

Evaluation of Certain Adjuvants to Enhance Pesticides Efficacy Against The Cotton Leafworm, *Spodoptera littoralis*

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ABSTRACT: Non-ionic polyoxyethylene glycol (PEG) oleate or/and laurate surfactants manufactured in Egypt, as well as a foreign wetting agent; ethoxylated octylphenol (Extravon[®]) were tested at a concentration range of 0.25%- 1.0% for their physical properties alone and/or in combinations with certain pesticides formulations namely, Halothrine-N[®] 5% EC (lambda-cyhalothrin), Vertimec[®] 1.8% EC (abamectin), Pasha[®] 1.9% EC (emamectin benzoate), Radical[®] 0.5 %EC (emamectin benzoate), Confidate[®] 35% SC (imidaclopride) and Vydate[®] 24 %SL (Oxamyl), at their recommended field rates in Egypt.

The obtained results indicated that PEG 200 di-laurate, PEG 200 Mono-oleate and Top film[®] were capable to give stable milky emulsion in water where hydrophilic-lipophilic balance (HLB) values were in the range of 8-11. On the other hand, PEG 600 di-oleate and 600 dilaurate substances can gave stable milky dispersion where HLB values were also in the range of 9-11. However, HLB values for both butyl diglycol surfactants were in the range of 10-12, while HLB value of Extravon[®] (as a wetting agent) was more than 12. These adjuvants can give translucent to clear solutions. The evaluated adjuvants highly reduced the surface tension of water from 72.80 dyne/cm to a range of 32.27-50.93 dyne/cm without showing any undesirable properties indicating that these adjuvants are promising to improve the absorption and adhesion of pesticides under field application. The pH values for PEG 200 di-laurate, PEG 200 mono-oleate, PEG 600 di-oleate, PEG 200 di-oleate, PEG 600 di-laurate, Top film[®], Extravon[®] and butyl diglycol were 6.34, 6.70, 6.90, 6.52, 5.09, 7.27, 6.64 and 4.08, respectively. Moreover, the adjuvants lowered the surface tension of used pesticides at the tested recommended field rate to be in a range of 28.89-59.49 dyne/cm and lowered the pH to a range of 3.57-7.31. It was noticed that the addition of the evaluated adjuvants increased the residual toxicity of the formulated pesticides. The efficacy of Lambda-cyhalothrin increased when it was mixed with evaluated at its recommended rate with the evaluated adjuvants against the cotton leaf worm *Spodoptera littoralis*.

Keywords: adjuvant, pesticides, PEG, cotton leafworm, *Spodoptera littoralis*, hydrophilic-lipophilic balance

INTRODUCTION

The adjuvants have an important role in formulating the agricultural pesticides. Some of these adjuvants include surface-active and wetting agents. An adjuvant is a compound or a mixture of compounds which, when blended with pesticide active ingredients (as formulation components) improve a number of objectives. These adjuvants are added to pesticides to enhance the performance or handling of those pesticides (Foy, 1989 and Bohmont, 1990) and reduce the interfacial tension of water of hardly wettable plants, improving the absorption and adhesion of sprayable pesticides. They also help the pesticide to work better and enhance its activity through increasing the pesticide foliar penetration. Caux et al. (1988) stated that 30 to 40 of toxic effects which cannot be attributed to the known effects of the pesticides may be due to the action of adjuvants. Also, these adjuvants reduce evaporation and drift of pesticides when sprayed on crop and they may increase the efficacy of deposition and plant uptake. On the other side, because the non-ionic surface active agents as emulsifiers are uncharged hydrophilic head group, they will be unaffected by ions that may present in the used diluting water in preparing the

various formulations of pesticides during spray dilution. These ions can adversely affect the properties and efficiency of these pesticides. Moreover, surfactants and other adjuvants were found to enhance the biological performance of the pesticides (Foy and Pritchard, 1996; Knowles, 1998; EL-Moslhey, 2006 and EL-Shahaat et al., 2010).

The present investigation is carried out to evaluate certain combined adjuvants with five pesticides formulations (Halothrin-N® 5% EC, Vertimec® 1.8% EC, Pasha® 1.9% EC, Confidate® 35%SC and Vydate® 24 %SL). The physical properties of such combinations were determined under laboratory conditions. The efficacy of the pesticides and /or adjuvants-pesticides combinations against the cotton leafworm was evaluated at certain intervals after field spray.

MATERIALS AND METHODS

1) Adjuvants

- a. Polyoxyethylene glycol (PEG) of laurate or/and oleate and butyl diglycol were tested as non-ionic surfactants and they are produced by the Egyptian Company for Starch, Yeast and Detergents, Alex, Egypt.
- b. Top Film® as an emulsifier (chemical composition is unknown) is produced by El-Help Company for Agrochemicals, Egypt.
- c. Ethoxylated octylphenol (Extravon®) as a wetting agent is produced by Ciba-Geigy Co. (Switzerland).

2) Pesticides

- a. Lambda-cyhalothrin was used as a Halothrin-N® 5% EC.
- b. Emamectin benzoate was used as Pasha®s 1.9% EC and Radical® 0.5 %EC.
- c. Imidaclopride a compound related to new nicotinoid pesticides was used as Confidate® 35%SC.
- d. Abamectin is a compound related to natural chemical origin was used as Vertimec® 1.8% EC.
- e. Oxamyl related to carbomoyl oxime carbamates was used as Vydate® 24.

3) Physical properties of the tested adjuvants alone and /or combined with pesticide formulations

- a. Hydrophilic-Lipophilic Balance (HLB): it is determined using 5g of each adjuvant with 95ml water as described by Griffin (1954).
- b. Surface tension value (dyne/cm) is determined in series of concentrations of 0.25, 0.50, 0.75 and 1 ml for each adjuvant by Traub Stalгамometer method in aqueous dilution for each surfactant.
- c. pH values were determined for each dilution using pH meter .
- d. The density (g/ml) is determined for series of concentrations of each of tested adjuvants, pesticides and surfactants-pesticides combinations.

4) Field evaluation against cotton leaf worm

The pesticides were sprayed at their recommended rates; and at the rate of 0.75 of the recommended rates and mixed either with PEG 600 di-oleate or 600 di-laurate. The rate of the mixed adjuvant in tank is 0.25% of the final spray

volume. This experiment was carried out to evaluate the efficacy of the tested pesticides alone or/and their combination with adjuvants by feeding 4th instare larvae of the cotton leafworm on castor leaves that have been sprayed with these pesticides or/and their combinations. The leaves were picked and offered to larvae after 1,3,5,7,9,11,13,15 days from spraying to feed on and to investigate the efficiency of the residual effect of tested pesticides alone or their mixtures with each of the evaluated non-ionic surfactants (PEG 600 di-oleate and 600 di-laurate). The mortality percentages were estimated and corrected according to Abbot's formula (1925).

RESULTS AND DISCUSSION

a- The Physico-chemical properties of the adjuvants alone

The results of the Hydrophilic-Lipophilic Balance (HLB) values shown in Table (1) indicated that polyoxyethylene glycol (PEG) 200 di-laurate and 200 mono-lolieate surfactants can gave milky dispersion after vigorous agitation when added to water. Their HLB values were ranged from 6 to 8. Also, PEG 600 di-oleate and 600 di-laurate substances can give stable milky dispersion where their HLB values were higher and ranged between 9 and 11. However, the HLB values for PEG 200 di-oleate were lower showing a rather decreased range of 1-4 with no dispersibility in water. The HLB values for both butyl diglycol (10-12) and Extravon[®] as wetting agent (more than 12) were high which means that these adjuvants can give from translucent to clear solutions. These observations indicate that the evaluated adjuvants are promising to improve the O/W emulsion type without undesirable properties at the tested concentrations (0.25, 0.50, 0.75 and 1.00%) in water. These adjuvant highly decreased the surface tension of water (72.8 dyne/ cm) to a low range of 32.27– 50.93 dyne/cm at 1.00% concentration without either refused foaming or micelle formation where it is well known that the critical micelle concentration (CMC) is the point maximum surface activity after which the surfactant tends to coagulate in micelle (Osipow, 1964). Also, each of PEG 200 di-laurate, PEG 200 monol-lolate, PEG 600 di-oleate, PEG 200 di-oleate, PEG 600 di-laurate, Top film[®], Extravon[®] and butyl diglycol surfactants decreased the surface tension up to the ranges 49.02-40.14, 41.28-40.94, 54.28-50.93, 40.17-33.66, 43.81-37.87, 40.59-32.27, 46.04-38.29 and 59.02-49.97, respectively. The ability of the adjuvant to reduce the surface tension of water means that these substances are adequate to increase the surface activity of the oil/ water emulsion, and hence they will improve the absorption adhesion of pesticides, reduce evaporation and increase deposits of the pesticides emulsifiable concentrate (EC) on the plant surfaces after the field application. These explanations are agreed with that reported by Green (1958), Osipow (1964) and Knowles (1998).

b- Physico-chemical properties of the pesticides alone

The demonstrated data in Table (2) show that the estimated surface tension values of the tested pesticides (Halothrin-N[®], Pasha[®], Radical[®], Confidate[®], Vertimec[®] and Vydate[®]) at the field rate were 40.50, 52.43, 50.80, 56.31, 59.59, and 60.67, respectively, and show the pH values of 7.64, 7.52, 7.55, 7.46, 7.64 and 6.70 respectively. The densities of these pesticides were 0.81, 0.86, 0.73, 0.89, 0.98 and 0.89 g/ml, respectively.

Table 1. The estimated values of the tested Hydrophilic-Lipophilic Balance (HLB), surface tension and surface activity of adjuvants in their aqueous dilution

Adjuvant	HLB values	Concentration (%)	Surface tension α (dyne/cm)	Surface activity ($\alpha_0 - \alpha$)	CMC % (wt/v)	pH values	Density (g/ml)
Polyoxyethylene glycol (200 di-Laurate)	6-7	0.25	49.02	23.78	32.66	6.34	0.996
		0.50	44.70	28.10			
		0.75	40.98	31.82			
		1.00	40.14	32.66			
Polyoxyethylene glycol 200 mono-oleate	6-7	0.25	41.28	31.86	31.52	6.70	0.959
		0.50	41.05	31.75			
		0.75	41.05	31.75			
		1.00	40.94	31.52			
Polyoxyethylene glycol 600 di-oleate	9-10	0.25	54.28	18.52	20.16	6.90	0.993
		0.50	52.64	21.87			
		0.75	51.60	21.20			
Polyoxyethylene glycol 200 di-oleate	2-3	0.25	40.17	32.63	39.14	6.52	0.895
		0.50	34.23	38.57			
		0.75	33.83	38.97			
		1.00	33.66	39.14			
Polyoxyethylene glycol 600 di-laurate	10-11	0.25	43.81	28.99	34.93	5.09	0.990
		0.50	43.20	29.60			
		0.75	38.90	33.90			
		1.00	37.87	34.93			
Top film®	8-10	0.25	40.59	32.21	40.53	7.27	0.907
		0.5	32.79	40.01			
		0.75	32.49	40.31			
Extravon®	>12	1.00	32.27	40.53	34.51	6.64	0.921
		0.25	46.04	26.76			
		0.50	39.64	33.16			
		0.75	39.54	33.26			
Butyl diglycol	10-12	1.00	38.29	34.51	22.83	4.08	0.990
		0.25	59.02	13.78			
		0.50	56.06	16.74			
		0.75	51.11	21.69			
		1.00	49.97	22.83			

(*) = water surface tension value = 72.8 dyne/cm at 25 c

Table 2: The calculated values of surface tension, pH and density of the prepared pesticides emulsions according to the Egyptian recommended rate of application

Pesticides (Trade name)	Recommended rate (ml/100 l water)	Surface tension γ (dyne/cm)	pH values	Density (g/ml)
Lambda-cyhalothrin (Halothrin-N [®] 5% EC)	187.5	40.50	7.64	0.81
Emamectin benzoate (Pasha [®] 1.9% EC)	125	52.43	7.52	0.86
Emamectin benzoate (Radical [®] 0.5 %EC)	200	50.80	7.55	0.73
Oxamyl (Vydate [®] 24 %SL)	1500	60.67	6.70	0.89
Imidaclopride (Confidate [®] 35%SC)	75	56.31	7.46	0.98
Abamectin (Vertimec [®] 1.8% EC)	40	59.59	7.64	0.89

C- Determination of physico-chemical properties of the evaluated combinations of admixed surfactants with pesticides

The determined pH and the density values of each admixed pesticide at the recommended field rate mixed with each of the evaluated adjuvants at a concentration of 0.25 are shown in Table (3). In generally these adjuvants decreased the pH values of the pesticides. This decrease in pH value of performed insecticide spray solutions indicates an increase of the positive charge of spray solution leading to increase the attraction between spray solution and the surfaces of treated leaves, which have negative charges, and eventually increase the insecticidal efficiency. The density values of pesticides mixed with adjuvants were different. This difference in density values is attributed to the use of different adjuvant materials (wetting and spreading agent) in each of the tested pesticides commercial formulations.

Table 3. The calculated pH and density values of tested pesticides/adjuvants combinations.

Adjuvants	pH [Density (g/ml)]							
	Polyoxyethyl ene glycol (200 di - laurate)	Polyoxyethyl ene glycol (200 mono- oleate)	Polyoxyethyl- ene glycol (600 di- oleate)	Polyoxyethyl ene glycol (200 di- oleate)	Polyoxyethyl ene glycol (600 di- Laurate)	Top film [®]	Extravon [®]	Butyl di glycol
Halothrin- N [®] (5%EC)	6.70 [0.96]	6.89 [0.95]	7.13 [0.96]	6.88 [0.96]	3.69 [0.97]	7.31 [0.96]	6.96 [0.96]	3.93 [0.95]
Pasha [®] (1.9% EC)	6.67 [0.95]	7.04 [0.95]	6.91 [0.95]	6.86 [0.96]	5.03 [0.92]	7.28 [0.94]	7.27 [0.95]	3.82 [0.94]
Radical [®] (0.5 %EC)	6.93 [0.95]	6.98 [0.94]	6.95 [0.97]	6.88 [0.96]	3.68 [0.95]	7.31 [0.95]	6.95 [0.97]	3.99 [0.94]
Vydate [®] 24 %SL	6.31 [0.95]	6.51 [0.94]	6.45 [0.96]	6.46 [0.94]	3.57 [0.96]	6.67 [0.96]	6.50 [0.96]	3.91 [0.96]
Confidate [®] (35%SC)	6.57 [0.95]	6.74 [0.93]	6.54 [0.96]	6.56 [0.96]	3.64 [0.95]	7.28 [0.96]	6.64 [0.96]	3.99 [0.95]
Vertimec [®] (1.8% EC)	6.42 [0.95]	6.81 [0.96]	6.65 0.94	6.56 [0.96]	3.59 [0.99]	7.16 [0.96]	6.65 [0.96]	4.12 [0.96]

The results presented in Table (4) show the physical properties of the combined pesticides mixed with the evaluated adjuvants. The detected surface tension values of the mixed pesticides (Halothrin-N[®], Pasha[®], Radical[®], Confidate[®], Vertimec[®] and Vydate[®]) at the field rate mixed with adjuvants PEG 200 di-laurate, PEG 200 mono-oleate, PEG 600 di-oleate, PEG 200 di-oleate, PEG 600 di-laurate, Top film[®], Extravon[®] or butyl diglycol are also included in the table. The addition adjuvant at concentration rate of 0.25ml was found to decrease the surface tension of each used pesticides at a recommended field rate and when the surface tension of a formulation decreases, the area of contact increases which mean that the area of contact between spray and sprayed surface increases and both wetting and spreading properties are also increase. These explanations are agreed with those reported by EL-Okda *et al.* (1985&1988) and EL-Shahaat *et al.* (2010).

These emulsifiers as well as the evaluated wetting agents can enhance the spreading of the pesticides formulations on plant surface and sequently improve the wettability. The results are in agreement with those reported by EL-Sebae *et al.* (1976), Tadross (1995) and Knowles (1998).

D- Residual toxicity of pesticides alone and/ or mixed with two emulsifiers against the cotton leafworm

The exhibited results in Table (5) show the residual toxicity of the different tested pesticides (lambda-cyhalothrin, emamectin benzoate (2 compounds), oxamyl, imidaclopride and abamectin) either alone and/or mixed with PEG 600 di-oleate and 600 di-laurate against the 4th instar larvae of the cotton leafworm. The leaves of the castor been shrubs were sprayed with the used pesticides alone or/and their mixtures with the tested adjuvants. The sprayed leaves were offered to larvae for different intervals. The deduced general of larval mortality means after 13 days from spraying proved that the residual efficacy of lambda-cyhalothrin was the highest (41.90%) larval mortality of the treated cotton leafworm at its recommended rate of application mixed with PEG 600 di-laurate, while the pesticide alone gave lower mortality rate amounted to 34.29%. The means of larval mortalities were also 30.48 and 33.33% with 0.75 of the recommended rate of pesticide mixed with 600 di-oleate and 600di-oleate, respectively (Table 5). Meanwhile, the mean mortality of the cotton leafworm for the other tested pesticides at the recommended dose mixed with PEG 600 di-oleate were 33.34 % for Vertemic[®], versus 7.78 % when tested alone; while it was 15.56% when the pesticide mixed with PEG 600 di-laurate at 0.75 recommended rate and nevertheless, this mortality was higher than that of the pesticide alone at 0.75 of the recommended rate (8.89%) (Table 5). The results also show the residual toxicity of Confidate[®] and Pasha[®] alone and/or when they were mixed with both evaluated adjuvants after three and seven days from spray. The residual efficacy of Confidate[®] gave the highest mortality of 26.67% when applied at for the recommended rate of application and mixed with PEG 600 mono-oleate, while this value was only 6.67% when the pesticide was used alone. The mean mortality was 10 % with 0.75 of the recommended rate of pesticide mixed with PEG 600 di-oleate. Remarkably, the mortality of the cotton leafworm larvae was the highest 55% in case of admixing Pasha[®] at its recommended rater with PEG 600 di-oleate that was mean value of larval mortality higher than the recorded mortality for the

pesticide alone at its recommended rate (31.67%) and also at 0.75 of its recommended dose) alone or/and admixed with PEG 600 di-laurate alone (26.67%) and 34.99% respectively (Table,5).

The aforementioned results indicated that the efficacy of tested pesticides and their residual effect had been increased when they were mixed with adjuvants. These findings had been attributed to the fact that the adjuvants can decrease the surface tension or increase the surface activity of pesticide dilution. This influence could improve the property of wettability the sprayed plant surfaces and improve the adhesion and spreading of pesticides. The present results are in agreement with those reported by EL-Sebae and EL-Okda (1972), Valkenburg (1973), Knowles (1998) and EL-Shahaat *et al.* (2010).

Table 4: The assigned physical properties of the tested pesticides alone at recommended rate either alone or/admixed the evaluated and with certain adjuvants

Pesticides + adjuvants	Adjuvant concentration (%)	Surface tension (γ) dyne/cm	Emulsion properties					
			After mixing		$\frac{1}{2}$ hr. after mixing			
			Size of the emulsion (%)	Foams (%)	Creamy or oily	Size of the emulsion (%)	Foams (%)	Creamy or oily separation
Halothrin-N[®] 5% EC								
Alone	0.00	40.50	100	0.00	N.S	100	0.00	N.S
+ E ₁	0.25	34.94	100	0.00	N.S	100	0.00	N.S
+ E ₂	0.25	40.41	100	0.25	N.S	100	0.00	N.S
+ E ₃	0.25	39.34	100	2.00	N.S	100	0.00	N.S
+ E ₄	0.25	36.63	100	0.00	N.S	100	0.00	N.S
+ E ₅	0.25	35.83	100	0.25	N.S	100	0.00	N.S
+ E ₆	0.25	31.43	100	0.00	N.S	100	0.00	N.S
+ E ₇	0.25	37.59	100	0.00	N.S	100	0.00	N.S
+ E ₈	0.25	40.59	100	0.00	N.S	100	0.00	N.S
Pasha[®] 1.9% EC								
Alone	0.00	52.43	100	0.00	N.S	100	0.00	N.S
+ E ₁	0.25	28.89	100	1.00	N.S	100	0.50	N.S
+ E ₂	0.25	53.56	100	3.00	N.S	100	0.00	N.S
+ E ₃	0.25	47.02	100	2.00	N.S	100	0.00	N.S
+ E ₄	0.25	45.70	100	1.00	N.S	100	0.00	N.S
+ E ₅	0.25	48.93	100	0.00	N.S	100	0.00	N.S
+ E ₆	0.25	39.59	100	0.00	N.S	100	0.00	N.S
+ E ₇	0.25	40.47	100	2.00	N.S	100	0.00	N.S
+ E ₈	0.25	52.07	100	1.00	N.S	100	0.00	N.S
Radical[®] 0.5 %EC								
Alone	0.00	50.80	100	0.25	N.S	100	0.00	N.S
+ E ₁	0.25	29.68	100	0.50	N.S	100	0.00	N.S
+ E ₂	0.25	47.79	100	0.00	N.S	100	0.00	N.S
+ E ₃	0.25	50.04	100	1.00	N.S	100	0.00	N.S

Table 4 Continue

..	+ E ₄	0.25	50.74	100	1.00	N.S	100	0.00	N.S
..	+ E ₅	0.25	50.87	100	0.20	N.S	100	0.00	N.S
..	+ E ₆	0.25	42.79	100	0.00	N.S	100	0.00	N.S
..	+ E ₇	0.25	38.48	100	2.00	N.S	100	0.00	N.S
..	+ E ₈	0.25	49.64	100	0.50	N.S	100	0.2	N.S
Confidate® 35%SC									
	Alone	0.00	56.31	100	0.00	N.S	100	0.00	N.S
	+ E ₁	0.25	39.57	100	0.20	N.S	100	0.00	N.S
	+ E ₂	0.25	42.11	100	0.00	N.S	100	0.00	N.S
	+ E ₃	0.25	50.34	100	0.00	N.S	100	0.00	N.S
	+ E ₄	0.25	44.99	100	0.00	N.S	100	0.00	N.S
	+ E ₅	0.25	46.26	100	2.00	N.S	100	0.50	N.S
	+ E ₆	0.25	45.99	100	0.00	N.S	100	0.00	N.S
	+ E ₇	0.25	40.33	100	2.00	N.S	100	0.00	N.S
	+ E ₈	0.25	52.65	100	0.50	N.S	100	0.20	N.S
Vydate® 24 %SL									
	Alone	0.00	60.67	100	0.00	N.S	100	0.00	N.S
..	+ E ₁	0.25	38.51	100	0.30	N.S	100	0.00	N.S
..	+ E ₂	0.25	54.43	100	0.00	N.S	100	0.00	N.S
..	+ E ₃	0.25	48.80	100	3.00	N.S	100	1.00	N.S
..	+ E ₄	0.25	46.37	100	1.00	N.S	100	0.25	N.S
..	+ E ₅	0.25	53.52	100	3.00	N.S	100	0.00	N.S
..	+ E ₆	0.25	43.89	100	5.00	N.S	100	2.00	N.S
..	+ E ₇	0.25	39.99	100	0.00	N.S	100	0.00	N.S
..	+ E ₈	0.25	59.49	100	0.00	N.S	100	0.00	N.S
Vertimec® 1.8% EC									
	Alone	0.00	59.59	100	0.00	N.S	100	0.00	N.S
..	+ E ₁	0.25	40.13	100	0.50	N.S	100	0.50	N.S
..	+ E ₂	0.25	50.87	100	0.00	N.S	100	0.00	N.S
..	+ E ₃	0.25	48.44	100	0.00	N.S	100	0.00	N.S
..	+ E ₄	0.25	51.23	100	1.00	N.S	100	0.00	N.S
..	+ E ₅	0.25	57.99	100	2.00	N.S	100	0.50	N.S
..	+ E ₆	0.25	39.55	100	0.50	N.S	100	0.00	N.S
..	+ E ₇	0.25	39.34	100	0.00	N.S	100	0.00	N.S
..	+ E ₈	0.25	57.59	100	0.25	N.S	100	0.00	N.S

* N.S = No separation

E₁ = polyoxyethylene glycol 200 di-laurateE₃ = polyoxyethylene glycol 600 di-oleateE₅ = polyoxyethylene glycol 600 di-laurateE₇ = Ethoxylated octylphenol (Extravon®)E₂ = polyoxyethylene glycol 200 mono-oleateE₄ = polyoxyethylene glycol 200 di-oleateE₆ = Top film®E₈ = Butyl di glycol

Table 5. Residual toxicity of certain pesticides alone and/or in mixtures with two adjuvants against the cotton leafworm.

Days after Spray	Mortality (%)					
	Halothrin-N [®]					
	Alone (R)	Emulsifier I (0.25%)	Emulsifier II (0.25%)	(0.75R)**	Emulsifier I (0.25%)	Emulsifier II (0.25%)
1	60.00	73.33	80.00	40.00	60.00	53.33
3	46.67	53.33	60.00	33.33	46.67	46.67
5	40.00	46.67	53.33	26.67	40.00	40.00
7	33.33	40.00	40.00	20	26.67	33.33
9	26.67	26.67	26.67	13.33	26.67	20.00
11	20.00	13.33	20.00	13.33	20.00	13.33
13	13.33	6.67	13.33	6.67	13.33	6.67
Mean effect	34.29	37.14	41.90	21.90	33.33	30.48
		Vertimec[®] 1.8%				
1	10.00	33.33	46.67	13.33	26.67	20.00
3	6.67	26.67	26.67	6.67	13.33	13.33
5	6.67	20.00	26.67	6.67	6.67	6.67
Mean effect	7.78	26.67	33.34	8.89	13.33	15.56
		Confidate[®] 35%SC				
1	6.67	33.33	26.67	6.67	13.33	6.67
3	6.67	20.00	13.33	6.67	6.67	6.67
Mean effect	6.67	26.67	20.00	6.67	10.00	6.67
		Pasha[®] 1.9% EC				
1	60.00	80.00	80.00	40.00	60.00	53.33
3	46.67	53.33	26.67	33.33	26.67	40.00
5	13.33	46.67	20.00	20.00	20.00	33.33
7	6.67	40.00	6.67	13.33	6.67	13.33
Mean effect	31.67	55.00	33.34	26.67	28.34	34.99

* The emulsifiers I and II are polyoxyethylene glycol 600 di-oleate and 600 di-laurate, respectively.

** (0.75R) = 0.75 of the recommended dose

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الملخص العربي

تقييم بعض المواد الإضافية لزياده فعالية المبيدات ضد دوده ورق القطن

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تم إختبار بعض المواد النشطة سطحياً غير الايونية والمنتجة في مصر والتي تنتمي إلي مجموعة بولي أوكسي إيثيلين جليكول سواء المرتبطة بحامض الأوليك أو حامض اللوريك ، وكذلك تم استخدام أحد عوامل التبليل المعروفة تجارياً ب إكسترافورن (إيثوكسيلينيد اوكتايل فينول) في تخفيفاتها المائية وفي خلانطها مع المبيدات التالية هالوثرين-إن (لامبدا سيهاالوثرين) ، فيرتمك (أباميكيتين) ، باشا و راديكال (ايمامكتين بنروات) ، كونفيديت (ايميداكلوبريد) و فايديت (اوكساميل) باستخدام الجرعة الحقلية الموصي بها في مصر .

وقد وجد أن عوامل الإستحلاب المنتمية إلي بولي إيثيلين جليكول أولييت أو لوريك لها قيم إتزان هيدروفيلي-ليبوفيلي (HLB) تراوح ما بين 8إلي11 لجميع المواد المختبرة مما يدل علي أن هذه المواد تعطي مستحلباً ثابتاً عند الخلط مع الماء فيما عدا مادة بيوتيل داي جليكول ومادة إكسترافورن حيث أن قيمة HLB كانت تراوح ما بين 10إلي12 ، وأكثر من 12 علي الترتيب. وأعطت هذه المواد المختبرة محلول شفاف الي رائق. وتسببت المواد المختبرة في إحداث خفضاً للتوتر السطحي للماء من 72.8 دايين/سم إلي 32.27- دايين/سم بدون ظهور أي صفات غير مرغوبة فيما يخص الصفات الفيزيائية مما يوضح أهمية هذه المواد في تحسين صفات الإلتصاق والإمتصاص علي الأسطح النباتية المعاملة تحت الظروف الحقلية، وكانت قيم pH للمواد المختبرة بولي أوكسي إيثيلين جليكول 200 داي لوريات ، 200 مونو اولييت، 600 داي أولييت ، 200 داي أولييت ، 600 داي لوريات ، توب فيلم ، إكسترافورن و بيوتيل داي جليكول هي 6,34 ، 6,70 ، 6,90 ، 6,52 ، 5,09 ، 7,27 ، 6,64 ، و 4,08 علي الترتيب. و قد أدي إستخدام المواد الإضافية إلي إحداث خفضاً واضحاً للتوتر السطحي عند خلطها مع المبيدات المستخدمة تراوح ما بين 28,89إلي 59,49 دايين/سم وأيضاً أعطت انخفاض في قيم pH تراوح ما بين 3,57, 3 إلي 7,31. وتم اختيار مادتي بولي أوكسي إيثيلين جليكول 600 داي اولييت و600 داي لوريات و خلطها مع المبيدات (هالوثرين-إن ، فرتمك ، باشا ، كونفيديت) باستخدام الجرعة الموصي بها وثلاث أرباع الجرعة الموصي بها ورشها في الحقل و تغذية برقات العمر الرابع دوده ورق القطن علي الأوراق المعاملة علي فترات مختلفة وذلك لتقدير الأثر السام المتبقي لهذه المركبات. وقد بينت النتائج أن مبيد لامبدا سيهاالوثرين المخلوط بهذه المواد كان أكثر المبيدات فعالية ضد دوده ورق القطن عند إستخدامه بالجرعة الموصي بها.