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Raising the Influence of Insecticides against *Spodoptera littoralis* (Lepidoptera: Noctuidae) and Reducing Field Recommended Dose by Blending with Adjuvants to Simulate Eco-Friendly Formulations

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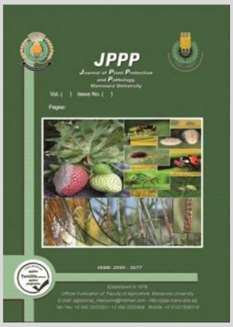

ABSTRACT

A wide variety of adjuvants surfactants are available fair therefore need to choose a suitable surfactant to give maximum system enables to choose proper surfactant with ease and enhanced the insecticide effectiveness and raises the perseverance of insecticides. This study swivel, the influence of adjuvants Triton® X-405 (Octylphenol ethoxylate), Codacide oil), Silwet Gold® (Trisiloxane Alkoxylates) to enhance the toxicity of (Lufenuron, Profenofos, and cypermethrin) as mercantile insecticides recommended against Egyptian cotton leafworm (CLW) *Spodoptera littoralis*. The results pointed out that the amalgamation of the adjuvants and half-recommended field rate of insecticides increased the toxicity of tested insecticides and decreased the rate of field application, decreases the surface tension of spray solutions to a much lower range, high range of (HLB) hydrophile-lipophile balance. Moreover, comparing sedimentation after half an hour of mixing as well as foaming after half an hour of mixing results gives different values in Emulsion properties (foaming and Stability).

***KeywordS*:** adjuvants; surfactants; emulsion; hydrophile-lipophile; insecticide

INTRODUCTION

The formulation pesticides are a combination of active and inactive ingredients that shapes the manufacture of the terminus-utilize pesticide. Pesticides are manufactured to turn out them securely, safer and easier to usefulness. This is due to many pesticide active ingredients, in "pure" (technical grade) compose are not convenient for application. In their concentrated compose, some are considerably toxic, numerous do not mix with water, some are unsettled, and some are dangerous (or unsafe) to handle, transport, or store. To remedy these troubles, the industrialiser appends the inert ingredients which have not toxic activity to terminus-utilize pesticide products, some of them simply used as diluents or carriers. In plentiful cases, inert ingredients turn out the formulated manufactures safer, easier to handle and apply, and more effective. So, in addition to the active ingredient intended to management the target pests, formulated pesticides manufactures may consist of:

- A carrier or diluent, such as organic solvent or mineral clay .
- Surface-active ingredients, such as stickers and spreaders.
- Other additives, such as stabilizers, dyes, and chemicals, make the product safer or enhance pesticide activity.

The application of pesticide rates by adding auxiliary materials during installation in a tank blend is an internationally agreeable tactic. The chosen diverge of adjuvant conferring to the specifications of the insecticide, its mode of action, and the molding formulation utilized, as well as the nature of the intended target (Holloway 1998). Using adjuvants improves insecticide efficiency and raises the persistence of insecticides. This may decrease the effective pesticide dose as much as 10-fold (Green and Green 1993; Hammami et al. 2014). Therefore, the adjuvants can be used for reducing the number of applications in the season and the application rates of insecticides (Abdelgaleil et al. 2018). Commonly, the adjuvants can improve the properties of pesticide applications chief to the improvement of their effectiveness and biological activity against insect pests (Larson 1997; Cowles et al. 2000; Liu and Stansly 2000; Lacey et al. 2006; Dewer et al. 2017).

Egyptian cotton was confronted by many pests. However, the cotton leaf worm (CLW), *Spodoptera littoralis* (Boisd) considers one of the infamous and critical insects for cotton yield and quality in Egypt. In addition, it is considered the most destructive pest not only on cotton but also to more than 60 other crops, ornamentals, and vegetables of economic importance (Lanzoni et al. 2012; Kandil et al. 2003), also about 73 species of plants attacking by (CLW) recorded at Egypt (Ahmad 1988; Amin and Salam 2003).

To meet the global demand to reduce global warming due to the overuse of conventional chemical pesticides used in pest management practices, the appeal of diminishing a loss and conserving the quality of crop harvest, pest management manners and pesticides jointly are exploited to dominance, destroy and prevent pests. Indiscriminate use of conventional pesticides leads to accumulating pesticide residues in plant tissues along with environmental pollution. Furthermore, the growing realization of the toxic effects of conventional insecticides, in our study will measure the ability of adjuvants surfactants mixing tank with insecticides on the toxic of active ingredients of the conventional insecticides, also increase the bio-efficacy, the hydrophile-lipophile balance (HLB) and surface tension of the products through this incorporating.

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MATERIALS AND METHODS

Experiment Design

Field trials were carried out at the Abo-Homos center, El-Bheira Governorate, Egypt during the season 2021.

The cotton plants were field sprayed by cypermethrin, Profenofos, and Lufenuron formulations alone and/or mixed with adjuvants. Both of the insecticides were tested at their recommended (R) and half-recommended (0.5 R) rates. Evaluation of the efficacy of the tested insecticides alone and/or mixed with the estimated adjuvants was run against larvae of cotton leafworm (CLW) S. litorallis. Each treatment was ¼ feddan (1050 m2) which was divided into four replicates (262.5 m2 for each replicate). Randomly 100 cotton plants were selected to count (CLW) in the early morning before and after treatment. The examination was performed after 24 hours of the conventional compounds and three days for (IGRs) in order to calculate the initial reduction effect (I.R.E.) Moreover, the latent reduction effect (L.R.E.) was carried out after 5, 7, and 10 days of application. Insecticides application sprayed using the motor knapsack sprayer 20 liters, (30 liters/ treatment).

Adjuvants

It is known that the additive and auxiliary materials (Adjuvants) when pro-blended with insecticides, the emulsifiers latch on to the insecticides, and when blended or mixed to be a spray solution in the spray tank, the emulsion is formed and it is this that is the Evidence to Adjuvant's efficiency as a carrier in the plant protection pesticides, The three adjuvants which investigated in this study were:

1. TRITON®, Dow Chemical Company (Octylphenol ethoxylate), adjuvant for insecticide spray used as a wetting agent.
2. CODACIDE OIL 95% (Food grade Canola Oil) is a natural vegetable oil adjuvant formulated with a concatenation of plant-based emulsifiers (5%) used as natural adjuvants; purchased from Microcide Limited, Shepherds Grove, Stanton, Bury St Edmunds, Suffolk IP31 2AR, UK.
3. SILWET GOLD®, UPL Limited-India: is a Trisiloxane Alkoxylates adjuvant in the category of A non-ionic universal organic silicone called "super-spreaders", which can improve the absorption in the stomata by reducing the active tension of aqueous solutions. As a result, the solution in which Silwet Gold® has been added penetrates much easier and faster inside the green parts of the plants, ultimately leading to a better effect of the products in the mixture. Silwet Gold® ensures a particularly fast penetration into the leaves of any partner from the mixture significantly improving its effect.

Pesticides used

The experiment involved a wide range of insecticides, three groups of pyrethroids, organic phosphorous (Ops), Insect Growth Inhibitor (IGI)) with relatively toxic with are known to be effective against cotton leafworm (CLW) S. littoralis in Egypt (Awad et al. 2014a and 2014b).

Cypermethrin (Nasr-thrin® 25%)

NRDC 149; PP383 (ICI); WL 43 467 (Shell); LE 79-600 (Rhône-Poulenc); FMC 30980 (UPL Ltd, 610 B/2, Bandra Village, Off Western Express Highway, Bandra (East), Mumbai 400 051 India).

Application Rate 250 cm^2/Fed.

Profenofos (Teleton® 72%)

CGA 15 324 (Ciba-Geigy) Agrochem for Fertilizers & Chemicals, 473 El-Horreya Street, Bolkeley, Alexandria, Egypt.

Rate of application: 750 cm^2/Fed.

Lufenuron (Match® 5%)

CGA 184699 (Ciba-Geigy) (Senganta Egypt Polts 31, El-Sheikh Zayed, 6th October, Giza, Egypt.

Application Rate 160 cm^2/Fed.

Adjuvants' Physical properties and/or mixed with the insecticides:

Physical compatibility between the used insecticides and additives was studied by the determination of emulsion stability for cypermethrin, profenofos, and lufenuron according to the (WHO 1979) specification (visually method). The physicochemical properties of the tested insecticide alone and/or mixed with Adjuvants were determined according to:

a) Hydrophilic-lipophilic Balance (HLB) Value was determined using the method described by (Gadhave 2014).
b) The surface tension value (dyne cm-1) was determined using the Traube Stalgamometer method (Phares 1965).
c) The emulsion stability test of each pesticide alone or/and admixed with each of the evaluated adjuvants was determined according to (Sherman 1968).

Statistical analysis

Percentage reduction of infestation was recorded according to (Henderson and Tilton 1955). Then data were exposed to the analysis of variance test (ANOVA), with mean separation at 5% levels of significance, Computer program COSTAT, and Duncan's Multiple.

RESULTS AND DISCUSSION

Results

Effect of adjuvant on Physico-chemical properties of spray solution of tested insecticides

It's known and scientifically proven that hydrophilic–lipophilic (HLB) is the amount of surfactant required to make oil keep on in solution and the disparity of the proportion of the mixed emulsifiers gives obtain best results. Referring to the effect of adjuvant on Physico-chemical properties of spray solution to tested insecticides (Table 1, 2, and 3) the results indicate that the ratio of HLB balance for the three adjuvants gave disparity differently when blended with the used insecticides. Where Silwet Gold and Triton® give a high range of HLB (11-13 and >11) respectively, that means that the dispensability/Behavior to HLB in water are Translucent-to-clear solutions and the application of surfactants depending on HLB range are Solubilizers. While Codacide gave less range of HLB (5-6), poor dispensability and the type of emulsion was w/o emulsifiers.

The effect of adjuvants blended with the used insecticides has been studied on surface tension, and have found that Silwet Gold® gave the least surfactants (37.7, 33.5, and 36.14 dyne/cm), whilst Triton® (39.5, 36.90, 40.60 dyne/cm), Codacid were recorded (51.4, 39.0, 49.30 dyne/cm) in lufenuron, profenofos, and cypermethrin respectively compared with insecticides alone without adjuvants.

Furthermore, the Stability post 1/2hr of blended was No creamy or oily sedimentation in the Silwet Gold and Triton® while Codacid Stability was 1.0 ml oily separation post 1/2hr. also foaming post 1/2 hr of blending was disparity different value, Codacid never had any foam when blended with Lufenuron and Profenofos while cypermethrin recorded 3ml post 1/2hr. on another hand, Silwet Gold gave (1.0, 7.0, 3.0 ml) Foams post 1/2 hr of blending with lufenuron, profenofos, and cypermethrin respectively. While Triton® recorded (9.0, 8.0, and 4.5 ml) Foams post 1/2 hr of blending with Lufenuron, profenofos, and cypermethrin respectively.

Table 1. The estimated physical properties of lufenuron (5% EC) in its combinations with some adjuvants

Insecticides & Adjuvants	Adjuvants Conc. (%)	Hydrophilic–Lipophilic Balance (HLB)			Surface Tension (dyne/Cm)	Emulsion properties	
		HLB range	Dispensability/ Behavior in water	Application of surfactants depending on HLB range/ type of emulsion		Stability post 1/2hr. of mixing	Foam (ml) post 1/2hr. of mixing
Lufenuron (R)	0.0	-	No	No	56.2	No creamy or oily sedimentation	6.0
Lufenuron (1/2 R)	0.0	-	No	No	69.2	"	4.0
1/2R + Silwet Gold	0.5	11-13	Translucent-to-clear solution	Solubilizers	37.7	"	1.0
1/2R + Triton®	0.25	>11	Translucent-to-clear solution	Solubilizers	39.5	"	9.0
1/2R + Codacide	0.50	5-6	Poor dispensability	w/o emulsifiers	51.4	1.0 ml oily separation	0.0

R and 1/2R: Recommended and half-recommended rates of field application under Egyptian conditions

Table 2. The estimated physical properties of profenofos (72% EC) in its combinations with some adjuvants

Insecticides & Adjuvants	Adjuvants Conc. (%)	Hydrophilic–Lipophilic Balance (HLB)			Surface Tension (dyne/Cm)	Emulsion properties	
		HLB range	Dispensability/ Behavior in water	Application of surfactants depending on HLB range/ type of emulsion		Stability post 1/2hr. of mixing	Foam (ml) post 1/2hr. of mixing
Teleton®(R)	0.0	-	No	No	56.10	No creamy or oily sedimentation	2.0
Teleton® (1/2 R)	0.0	-	No	No	60.73	"	1.5
1/2R + Silwet Gold	0.5	11-13	Translucent-to-clear solution	Solubilizers	33.5	"	7.0
1/2R + Triton®	0.25	>11	Translucent-to-clear solution	Solubilizers	36.90	"	8.0
1/2R + Codacide oil	0.50	5-6	Poor dispensability	w/o emulsifiers	39.0	1.0 ml oily separation	0.0

R and 1/2R: Recommended and half-recommended rates of field application under Egyptian conditions

Table 3. The estimated physical properties of cypermethrin (25% EC) alone and in combination with tested adjuvants

Insecticides and adjuvants	Adjuvants concentration (%)	Hydrophilic–Lipophilic Balance (HLB)			Surface tension (dyne/cm)	Emulsion properties	
		HLB range	Dispensability/Behavior in water	Application of surfactants depending on HLB range/ type of emulsion		Stability post 1/2 hr. of mixing	Foams ml post 1/2 hr. of mixing
Nasr-thrin® (R)*	0.0	-	No	No	62.50	No creamy or oily sedimentation	5
Nasr-thrin® (1/2R)*	0.0	-	No	No	68.62	"	3
(1/2R)+Silwet Gold	0.5	11-13	Translucent-to-clear solution	Solubilizers	36.14	"	3
(1/2R) + Triton®	0.25	>11	Translucent-to-clear solution	Solubilizers	40.60	"	4.5
(1/2R) +Codacide	0.5	5-6	Poor dispensability	w/o emulsifiers	49.30	1.0 ml oily separation	3

Effect of adjuvant on the total chlorophyll content in cotton leaves

It is important to highlight the effect of the tested adjuvant on the chlorophylls contents in the leaves of cotton, the results presented in (Table 4) indicates that no side effects of the three tested adjuvant on the cotton leaves and it ranged between (4.4 to 4.8 mg/100g fresh leaves), the same data also recorded in untreated check (4.6 mg/100g fresh leaves) after 10 days of treatment.

Table 4. effect of tested adjuvants on the average of total chlorophyll ± stander error content in cotton leaves

Adjuvants	Adjuvants Conc. (%)	Total chlorophyll content(mg/100g fresh leaves*		
		5 days	10 days	15 days
Untreated check	0.0	3.1±0.8	4.6±1.1	5.7±1.2
TREND-90	0.2	3.12±0.6	4.4±0.76	5.4±0.66
Extravon	0.25	3.5±0.8	4.9±0.90	5.95±0.60
Codacide Vegetable oil	0.5	2.95±1.0	4.8±0.65	6.2±0.89
L.S.D$_{0.05}$		1.46	1.64	2.49
P value		0.866	0.897	0.589

Residual toxicity of insect growth regulator lufenuron (Match 5% EC) blending with test adjuvants against the cotton leaf worm, *S. littoralis* larvae

From the exhibited results in (Table 5), the treatment of Match by ½R with Silwet Gold® gave the highest effect on cotton leaf worm after 10 days from the spray which gave 172.41 larvae followed by Match by R (179.83 larvae), while, Match by ½R gave less effect 464 larvae/100 cotton plant. For the other treatments the mean numbers of Match by ½R with Triton® and Match by ½R with codacide oil (194.41 and 217.16 larvae, in respect) in comparison to untreated check (1197.58) larvae/100 cotton plant. On the other hand, IGRs of Match® (½R) with three adjuvants of Silwet Gold®, Triton®, and codacide oil gave the same higher effect on cotton leaf worm which determined (205,176.5, 135.75 larvae/100 cotton plant), (216.75, 204.25, 162.25 larvae/100 cotton plant) and (232.25, 232,187.25 larvae/100 cotton plant) through the three inspection dates 3, 7 and 10 days), respectively as same as Match® (R) (240.25, 163.75and 135.5 larvae/100 cotton plant, respectively) compared with an untreated check (1375.5, 1212.25 and1005 larvae/100 cotton plant., in respect.

Table 5. Residual toxicity of insect growth regulator lufenuron 5% EC blending with test adjuvants against the cotton leafworm, *Spodoptera littoralis* larvae:

Treatments	Larvae/100 cotton plant Inspection dates			Average
	3 days	7 days	10 days	
Match (R)	240.25[c]	163.75[d]	135.5[c]	179.83[d]
Match (½R)	530[b]	477.25[b]	384.75[b]	464[b]
Match + Silwet Gold	205[c]	176.5[d]	135.75[c]	172.41[d]
Match+Triton®	216.75[c]	204.25[cd]	162.25[c]	194.41[cd]
Match+codacide oil	232.25[c]	232[c]	187.25[c]	217.16[c]
Untreated Check	1375.5[a]	1212.25[a]	1005[a]	1197.58[a]
$LSD_{.05}$	91.02	47.76	65.65	35.05
P value	0.0001	0.0001	0.0001	0.0001

R and 1/2R: Recommended and half-recommended rates of field application under Egyptian conditions

Residual toxicity of Profenofos (72% EC) and cypermethrin (25% EC) insecticide blending with test adjuvants against the cotton leaf worm, *Spodoptera littoralis* larvae

The results in (Table 6) show that the lowest mean number of cotton leafworm larvae was obtained by adding the adjuvants of Silwet Gold®, Triton®, and codacide oil with either insecticides profenofos (Teleton®) and cypermethrin (Nasr-thrin®) at half the recommended dose so after ten days of spraying it was estimated (149.66, 162.66, 209.75, 206.08, 171.58 and170.91 larvae/100 cotton plant, respectively), while Teleton® and Nasr-thrin® by recommended dose gave the same effect without additive (154.66 and 157.25 larvae/100 cotton plant), respectively.

Table 6. Residual toxicity of (Teleton® 72% EC) and (Nasr-thrin® 25% EC) insecticide blending with test adjuvants against the cotton leafworm, *Spodoptera littoralis* larvae:

Treatments	Larvae/100 cotton plant Inspection dates			Average
	3 days	7 days	10 days	
Teleton® (R)	202[c]	148.5[c]	113.5[d]	154.66[c]
Teleton® (½R)	629.75[b]	493.5[b]	350.5[b]	491.25[b]
Teleton® (½R)+ + Silwet Gold	195[c]	142.75[c]	111.25[d]	149.66[c]
Teleton® (½R)+ Triton®	209.25[c]	157.25[c]	121.5[d]	162.66[c]
Teleton® (½R)+ codacide oil	238.75[c]	210.25[c]	180.25[c]	209.75[c]
Nasr-thrin®(R)	170[c]	180.5[c]	121.25[d]	157.25[c]
Nasr-thrin® (½R)	629.75[b]	487.25[b]	395.5[b]	504.16[b]
Nasr-thrin® (½R)+ + Silwet Gold	166[c]	340[bc]	112.25[d]	206.08[c]
Nasr-thrin® (½R)+ Triton®	212.5[c]	172.5[c]	129.75[d]	171.58[c]
Nasr-thrin® (½R)+ codacide oil	170[c]	190.5[c]	152.25[cd]	170.91[c]
Untreated Check	1168[a]	1030[a]	798.25[a]	998.75[a]
$LSD_{.05}$	69.17	180.21	45.98	61.91
P value	0.0001	0.0001	0.0001	0.0001

Vice versa, Teleton® and Nasr-thrin® at half the recommended dose without additions gave the least effective (491.25 and 504.16 larvae/100 cotton plant), respect compared with an untreated check (998.75 larvae/100 cotton plant. On the other hand, through the three inspection dates 1, 7, and 10 days adding three adjuvants of Silwet Gold®, Triton® and codacide oil with Teleton® at half the recommended dose gave higher effectiveness against cotton leave worm which determined (195, 142.75, 111.25 larvae), (209.25, 157.25, 121.5 larvae/100 cotton plant) and (238.75, 210.25, 180.25 larvae/100 cotton plant), respectively and the same effect happened with Nasr-thrin® at half the recommended dose with the same adjuvants which estimated (166, 340, 112.25 larvae/100 cotton plant), (212.5, 172.5, 129.75 larvae/100 cotton plant) and (170, 190.5, 152.25 larvae /100 cotton plant), in respect, while, Teleton® and Nasr-thrin® by recommended dose gave the same effect without additive (202,148.5, 113.5 larvae/100 cotton plant) and (170, 180.5, 121.25 larvae), in comparison to untreated check (1168, 1030,798.25 larvae/100 cotton plant) in respectively. Vice versa, Teleton® and Nasr-thrin® at half the recommended dose without additions gave the least effective but less than untreated check during the same inspection dates (629.75, 493.5, 350.5 larvae/100 cotton plant) and (629.75, 487.25, 395.5 larvae/100 cotton plant), respectively.

Discussion

The results above mentioned refer to the three adjuvants used to enhance the Physico-chemical properties of spray solution of tested insecticides against cotton leafworms, agreement with (Saad et al. 2013) indicated that Extravon® (Octylphenol ethoxylate) as having a high HLB which means that these adjuvants can give from translucent to clear solutions. Moreover, the adjuvants lowered the surface tension of used pesticides at the tested recommended field rate. (Dewer et al. 2017) reported that the Extravon® and Codacide oil adjuvants gave acceptable properties to-wards the emulsion stability, foaming, and emulsification. Holloway et al. (2000) showed that a natural vegetable oil Codacide recorded significantly reduced DST values at a surface as compared to the mineral oil adjuvant, Also, provided that it assists adhesion and retention efficacy where contains the analogous structure to leaf and insect cuticle wax (both are triglycerides). Balsari et al (2001), displayed that Codacide enhanced adhesion and retention on the leaves of different vine cultivars (Moscato, Pinot Nero, and Barbera) with a 17% and a 27% increase for Pinot Nero and Barbera consecutively compared to clear water alone on the upper leaf surface of vine cultivars (as determined by spray deposit ul/cm2). (Gaskin et al. 2005) clarified that the depression of surface tension for spray solution might raise the number of smaller uniformly deposited droplets, whilst better spreading on the leaf surface might also raise qualitative deposition, subsequently increasing the insecticides qualifications. Also, these effects agree with (Ryckaert et al. 2007) point out that raising the surface tension leadership to diminution the contact angle between the droplets and the epicuticular wax layer for superior droplet contact and increased droplet spreading properties, consequence enhanced the quantum and quality for spray surfaces deposition. (Wasfy et al. 2012) explant that the surfactants increased the performance of examined insecticide for management against cotton leafworms. Whereas, the addition of local surfactants to the select pesticides changes the Physico-chemical properties of tested insecticide spray solutions.

Romanian Research Institute for Plant Protection (1997) reported that Codacide alone as Foliar application at double the recommended maximum rate (5 l/ha) on French beans, sunflowers, and potatoes not recorded any phytotoxicity.

The data showed that adjuvants increased the toxicity of tested insecticides and decreased the rate of field application which agreement with (Beattie et al. 2002) reported that the mix of Acephate and Codacide Oil improved the untreated check of Melon Aphid on cucumber (18 Insect

Numbers/plant) compared with Acephate alone (23 Insect Numbers/plant) also, significantly improved recorded on Tomato Fruit worm on tomato (1-2 Insect Numbers/plant). Tipping et al. (2003) showed that Thompson Seedless table grapes were not damaged when treated with up to 1% Silwet L-77; however, grapes treated with the 0.5 and 1.0% solutions appeared wet after removal from cold storage because of the effect of the surfactant spreading the water condensation. Agrodan (2005) reported that the blended Codacide oil with Achrinathrin (Rufast®) provided the efficacy of the management larvae and adult thrips on strawberries in comparison to Achrinathrin alone. Saad et al. (2013) reported that the adjuvants increased the residual toxicity of the formulated pesticides and the efficacy of Lambda-cyhalothrin increased when it was mixed with its recommended rate with the evaluated adjuvants against the cotton leaf worm *S. littoralis*. Abdelgaleil et. al. (2018) proved that the results of the joint toxic effect between Adjuvants (Top Film and Tritone K) and insecticides indicated that adjuvants revealed a potentiating effect on the toxicity of tested insecticide formulations as co-toxicity factor values were greater than +20. Zakia et al. (2016) decided that the adjuvants Argal (trisiloxane ethoxylate) gave the highest increase in average residual effect than the pesticide alone. Dewer et al. (2017) concluded that adjuvants PEG 600 di-laurate, Extravon®, and Codacide oil in combination with the tested insecticides at their half-recommended field rate gave a good potential for untreated checking the Egyptian cotton leafworm, (Negash et al. 2020) who stated that Surfactant added insecticides gave fewer numbers of thrips and higher yields than the corresponding insecticides applied without surfactant.

CONCLUSION

It can be concluded that the use of some adjuvants showed a stimulating effect on the toxicity of the tested insecticide formulations as simulating environmentally friendly formulations, providing an effective protection system for the cotton leafworm *S. littoralis*. Moreover, this technology made it possible to use lower doses of pesticides; this reduces its use to its cost (economic ratio/pesticides). Likewise, this technic complies with ethical standards; reduces the risks of health pesticides and emissions that may cause environmental problems such as global warming.

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رفع تأثير المبيدات الحشرية ضد دودة القطن وتقليل الجرعة الموصى بها حقليا عن طريق المزج مع المواد المساعدة لمحاكاة التركيبات الصديقة للبيئة

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الملخص

تتوفر مجموعة متنوعة من المواد الخافضة للتوتر السطحي بشكل عادل وبالتالي نحتاج إلى اختيار عامل خافض للتوتر السطحي مناسب لإعطاء أقصى قدر من النظام يتيح اختيار تعزز كفاءة المبيدات الحشرية وتزيد من ثباتها. تدور هذه الدراسة حول تأثير المواد المساعدة (تريتون إكس®، وزيت الكوديسيد، سيل ويت جولد®) لتعزيز سمية مركبات ليفينيرون، سيبرمثرين، بروفينفوس كمبيدات حشرية تجارية موصى بها ضد دودة ورق القطن *Spodoptera littoralis* في مصر. أشارت النتائج إلى أن مزج المواد المساعدة بنصف المعدل الحقلي الموصي به يزيد من سمية المبيدات الحشرية المختبرة ويقلل من معدل التطبيق الحقلي ، ويقلل من التوتر السطحي لمحاليل الرش إلى مدى أقل بكثير ، وزيادة المدى من التوازن المحب للدهون. علاوة على ذلك ، بمقارنة الترسيب بعد نصف ساعة من الخلط أعطت النتائج قيمًا مختلفة في خصائص المستحلب (الرغوة والثبات).