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MIXING AS AN IMPORTANT FACTOR ON THE PHYSICAL COMPATIBILITY OF FOLIAR FERTILIZERS AND INSECTICIDES.

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Abstract

Three methods of mixing fertilizers and insecticides were used. The first was the addition of formulated insecticide to the aqueous solution of foliar fertilizer, the second was the addition of formulated fertilizer to the aqueous emulsion of the insecticide, and the third was the direct mixing of both formulations then dilution by water.

Physical properties such as emulsion stability, foam, electrical conductivity, viscosity and surface tension were studied at aerial dilution rate for insecticides alone and their binary mixtures with foliar fertilizers under the studied methods of mixing. Data showed that the compatibility was highly affected with the method of mixing , a matter necessitating the mention of the method of mixing in the application instructions.

INTRODUCTION

During the period 1984-1989, insecticide-foliar fertilizer combinations were widely used by aircraft on field crops . Such mixing might produce incompatibility, thus reducing the benefit expected from the mixture. Physical compatibility of insecticide-foliar fertilizer combinations was evaluated by several workers (El-Attal *et al.*, 1981; Osman *et al.*, 1987; Tawfik and El-Sisi 1987)

The present work was directed to study the effect of several methods of mixing on the physical properties of insecticides when mixed with foliar fertilizers.

MATERIALS AND METHODS

Foliar fertilizers

It consisted of the principal elements (nitrogen, phosphorus and potassium) and the rare elements (magnesium, chelated ferrous, chelated zinc, chelated manganese, boron, copper, and cobalt) and salts at different percentages. Type of salts and its percentages in the fertilizer is patent to company manufacture . The following foliar-fertilizers and their recommended rates were used:

Bayfolan (Bayer Co.) at 1 L/feddan, Greenzite NPK (Ciba - Geigy AG Co.) at 0.5 L/feddan, and Wuxal (Schering AG Co.) at 0.5 L/feddan.

Insecticides

The following insecticides and their recommended rates were tested :

Dursban (Chlorpyrifos) 48% EC, Dow Chemical Co., (1 L/feddan); Nurelle 200 EC, Dow Chemical Co. (200 g cypermethrin/L and 300 ml/ feddan); Teber (ICI) EC (600 g/L pirimiphos ethyl and 20 g/L of the insect growth regulator IKI 7899, at the rate of 1 L/feddan); DC 806 (Merlin) EC, Dow Chemical Co. (480 g/L chlorpyrifos and 30 g/L Dowco 439, at the rate of 1 L/feddan).

Method

The following physical properties were studied for insecticides alone or in mixtures with foliar fertilizers under aerial dilution with tap water. The methods of mixing were : 1) addition of the formulated insecticide to diluted solution of foliar fertilizer in tap water, 2) addtion of the formulated foliar fertilizer to the diluted emulsion of insecticide in tap water, and 3) direct mixing of the formulated insecticide with the formulated foliar fertilizer then addition to tap water.

Emulsion stability test was carried out according to the specification of WHO (1979) but under aerial dilution rate in tap water, foam volume(cm^3) was measured after 5 minutes of inverting the cylinders containing diluted insecticide alone or their mixtures with foliar fertilizers. Surface tension was determined using DuNouy Tensiometer (El-Sisi *et al.*, 1989), the viscosity was determined using Viscometer and conductivity through a Conductimeter (Moustafa *et al.*, 1990). Total hardness of water was deretmined according to Clark method. (Vogel, 1950).

RESULTS AND DISCUSSION

The compatibility between insecticide and foliar fertilizers include three stages : physical chemical and biological compatibility. The physical compatibility means less amount of foam and good emulsion stability.

Table 1 shows that there are three cases of compatibility based on emulsion stability of the studied mixtures : 1) compatible in all methods of mixing such as Dursban-Greenzit combination, 2) incompatible in all methods of mixing such as Dursban -Bayfolan combination, and 3) compatible if mixed by a certain method and incompatible if mixed by other methods. In this respect, the mixture of Nurelle-Bayfolan was compatible if mixed by adding the formulated foliar fertilizer to the dilute emulsion of the insecticide. On the contrary it became incompatible if mixing was done by any of the other methods. The same applies with Nurelle-Greenzit, and Teber-Wuxal mixtures. Merlin-Wuxal mixture was incompatible in case of addition of the formulated insecticide to the diluted solution of foliar fertilizer, and was compatible if the mixing was achieved by the other two methods.

The volume of foam was reduced as a result of mixing Merlin with Wuxal, while the other insecticide-foliar fertilizer combinations did not show any difference in foam compared with the insecticide alone (Table 1).

Data presented in Tables 1and 2 indicated that compatible mixtures had the highest value of conductivity (hydrophility) compared with the other incompatible mixtures. This was clearly shown in cases of Nurelle-Greenzit, Merlin/Wuxal and Teber/Wuxal mixtures which were compatible when mixed by certain method and incompatible when mixed by other methods. El-Attal and El-Sisi (1979) reported that emulsion stability increases with the increase of the hydrophility of emulsions.

Table 2 shows that there was no correlation between viscosity, surface tension and compatibility.

In general , the mixtures were more stable in emulsions (compatible) in case of adding formulated foliar fertilizers to the diluted emulsion of the insecticide compared with the other two methods of mixing . This could be due to the effect of the

Table 1. Physical compatibility of insecticide - foliar fertilizer mixtures under different methods of mixing.

Insecticide	Foliar fertilizer	Insecticide alone		Insecticide								
				I*			II*			III*		
		Foam	E.st*	Foam	E.st	Compatib-ility	Foam	E.st	Compatib-ility	Foam	E.st	Compatib-ility
Dursban	Greenzit	10	-	9	-	✔*	8	-	✔	8	-	✔
Dursban	Bayfolan	10	-	5	Complete sparation	x*	4	Complete sparation	X	3	Complete sparation	X
Nurelle	Bayfolan	-	1	-	Complete sparation	*	-	2	✔	-	Complete sparation	X
Nurelle	Greenzit	-	1	-	3	*	2	-	✔	1	3	X
DC 806	Wuxal	10	-	2	7	*	2	1	✔	2	-	✔
Teber	Wuxal	12	-	12	7	*	12	1	✔	10	7	X

1 * : Addition of formulated insecticide to diluted foliar fertilizer
II * : Addition of formulated foliar fertilizer to diluted emulsion of insecticide.
III *: Direct adddition of formulated insecticide to formulated foliar fertilizer.
E.st.: Emulsion stability (ml. of cream separation).
✔ : Compatible
X : Incompatible

Table 2. Physical compatibility of spray solution under aerial dilution for insecticide alone or in binary mixtures with foliar fertilizers.

Insecticide	Foliar fertilizer	Insecticide alone			Insecticide + Foliar fertilizer								
					I*			II*			III*		
		Con.	*V*	S.T*	Con.	V	S.T	Con.	V	S.T	Con.	V	S.T
Dursban	Greenzit	400	1.429	36.5	14000	1.143	36.5	14000	1.143	31.5	13000	1.143	33.0
Dursban	Bayfolan	400	1.429	36.5	45000	1.143	31.9	30000	1.143	33.5	45000	1.071	31.9
Nurelle	Bayfolan	300	1.143	36.5	50000	1.429	27.4	50000	1.429	27.4	50000	1.071	27.4
Nurelle	Greenzit	300	1.143	36.5	15000	1.071	31.9	16000	1.143	36.5	14000	1.000	36.5
Dc 806	Wuxal	300	1.143	31.9	10000	1.071	27.8	12000	1.071	27.4	11000	1.143	27.4
Teber	Wuxal	300	1.071	27.4	10000	1.071	27.4	12000	1.285	31.9	10500	1.071	28.0

1 * : Addition of formulated insecticide to the diluted foliar fertilizer
II * : Addition of formulated foliar fertilizer to diluted emulsion of insecticide.
III *: Direct adddition of formulated insecticide to formulated foliar fertilizer.
V. * : Viscosity (Centipoise)
Con.* : Conductivity (uMHOS)
S.T. * : Surface tension (dyne / cm.).

mineral elements present in the foliar fertilizers, as they increase the hydrophilicity of emulsion and the electrical diffuse layer which cause noticeable stability.

It should be mentioned that foliar fertilizers containing chelating agents, reacted with calcium and magnesium salts found in tap water , thereby decreasing its hardness (Table 3).

According to Behrens (1958) emulsion stability increases with the decrease of water hardness but to a certain level after which the emulsion stability decreases. This fact explains clearly the incompatibility of mixtures obtained by the addition of formulated insceticides to diluted foliar fertilizers. Foliar fertilizers seemed to decrease the hardness of tap water than the optimum level thus causing incompatibility.

The incompatibility of mixtures obtained by mixing formulated insecticides with formulated foliar fertilizers may be due to the reaction of the mineral elements of foliar-fertilizers with the emulsifier of the formulated insecticide.

Table 3. Effect of foliar fertilizers in decreasing the total hardness of water.

Treatment	Total hardness (ppm) Ca Co_3
Tap water	160
Bayfolan (diluted solution)	106
Greenzit (diluted solution)	53
Wuxal (diluted solution)	53

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طريقة الخلط كعامل هام محدد للتوافق الطبيعي بين الأسمدة الورقية والمبيدات

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المعمل المركزي للمبيدات – مركز البحوث الزراعية

أستخدمت ثلاث طرق لخلط الأسمدة الورقية والمبيدات. الطريقة الأولي بإضافة المبيد المجهز الي المحلول المائي للسماد الورقي، والثانيه بإضافة السماد المجهز الي المحلول المائي للمبيد ، والثالثه بالإضافة المباشرة للسماد المجهز الي المبيد المجهز ثم التخفيف في الماء .

وتم دراسة الخواص الطبيعية للمحاليل الناتجة مثل ثبات الإستحلاب ، الرغاوي ، التوصيل الكهربي والتوتر السطحي تحت معدل تخفيف الطائرة وذلك للمبيد بمفرده أو خلائطه مع الاسمده الورقيه بطرق الخلط المختلفة.

وتم الحصول علي عدة حالات للتوافق الطبيعي طبقا لطريقة الخلط.

والإستنتاج العام لهذا البحث أن التوافق يتأثر بطريقة الخلط ولذلك يجب ذكر طريقة الخلط التي نجحت في الإختبار في التوصيات حتي لا يتم الخلط بسواها في التطبيق الحقلي وتحدث نتائج غير مرجوة.