seven tested additives, arabic gum mixtures with betanal showed slight decrease in sucrose content by (6.76%) than untreated control. As for total sucrose %, betanal at half rate alone showing reduction estimated by (4.64%) than untreated control. The reduction percentage was ranged from (7.87 to 5.65%). The lowest reduction achieved from arabic gum mixtures with betanal at half rate in sucrose content by (3.41%) than untreated control. From the above results, split application usually increases weed control and reduces injury to sugar beet, whereas the combination of betanal mixed with additives improve control of *E. spinosum* and *C. album.*

The above result indicated that treating with betanal alone produced significantly lower sugar percentage, however betanal at low concentration slightly affect sugar percentage, although there was no significant difference among herbicide–additives as compared to the control (Campagna *et al*., 2000; Kaya and Buzluk, 2006). The effect of herbicide treatments on sugar beet root yield, gross sugar yield, and white sugar yield was significant (Birgani *et al.,* 2006). In the presence of additives mixture with betanal, the efficiency varied depending on the type of additives and the concentration, however the controlling factor was still betanal rate.

Addition of surfactant to betanal spray tank expected to improve the uptake in weed leaves, and the retention of sprays by sticking agent. On the other hand the types of surfactant and oil used have varied effect in betanal activity. There is a correlation between increasing herbicidal efficiency and decreasing the surface tension of mixture with surfactant solution. It is necessary to optimize the ratio of droplet in the leaves and the penetration from leaves cuticle to achieve good spray retention and good uptake at the same time (De-Ruiter *et al.,* 1997), however, increased herbicide absorption does not always correlate with increased efficacy (Starke *et al*., 1996). Bukovac *et al*., 1990 showed the importance of physicochemical properties of herbicides in cuticle penetration, so alkyl oleate improved the efficacy of phenmedipham. Butyl and octyl oleates appeared to be most effective as suggested by (Briggs and Bromilow., 1994).

Crop seed oil improve phenmedipham activity but less than surfactant when it added to spray tank. Vegetables oil is not phytotoxic per se and is readily metabolized by soil microorganism, (Cornish *et al*., 1993). The usage of low-dose herbicide twice or more not only increases their effectiveness on weeds but also decreases the amounts of their residues in soils (Eronen and Mutanen, 2000). The effect of petroleum oils generally, increased phenmedipham herbicide activity more than crop seed oil De -Ruiter *et al.*,1997 ; Manthey *et al*.,1989). Changes in herbicide application system, especially the micro-rates program used allowed reducing the herbicide dose with no efficacy loss (Kucharski*,* 2009*)*. At the current application rates, the cost would probably be lowest for effective management of both these weeds through reducing the recommended dose to 3 quarters from betanal full rate.

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زيادة الكفاءة البيولوجية لمبيد حشائش بنجر السكر المستخدم بعد الانبثاق بواسطة بعض المواد الإضافية

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استهدفت الدراسة تطوير معدل منخفض للمبيد العشبي البيتانال بروجرس المستخدم لمكافحة حشائش بنجر السكر حقليا بواسطة سبعة من مواد الإضافية فى مخاليط ثنائية لتنك الرش وذلك باستحداث معدلين منخفضين من المبيد وهو(1.5 لتر \ ف و 1.0 لتر|ف) وخلطهم بالمواد الإضافية التي استخدمت بمعدل (0.05%) لسائل الرش(المواد ذات النشاط السطحي والزيوت النباتية و البترولية) و(5. 0%) (المادة اللاصقة) ومقارنتهم بالمعدل الموصى بة (2 لتر|ف) بدون مواد إضافية بينما تم التقييم الحقلي في مرحلة 3الى4 ورقات من عمر محصول بنجر السكر على مرتين بينهم 7 أيام وتم تسجيل النتائج على أكثر الحشائش العريضة سيادة (الزربيح ودرس العجوزة) في منطقة زراعة بنجر السكر(برج العرب ،مصر).أظهرت النتائج إن أعلى انخفاض في الوزن الجاف للزربيح سببه خلط البيتانال (1.5 لتر \ ف) مع نونيل فنيل بولى ايثلين اوكسيد(مادة نشطة سطحيا) ثم مع الصمغ العربى (مادة لاصقة) حوالي 74.45 و71.36 % على التوالي بالمقارنة بالكنترول،بينما أعلى انخفاض فى الوزن الجاف لدرس العجوزة انتجة خلط البيتانال (1.5 لتر \ ف) مع الزيت البترولي حوالي (76.63%) عن المقارنة . تم تقدير أعلى نقص في نسبة السكر سببه خلط المبيد بتركيز(1.5 لتر \ف) مع الصمغ العربي (6.76 %) تقريبا ،بينما بلغ مع المبيد على المعدل الموصى بة بدون مواد إضافية (14.23%) بالمقارنة بمعاملة الكنترول.كما كان لجميع معاملات المبيد تأثير طفيف على المحتوى الكلوروفيلى ثم انتهى بعد فترة قصيرة من المعاملة. أظهرت النتائج ان أكثر المواد تنشيطا لمبيد البيتانال هي المواد ذات النشاط السطحي ثم الزيت البترولي و المادة اللاصقة بالاضافه لتركيز(1.5 لتر \ ف)،بينما استخدام البيتانال بتركيز (1.0 لتر/ ف) مع المواد الإضافية غير كافي لمكافحة حشائش بنجر السكر.