EFFECT OF SOME AGROCHEMICALS APPLIED ALONE OR IN BINARY MIXTURES ON BOTH THE CONTENT OF PLASTID PIGMENTS AND THE YIELD OF SOYBEAN

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ABSTRACT

The effects of some agrochemicals (as inducers) applied alone or in binary mixtures with certain acaricides on the content of plastid pigments and the yield of soybean were studied. In case of single application of agrochemicals, all treatment resulted in significant decreases of chlorophyll (a) chlorophyll (b) and total chlorophyll, but their effects on carotenoid varied between significant and no effect. The data also showed that among the tested agrochemicals, dicofol (as acaricide) and oxyfluorfen (as herbicide) caused the most significant effects on total chlorophyll with corresponding values of 3.44 and 3.87 mg/dm^2, reflecting percentage of reduction of 52.2 and 46.2%, respectively with respect to untreated control.

As for the effect of the interaction between tested acaricides and agrochemicals (as inducers) on the content of plastid pigments, the current results revealed that, all treatments resulted in significant effect on chlorophyll (a), (b), carotenoide and total chlorophyll except the interaction between Zn-chelated and bromopropylate treatment.

With respect to the effects of different treatments on soybean yield, it was quite clear that all treatments, expcept few cases, either applied singly or in pairs resulted in significant increase in the number and weight of pods/5 plants. The data also showed that, the effect of pair treatments was time-dependant. The most pronounced effect was noticed 48 hrs between the tested acaricides and the inducers.

INTRODUCTION

It is well known that, there is large number of foreign compounds that have shown to increase the activities of some enzyme systems that catalyzed the metabolism of xenobiotics in various plant and animal species including man (**Bernbaum *et al.*, 1977 and Alla 1996**)

This process of increased activity of these enzyme systems on exposure to chemicals is referred to as enzyme induction. A symposium in 1965 and a landmark review by **Conney in 1967** established the importance of induction in xenobiotic interactions.

Nowadays, weed control using herbicides is recommended for soybean fields in Egypt. Thus, it was necessary to determine the phytotoxic effect of the chemicals on soybean plants. Therefore, the plastid pigments content in soybean plants treated with pesticides alone or in combination with micronutrients, shoud be determined, because it considered one of the measurements of the degree of phytotoxicity (**Milivojevic and Markovic, 1989; Bierman *et al.*, 2006 and Bernal *et al.*,** 2007).

The major aims of this study is to determine the effect of different treatments including acaricides, herbicides or micronutrients alone or in combinations in pairs in photosynthesis chlorophyll (a) and (b), carotenoid and their total chlorophyll were calculated.

MATERIALS AND METHODS

I.Agrochemical used:

I.a. Acaricides:

- Propargite(68%) Bromite: 2-[4-(1,1-dimethylethyl)phenoxy] cyclohexyl 2-propynyl sulfite. A formulated sample (68% E.C.) was supplied by Uniroyal for Chemical Company U.S.A.
- Propargite(73%) Comite: 2-[4-(1,1-dimethylethyl)phenoxy] cyclohexyl 2-propynyl sulfite. A formulated sample (73% E.C.) was supplied by Uniroyal for Chemical Company U.S.A.
- Fenpyroximate: 1,1-dimethylethyl(*E*)-4-[(1.3-dimethyl-5-phenoxy-1*H*-pyrazol-4-yl) methyl-ene] amino]oxy]methyl] benzoate. A formulated (5% suspension concentrate) was supplied by Nihon Nohyaku Company Tokyo-Japan.
- Dicofol (Kelthane): 2,2,2- trichlor-1,1-bis (4-chloro-phenyl) ethanol. A formulated sample (18.5% E.C.) was supplied by Rohm and Haas Company.
- Bromopropylate (Noeron): Isopropyl 4,4- dibromo-benzilate. A formulated sample (50% E.C.) was supplied by Ciba-Gaigy AG-Egypt.

I.b. Inducers:

I.b.1. Herbicides:

- Flumeturon (Cotoran): *N,N*-dimethyl-*N'*-[3-(trifluoromethyl) phenyl]urea. A formulated sample (50% E.C.) was supplied by Ciba-Gaigy AG-Egypt.
- Fluazifop (Fusilade): (*RS*)-2-[4-(5-(trifluoromethyl)-2-pyridyloxy)phenoxy]propionic acid. A formulated sample (12.5% E.C.) was supplied from Manufacture Zeneca.
- Haloxyfop (Gallant): (*RS*)-2-[4-(3-chloro-5-(trifluoromethyl)-2-pyridyloxy) phenoxy] propionic acid. A formulated sample (12.5% E.C.) was supplied from (DowElanco)
- Oxyfluorfen (Goal): 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene. A formulated sample (24 % E.C.) was supplied from Manufacturer Rohm and Haas.
- Pendimethalin (Stomp): *N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine. A formulated sample (24 % E.C.) was supplied from American Cyanamid Company.

I. b.2.Micronutrients chelates:

- Fe-chelate: contains 12% ferric in the form of EDTA (ethylene diamine tetra acetic acid). A sample was supplied from El-Naser Company for feltilizer and pesticides.
- Mn-chelate: contains 12% manganese in the form of EDTA (ethylene diamine tetra acetic acid). A sample was supplied from Ciba- Geigy.
- Zn-chelate: contains 14% zinc in the form of EDTA (ethylene diamine tetra acetic acid). A sample was supplied from Ciba-Geigy.
- Boron: NaB2O7 the rate of application is 200g/200 liter water/fed

II. Leaf sampling, extraction and determination of chlorophyll and carotenoids:

Chemical analysis was carried out using leaf samples taken from the following treatments:

Plants treated with LC_{25} of acaricides. Plants treated with 1/16 of the concentration recommended per/feddan of the herbicides and micronutrients. Plants treated with 1/16 of the recommended concentration of herbicides. or micronutrients. then they treated with

$LC_{25}$of acaricides 24 hrs after the herbicidal and micronutritional treatments. Control treatment was treated with water.

Chlorophyll a, b and carotene were analyzed ten days after treatment using fresh leaves taken from the main stem on the fourth node from the apex. Leaf discs were taken from different leaf parts using cork borer. Five discs (one disc = 1.7 cm^2) were taken and the pigments were extracted by grinding in 95% aqueous acetone (20 ml) after adding a pinch of $CaC0_3$ to prevent pheophytin formation and the extract is filtered. After filtration, the volume of acetone solution was completed to 20 ml. the total chlorophyll pigments were determined by recording the absorbance on spectrophotometer at 662, 644 and 440 nm and the concentrations of photosynthetic pigments were calculated according to the following formulae of **Arnon (1949)**.

$$\text{Chl. a} = 9.784\ (O.D)_{662} - 0.99\ (O.D)_{644} = \text{mg/l}$$

$$\text{Chl. b} = 21.426\ (O.D)_{644} - 4.65\ (O.D)_{662} = \text{mg/l}$$

$$\text{Carotenoids} = 4.695\ (O.D)_{440} - 0.268\ (\text{chl. a} + \text{chl. b}) = \text{mg/l}$$

Where (O.D.) = Optical density at the wave length indicated.

The quantitative determination of chlorophyll pigments mg/d cm^2 according to the area of leaf and the degree of dilution of leaf can be calculated.

III. Yield determination:

The number of pods in five plants picked randomly from each replicate was counted. Each treatment was repeated four times. The average weight of the counted number of pods in grams was calculated. Then the average weight of seeds in each treatment was determined. Seed yield per feddan in tons was calculated from seed yield per plant.

RESULTS AND DISCUSSION

I. Effect of some agrochemicals on plastid pigments content of soybean leaves:

The mean values of chlorophyll (a). chlorophyll (b) and carotenoid (in mg/dm^2) in different agrochemical-treated soybean leaves are presented in Table (1). Data indicated that all agrochemical-treated leaves had significantly lower chlorophyll (a) and (b) than that of the control treatment. Some compounds were more effective than the others in this respect. In case of acaricidal treatments, the lowest contents in chlorophyll (a) and (b) were noticed in the leaves treated with bromopropylate and dicofol. while propargite(68%), propargite(73%) and fenpyroximate were equally effective against chlorophyll (a) content. The same trend of results was noticed in the determination of chlorophyll (b) with some slight variation. The data also revealed that although propargite(68%) and propargite(73%) has similar effects and increased the carotenoid content, but fenpyroximate was the most effective compound in this respect.

With regards to the effect of herbicides on plastid pigments, the results in Table (1) indicated, that although control treatment had the highest significant contents of chlorophyll (a) (3.59 mg/dm^2), and chlorophyll (b) (2.61) comparable to all tested herbicidal treatments. The data also revealed that within the herbicidal treatments, one can noticed that no significant differences were found between haloxyfop, fluazifop, and flumeturon treatments, where their contents of chlorophyll (b) were: 1.34, 1.37 and 1.52 mg/dm^2, respectively. Moreover, no significant difference was also present between pendimethalin, haloxyfop and fluazifop, where their chlorophyll (b) content were 1.24, 1.34 and 1.37 mg/dm^2, respectivily. In addition, oxyfluorfen had decreased chlorophyll (b) content significantly as compared with the other treatments.

When carotenoid content was determined, it was found that oxyfluorfen had decreased carotenoid content of soybean plants comparable to the other treatments including control. No significant differences were found between control, haloxyfop and fluazifop treatments, as their contents were 0.99, 1.16 and 1. 11 mg/dm^2, respectively. In addition, no significant difference was found between pendimethalin and flumeturon treatment. where their carotenoid contents were 1.47 and 1.31 mg/dm^2, respectively.

Chlorophyll contents in leaves of soybean plants treated with the tested micronutrients 10 days after application were determined and recorded in Table (1). The micronutrients decreased the content of chlorophyll (a) comparable to the control treatment. However, Fe and Mn chelate treatments showed moderate effects, where the chlorophyll (a) contents were 2.55 and 2.65 mg/dm^2. respectively. Zn chelated had significantly the lowest value compared with the other treatments where chlorophyll (a) content was 1.54 mg/dm^2. The recorded values of chlorophyll (b) indicated that the control had the highest value of chlorophyll (b) (2.61), while all tested microelements caused significant reductions. Mn chelated and Boron were the most effective microelements that significantly decreased chlorophyll (b). as their values were 0.51 and 0.65 mg/dm^2, respectively. Zinc chelated was the least effective element that decreased chlorophyll (b) with a value of 1.65 mg/dm^2 followed by Fe chelated which had a value of 0.97 mg/dm^2 and varied considerably from the other treatments.

Table (1): Effect of certain acaricides, herbicides and micronutrients on the chlorophyll content of soybean leaves 10 days after application.

Treatments	Conc.	Plastid pigments content mg/dm^2				% reduction
		Ch(a)	Ch(b)	Carotenoid	Total chlorophyll	
1- Acaricides	LC_{25}					
Propargite(68%)		2.42 b	1.69 b	1.28 a	5.39ab	25.0
Propargite(73%)		2.37 b	1.31 c	1.25 a	4.93ab	31.4
Fenpyroximate		2.44 b	1.71 c	0.59 c	4.20bc	41.6
Dicofol		1.60 c	0.88 d	0.96 b	3.44c	52.2
Bromopropylate		1.71 c	1.38 c	1.10 ab	4.19bc	41.7
2- Herbicides	1/16 R.R.					
Flumeturon	0.078 kg	2.07 b	1.52 c	1.31 cd	4.90b	31.8
Fluazifop	62.5 ml	2.17 b	1.37 bc	1.11 bc	4.65b	35.3
Haloxyfop	31.25 ml	1.98 b	1.34 bc	1.16 bc	4.48bc	37.7
Oxyfluorfen	46.88 ml	2.32 b	0.96 d	0.68 c	3.87d	46.2
Pendimethalin	62.5 ml	1.76 b	1.24 b	1.47 d	4.47cd	37.8
3-micronutrients	1/16 R.R.					
Fe-chelate	12.5 gm	1.84 c	0.65 d	0.76 d	3.25b	54.8
Mn-chelate	12.5 gm	2.55 b	0.97 c	1.04 b	4.56b	36.6
Zn-chelate	12.5 gm	2.65 b	0.51 d	0.84 c	4.00b	44.4
Boron	12.5 gm	1.54 d	1.65 b	1.34 a	4.53b	37.0
Control		3.59 a	2.61 a	0.99 b	7.19a	0.0

R.R. = Field application rate. Ch(a)= Chlorophyll (a), Ch(b)= Chlorophyll (b). Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

The effect of tested microelements on the carotenoid contents differed significantly from one treatment to another. Zn chelated-treated leaves had the highest carotenoid content among all treatments including control, while Boron had the lowest value in this respect. Zn chelated increased the content of carotenoid than control (1.34 and 0.99 mg/dm^2, respectively), while Fe chelated was as effective as control (1.04 and 0.99 mg/dm^2, respectively).Concerning the effect of tested microelements on total chlorophyll, the data clearly showed that there is no significant difference between all treatments. In other words. all microelements had similar effect on reducing the total chlorophyll. On the other hand, the untreated control treatment had much more total chlorophyll content comparable to all micronutrient treatments (7.19 mg/dm^2).

II. Effect of agrochemical interaction on the plastid pigments content of soybean leaves:

II.1. Effect of acaricides-herbicides interaction on the plastid pigments content of soybean leaves:

The inductive effects of the binary mixtures of tested acaricides and certain herbicides (pendimethalin, oxyfluorfen, haloxyfop, fluazifop and flumeturon) on plastied pogments were assayed. The results recorded in Table (2) indicated that, there were significant differences between control treatment and all other treatments, where the control treatment had the higher values of chlorophyll (a) (3.59 mg/dm^2), chlorophyll (b) (2.61 mg/dm^2) and carotenoid content (0.99 mg/dm^2) compared with the other treatments.

The results also revealed that significant effects on the content of plastid pigments were also found for each tested acaricide when being applied on soybean plants previously sprayed with the different herbicides, i.e. propargite(68%) when being applied on flumeturon or oxyfluorfen-treated leaves were the most effective treatments that reduced the total chlorophyll in soybean plants with values of 60.2 and 54.7 mg/dm^2 , respectively. On the other hand, the same acaricide when being used on leaves pre-treated with fluazifop, haloxyfop or pendimethalin resulted in moderate reduction of the total chlorophyll with values of 38.7. 41.9 and 43.8%, respectively.

Table (2): Effect of certain acaricides, herbicides and micronutrients on the chlorophyll content of soybean leaves 10 days after application.

Acaricide	Herbicide	Plastid pigments content mg/dm²				
		Ch(a)	Ch(b)	Carotenoid	Total chlorophyll	% Reduction
Propargite(68%)	Flumeturon	1.52d	0.69c	0.65d	2.86d	60.2
	Fluazifop	2.45b	1.16b	0.80c	4.41b	38.7
	Haloxyfop	2.18c	1.10b	0.90b	4.18b	41.9
	Oxyfluorfen	1.43d	1.18b	0.65d	3.26b	54.7
	Pendimethalin	2.35b	0.85c	0.84c	4.04b	43.8
Propargite(73%)	Flumeturon	3.05c	1.21c	1.27b	5.53bc	23.1
	Fluazifop	4.57a	1.92b	1.66a	8.15a	+13.4
	Haloxyfop	2.77d	1.12c	1.05c	4.94c	31.3
	Oxyfluorfen	1.90f	0.84e	0.74e	3.48c	51.6
	Pendimethalin	2.49e	0.91e	1.01d	4.41c	38.7
Dicofol	Flumeturon	1.52d	0.69c	0.65d	2.86d	60.2
	Fluazifop	2.45b	1.16b	0.80c	4.41b	38.7
	Haloxyfop	2.18c	1.10b	0.90b	4.18b	41.9
	Oxyfluorfen	1.43d	1.18b	0.65d	3.26b	54.7
	Pendimethalin	2.35b	0.85c	0.84c	4.04b	43.8
Bromopropylate	Flumeturon	3.47c	1.02b	1.44a	6.93b	3.6
	Fluazifop	3.21e	1.84c	1.63a	6.68c	7.1
	Haloxyfop	3.36d	1.22d	1.20b	5.78d	19.6
	Oxyfluorfen	3.11e	1.32d	1.14b	5.57e	22.5
	Pendimethalin	1.89f	1.17d	0.63c	3.69f	48.7
Fenpyroximate	Flumeturon	2.66b	1.83b	0.74c	5.23b	27.3
	Fluazifop	2.09d	0.93d	0.82b	3.84d	46.6
	Haloxyfop	1.93e	0.80e	0.74c	3.47e	51.7
	Oxyfluorfen	1.86f	0.71f	0.67d	3.24f	54.9
	Pendimethalin	2.59c	1.06c	0.95a	4.60c	36.0
Control		3.59a	2.61a	0.99a	7.19a	0.0

Ch(a)= Chlorophyll (a), Ch(b)= Chlorophyll (b). Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

Moreover, in spite of both propargite(68%) and propargite(73%) have the same chemical structure but their binary mixtures with fluazifop, differed drastically in their effects on the content of plastid pigments. In term of figures, propargite(68%)-fluazifop mixture reduced the total chlorophyll with a value of -38.7% while, propargite(73%)-fluazifop mixture increased the total chlorophyll with a value of +13.4%. These contradicted results might be due to the difference in their formulations or concentrations. However, these results agreed fully with the previous finding of Conney 1967 who reported that all inducers do not have the same effects, the effects tend to be non specific to the extent that any single inducer induces more than one enzymatic activity.

The current resultes also showed that the herbicide oxyfluorfen considered as a broad inducer as it increased the efficiency of all tested acaricides except bromopropylate. The interactions of dicofol, bromopropylate and fenpyroximate with tested herbicides were also evaluated. It is of interest to mention that using dicofol after fluazifop was the most effective on chlorophyll (a), while using it after flumeturon was the most effective on chlorophyll (b) and total chlorophyll content (Table 2).

With repect to bromopropylate-herbicidal interactions, the results revealed that the binary mixture of bromopropylate-flumeturon had very poor effect either on chlorophyll (a) (3.47 mg/dm^2) or total chlorophyll (6.93 mg/dm^2). The poor inductive effect of flumeturon: bromopropylate treatment on plastid pigments contradict drastically with the interaction of flumeturon-dicofol or flumeturon- propargite(68%) treatment. This results confirmed the statement of Conney (1967) that any single inducer could induce more than one enzymatic activity.

The interactions between fenpyroximate and different herbicides were also studied and the data revealed that oxyfluorfen considered the most effective inducer resulted in significant reduction on chlorophyll (a) (1.86 mg/dm^2), chlorophyll (b) (0.71 mg/dm^2), carotenoid (0.67 mg/dm^2) and total chlorophyll (3.24 mg/dm^2).

II.2. Effect of acaricide-micronutrients interaction on the plastid pigments content of soybean plants:

The effect of acaricides-micronutrients interaction on plastid pigments were recorded in Table (3) which revealed that the control treatment had the highest content of chlorophyll (a) (3.59 mg/dm^2), while Zn-chelated treatment with propargite (68%) had the lowest values on chlorophyll (a) (1.66 mg/dm^2), chlorophyll (b) (0.98 mg/dm^2), and total chlorophyll (3.39 mg/dm^2). The data also showed that Propargite(68%)-

boron treatment caused the lowest carotenoid content (0.43 mg/dm^2) compared to other treatments. Moreover, no significant difference in carotenoid content were observed between Fe, Mn, Zn and control, where their values were 0.96, 1.19, 0.75 and 0.99 mg/dm^2, respectively.

In case of propargite (73%)-micronutrients interactions, the data showed that, Zn and Mn treatment had the highest values of chlorophyll (a) (4.04 and 3.93 mg/dm^2) and total chlorophyll 7.05 and 6.27 mg/dm^2, respectively. The data also showed that Mn treatment had the highest value of chlorophyll (a) but it had the lowest one of chlorophyll (b) (1.53 mg/dm^2) comparable to the other treatments. Reviewing the resultes of dicofol-micronutrients treatments, one can noticed that, all micronutrients had equal moderate effect on total chlorophyll as their values ranged between 4.12 – 4.62 mg/dm^2. the resultes also revealed that, Boron affected significantly both of chlorophyll (a) (2.28 mg/dm^2) and chlorophyll (b) (0.85 mg/dm^2) but had no effect on carotenoid (0.99 mg/dm^2) which equal to the control treatment. The effect of bromopropylate on plastid pigments content of soybean leaves pre-treated with micronutrients was studied and the data are presented in Table (3). It is quite clear that Mn chelated was the most effective micronutrient that decreased the chlorophyll (a) content (2.16 mg/dm^2), while Zn chelated treatment had the highest chlorophyll (a) content (4.07 mg/dm^2). No significant differences were observed on chlorophyll (a) content between Zn, boron, Fe, and control treatments, where their values: 4.07, 3.51, 3.41 and 3.59 mg/dm^2, respectively. Control treatment had the highest chlorophyll (b) content comparable with the other treatments. On the other hand, boron treatment had the lowest chlorophyll (b) content. Mn chelated and Zn-chelated caused an equal effect on chlorophyll (b) (1.58 and 1.56 mg/dm^2), respectively. In addition, Fe chelated treatment had the highest chlorophyll (b) content comparable with other treatments except the control treatments.

Mn chelated treatment was statistically equal to the control treatment in its effect on carotenoid content. Moreover, Zn chelated was as effective as Boron on carotenoid content (1.41 and 1.35 mg/dm^2), respectively.

Table (3): Effect of different acaricides on plastid-pigments content of soybean plants treated with micronutrients

Acaricide	Herbicide	Plastid pigments content mg/dm²				
		Chl(a)	Ch(b)	Carotenoid	Total chlorophyll	% Red. of total chlorophyll
Propargite(68%)	Boron	3.53a	3.92a	0.43c	7.88a	+9.6
	Fe-chelate	2.47c	1.05d	0.96ab	4.48bc	37.7
	Mn-chelate	3.13b	1.45c	1.19a	5.77ab	19.7
	Zn-chelate	1.66d	0.98d	0.75b	3.39c	52.9
Propargite (73%)	Boron	3.54b	1.79b	1.31a	6.61bc	8.1
	Fe-chelate	3.59b	1.65b	1.24a	6.48c	9.9
	Mn-chelate	3.93a	1.53b	1.35a	6.27bc	12.8
	Zn-chelate	4.04a	1.59b	1.42a	7.05ab	1.9
Dicofol	Boron	2.28c	0.85c	0.99a	4.12b	42.7
	Fe-chelate	2.61b	1.06b	0.80b	4.47b	37.8
	Mn-chelate	2.71b	0.90c	1.01a	4.62b	35.7
	Zn-chelate	2.42c	1.03b	0.75c	4.20b	41.6
Bromopropylate	Boron	3.51ab	1.22d	1.35a	6.09ab	15.3
	Fe-chelate	3.41b	2.00b	1.18b	6.59ab	8.3
	Mn-chelate	2.61c	1.58c	1.01c	4.75b	33.9
	Zn-chelate	4.07a	1.56c	1.41a	7.04a	1.9
Fenpyroximate	Boron	2.47c	0.85b	0.96a	4.28b	40.5
	Fe-chelate	2.67b	0.95b	0.98a	4.60b	36.0
	Mn-chelate	1.67d	0.72c	0.79b	3.18b	55.8
	Zn-chelate	1.59e	0.51d	0.77b	2.87b	60.1
Control		3.59a	2.61a	0.99a	7.19a	0.0

Ch(a)= Chlorophyll (a), Ch(b)= Chlorophyll (b). Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

Regarding the effect of the different treatments on total chlorophyll content, the data revealed that equal effects were observed in case of the control, Fe, Zn-chelated and boron as their values were: 7.08, 6.59, 7.04 and 6.09 mg/dm², respectively. In addition, Mn chelated was the most effective element that decreased significantly the total chlorophyll content in soybean leaves (4.75 mg/dm²).

Treatment had the highest values of both chlorophyll (a) and (b) with values of 3.59 and 2.61 mg/dm², respectively. On the other hand Zn-chelated treatment had the lowest values for chlorophyll (a) (1.59

mg/dm^2), chlorophyll (b) (0.51 mg/dm^2) and carotenoid (0.77 mg/dm^2). The data also showed that all tested micronutrients were equally effective on the total chlorophyll content as there were no significant differences between their total chlorophyll values (Table 3).

Reviewing the previous data presented in Tables (1, 2 and 3), it is quite fair, in general to conclude that the inductive effects of spraying all tested acaricides on soybean leaves pre-treated with either tested herbicides or micronutrients resulted in significant reduction of the total chlorophyll expect few cases such as the treatments include the interaction of Propargite(73%) either Fluazifop or Zn-chelated.

Based on the percent reduction of the total chlorophyll content, it is quite clear that the magnitude of the phytotoxic action resulted from a single application of all tested compounds become more pronounced in case of using such compounds in binary mixtures. The phytotoxic action of most herbicides had been proved by many investigators (**Doger and Van Hair 1980; Foron *et al.*, 1975; Hogland 1984; Hough, 1985 and Knorzer *et al.*, 1996**) and might be potentiated by any toxic material such as acaricides. Inspite of the different mode of action of acaricides and herbicides, but at least the additive effect of the two compounds (acting separately according to their mode of action) on chlorophyll is expect. Also, the adjuvants which are expected to be different in both compounds are, responsible for the different responses of soybean plants to both compounds. No one can expect that, the additive materials (including solvents, surfactants, and other materials of different roles and different physical and chemical effects) have pronounced effects on chloroplast activity. The major difference in absorption and translocation rates of the herbicide.

The foregoing resultes agreed fully with many investigators. **Kakefuda *et al.* (1983)** showed that norflurozon inhibits carotenoid synthesis and impairs normal chloroplast development in soybean seedlings. In case of oxyflorfen there is a positive correlation between the magnitude of phytotoxicity and herbicidal concentration (Fabro and Robles, 1984). Norflurazon caused completely inhibited chlorophyll a, b and carotenoid synthesis in potatoes (**Zbiec *et al.*, 1985**). The adjuvant added to the herbicide may be responsible phytotoxicity found when three adjuvant were evaluated for their ability to reduce metribuzin phytotoxicity to soybean in sandy soils, a reduction in the herbicide phytotoxicity was observed but had no effect on soybean yields. On the other hand, no phytotyoxicity was evident after 20 weeks on soybean treated with oryzalin (**Blanco *et al.* 1988**). Pendimethalin (Stomp) was found by **Doulias (1990)** to cause severe phytotoxic symptoms on soybean plants.

III. Effect of some acaricides, herbicides, micronutrients alone and in combinations in pairs on soybean yield:

For this study, three acaricides we selected (Bromopropylate, Propargite (68%) and Dicofol), two herbicides (Flumeturon and Fluazifop) and one micronutrients (Fe-chelated) to be applied (alone or in pairs) on soybean plants during two seasons. The data are presented in Tables (4 and 5).

Table (4): Average number and weight of pods/5 soybean plants of different treatments during two successive seasons

Treatment	Mean number of pods/5 plants		
	First season	Second season	Total average
Propargite(68%)	465.7 h	472.00 L	468.84
Dicofol	358.67 m	363.33 k	361.00
Bromopropylate	297.00 h-m	302.0 c-k	299.50
Flumeturon	211.0 a-h	225.67 a-j	218.34
Fluazifop	207.33 a-g	207.33 a-h	207.33
Fe-chelate	281.0 e-m	314.33 g-k	397.67
Control	230.0 b-i	184.0 a-e	207.00

Table (4): Continued

Treatment	Mean weigh in grams of pods/5 plants		
	First season	Second season	Total average
Propargite(68%)	254.53 j	253.85j	254.19
Dicofol	235.27 j	235.28j	235.28
Bromopropylate	138.87 f-i	135.00 ghi	136.94
Flumeturon	90.82 a-f	92.35 ag	91.60
Fluazifop	102.03 b-h	103.60 bh	102.82
Fe-chelate	121.3 e-i	121.97di	121.64
Control	81.87 a-e	80.22ae	81.05

Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

The data in Table (4) indicated that propargite (68%) alone have the highest mean number of pods/5 soybean plants (468.84 pods) and the highest average weight (245.19 gram). The control treatment was also included in this comparison (207 pods) with an average weight of 81.05 gram. It is quit clear that the two herbicides (flumeturon and fluazifop) applied alone gained the lowest number of pods/5 soybean plants 225.67 and 207.33, respectively, comparable with the acaricides and Fe-chelated.

Table (5): Average number of pods/5 soybean plants of different treatments at indicated periods during two successive seasons

Treatment		Mean number of pods/5 plants		
		First season		
		24 hours	48 hours	72 hours
Flumeturon	Propargite (68%)	241.67 bi	277.33em	251.67ck
	Dicofol	228.67 bi	247.00cj	136.00a
	Bromopropylate	203.33 ag	325.67klm	192.00ae
Fluazifop	Propargite (68%)	219.67 ah	266.67cl	155.00ab
	Dicofol	193.33 ae	213.33ah	171.00abc
	Bromopropylate	206.33 ag	255.67cl	195.67af
Fe-chelated	Propargite (68%)	286.67 gm	330.00im	136.33a
	Dicofol	281.33 fm	316.00im	183.00ad
	Bromopropylate	227.67 bi	241.67im	185.00ad
Control		230.00 ai		
		Average weight of pods/5 plants		
Flumeturon	Propargite (68%)	135.01fi	141.58ghi	51.70 a
	Dicofol	111.13bh	110.32bh	53.43a
	Bromopropylate	93.31ag	149.39hi	50.78a
Fluazifop	Propargite (68%)	119.52di	121.02ei	71.79ad
	Dicofol	77.35ae	134.61fi	66.71ab
	Bromopropylate	91.05af	149.32hi	70.32abc
Fe-chelated	Propargite (68%)	118.73ci	160.36i	80.74ae
	Dicofol	159.59i	159.93i	147.63hi
	Bromopropylate	93.70ag	161.26i	90.43af
Control		80.87ae		

Table (5): Continued

Treatment		Mean number of pods/5 plants		
		Second season		
		24 hours	48 hours	72 hours
Flumeturon	Propargite (68%)	253.00bk	279.00dk	245.00aj
	Dicofol	228.00aj	284.30ak	138.30ab
	Bromopropylate	192.30af	201.70ag	121.00aj
Fluazifop	Propargite (68%)	212.30ah	266.70ck	155.00abc
	Dicofol	220.00ai	234.30aj	173.30ad
	Bromopropylate	258.00ck	304.70fk	195.70ag
Fe-chelated	Propargite (68%)	284.70dc	338.00ijk	130.00a
	Dicofol	287.00dk	313.00gk	184.30ae
	Bromopropylate	224.00aj	340.70jk	179.70ad
Control		184.00 ae		
		Average weight of pods/5 plants		
Flumeturon	Propargite (68%)	108.03bh	129.84fi	53.95a
	Dicofol	111.95bh	112.43bh	85.03a
	Bromopropylate	91.84ag	143.39hi	50.42a
Fluazifop	Propargite (68%)	116.13ci	122.9di	72.29abc
	Dicofol	73.80abc	127.24ei	65.80ab
	Bromopropylate	89.70ag	147.62hi	67.45ab
Fe-chelated	Propargite (68%)	117.84ci	161.13i	82.95af
	Dicofol	143.67hi	161.78i	72.06ad
	Bromopropylate	86.58af	151.12hi	81.99af
Control		80.22ae		

Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

The acaricides were applied after 24, 48 and 72 hours of spraying the inducer (micronutrients). The data exhibited that the number of pods/5 soybean plants at period of 24 hours are almost equal or less than that of the control (230 pods). In term of figures, flumeturon (inducer) combined with bromopropylate, propargite (68%) and dicofol gained number of pods after 24 hr. (203.33, 241.67 and 228.67, respectively). Moreover, the same trend of results was observed when fluazifop (inducer) was combined with the same three acaricides, as their number of pods/5 plants was less (206.33, 219.67 and 193.3 pods, respectively) than that of the control (230 pods). On the other hand, When Fe-chelated (inducer) was combined with the three acaricides, the number of pods/5 plants was more than that of the control one. The data of 48 hours period presented in Table (5) indicated that the number of pods/5 soybean plants was more in all treatments including the combination between each of flumeturon, fluazifop and Fe-chelated (inducers) with the three acaricides (bromopropylate, propargite (68%) and dicofol), than that of the control one. The only exception was that of the interaction between fluazifop and dicofol (213.33 pods) which was less than that of the control (230 pods). After 72 hours period the data exhibit that the number of pods/5 soybean plants in all treatments that involve all possible combinations in pairs between the three inducers and the three acaricides was less statistically than that of the control one. The only exception was that of Flumeturon-Propargite (68%) combination (251.7) which was more than that of the control (230). After 72 hours, the results indicated that the weight of pods/5 plants is in all cases, were more than that of control except the treatment between flumeturon (as inducer) and the three tested acaricides (bromopropylate, propargite(68%) and dicofol), which was less than that of control treatment. The most obvious yield in tested treatments was of Fe-chelated-dicofol (159.6, 159.93 and 147.63 grams periods of 24, 48 and 72 hours, respectively comparable with that of the control (80 grams) Table 5. While the single treatments (Table 4) exhibited that Propargite (68%) and Dicofol (acaricides) gained the most obvious yield (254 and 235 grams, respectively) comparable to that of the control (80 grams). Concerning the weight of seeds/5 plants, which considered the final score of the treatments, the average weight of seeds in different treatments included single or combination in pairs is' recorded in Tables (6) and (7).

The results clearly indicated that all single treatments including the three acaricides (bromopropylate, propargite (68%) and dicofol) and three inducers (flumeturon and fluazifop as herbicides and Fe-chelated as mineral nutrient) gained an average weight of seeds/5 plant more statistically than that of the control. The highest weight was of dicofol and propargite (68%) (110 and 137 gram, respectively) comparable to that of control (33.67 g). In addition, the combined treatments between the three acaricides and the-three inducers, gained an average weight of seeds/5 plants more statistically than that of the control one, with some exceptions in which the gained weight was equal to the average weight in the control (Table 7).

Table (6): Average weight of seeds/5 soybean plants of different treatments during two successive seasons

Treatment	Mean weight in grams of seeds/5 plants		
	First season	Second season	Total average
Propargite (68%)	137.19k	103.34k	120.27
Dicofol	110.13j	135.00L	122.57
Bromopropylate	69.29eh	73.79hij	71.54
Flumeturon	67.35eh	66.81fj	67.08
Fluazifop	75.16fgh	67.48gj	71.32
Fe-chelated	67.47eh	70.98fj	69.23
Control	33.67ab	32.30ab	32.99

Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

Table (7): Average weight of seed soybean plants of different treatments at indicated periods during two successive seasons

Treatment		Average weight of seeds/5 plants		
		First season		
		24 hours	48 hours	72 hours
Flumeturon	Propargite(68%)	56.49 cg	66.07dh	39.12abc
	Dicofol	59.64 cg	67.25ch	24.65a
	Bromopropylate	52.85bf	78.00ghi	30.38ab
Fluazifop	Propargite(68%)	68.01eh	69.71eh	32.57ab
	Dicofol	37.23abc	63.51dg	33.36ab
	Bromopropylate	48.12 be	74.40fgh	41.09abc
Fe-chelated	Propargite(68%)	59.15 cg	87.13hi	39.20abc
	Dicofol	97.57ij	110.49j	87.47hi
	Bromopropylate	47.83be	74.14fgh	43.89ad
Control		33.67ab		

Mean separation in columns designated by the same letter are not significantly differentat the 5% level by Duncan's multiple range test (DMRT).

Table (7): Continued

Treatment		Average weight of seeds/5 plants		
		Second season		
		24 hours	48 hours	72 hours
Flumeturon	Propargite(68%)	65.30ei	65.3 ei	56.28bh
	Dicofol	58.93ch	66.53fj	24.56a
	Bromopropylate	52.30bh	52.3bh	31.24ab
Fluazifop	Propargite(68%)	68.79fj	67.40fj	33.19ab
	Dicofol	36.49abc	62.32di	33.31ab
	Bromopropylate	47.88ag	77.19hij	41.11ae
Fe-chelated	Propargite(68%)	68.19fj	86.82ijk	59.36ch
	Dicofol	91.55jk	108.20k	37.39ad
	Bromopropylate	47.88ag	72.39gj	43.60af
Control		32.30ab		

The most obvious gain was achieved at 48 hrs period than those at 24 or 72 hours. While the most obvious treatment was of dicofol-Fe-chelated combination (97, 110 and 87 grams at periods of 24. 48 and 72 hours. respectively) comparable with control treatment (33.67 gm). It is clear that the data concerning the average number of pods/5 soybean plants. the average weight of pods/5 plants and the average weight of seeds/5 plants in all treatments in the 2nd season were, in most cases very similar to those data of the first season. The relative comparison between the two seasons in their measure exhibit the same trend in the two seasons.

Correlation between chlorophyll content in soybean leaves and weight of seeds:

The correlation coefficient between the two variables, chlorophyll content and weight of soybean seeds was calculated and presented in Table (8). The coefficient values (0.93) obviously indicate the high relationship between the two variables.

Unfortunately the conversion of light energy to chemical energy is brought about by flow of electrons through pigment systems in the chloroplasts. Light energy is absorbed by two pigment systems (photosystem that contain chlorophyll molecules and accessory pigments (e.g. carotenoids) acts as centers for trapping light energy. The enzymes responsible for CO_2 fixation and carbohydrate synthesis are located in the stroma of the chloroplasts. Accordingly, the high positive relationship between chlorophyll content and carbohydrate formation is expected to be reflected on seed weight and seed content.

Table (8): Correlation between chlorophyll content in soybean leaves and weight of seeds

Treatment	Total chlorophyll	Weight in grams of 100 seeds
Propargite (68%)	5.39	14.58
Dicofol	3.44	10.68
Bromopropylate	4.19	10.93
Flumeturon	4.90	14.41
Fluazifop	4.65	12.62
Fe-chelated	4.65	12.63
Flumeturon : Propargite (68%)	2.86	10.12
Flumeturon : Dicofol	4.86	13.62
Flumeturon : Bromopropylate	6.93	15.21
Fluazifop : Propargite (68%)	4.41	11.33
Fluazifop : Dicofol	4.22	11.05
Fluazifop : Bromopropylate	6.68	15.20
Fe-chelated : Propargite (68%)	4.48	12.58
Fe-chelated : Dicofol	4.47	12.58
Fe-chelated : Bromopropylate	6.59	14.59
Control	7.19	16.80

Correlation coefficient = 0.93

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الملخص العربي

تاثير بعض الكيماويات الزراعية المطبقة بطريقة فرديه او فى مخاليط على الصبغات النباتية وكذلك على المحصول فى نبات فول الصويا

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اجريت الدراسة بغرض القاء الضوء على دور بعض المركبات الزراعية كمبيدات الحشائش والمخصبات المحتوية على عناصر معدنية وتاثيرها المحتوى النباتى من الصبغات فى نبات فول الصويا. تم قياس المحتوى النبات من كلورفيل (أ) وكلورفيل (ب) والكاروتين وكذلك الكلورفيل الكلى كدالة للتسمم النباتى بعد مرور ١٠ ايام من المعاملة.

اولا: تاثير المعاملات المفردة : فقد اوضحت النتائج ان كل المعاملات احدثت خفض معنوى فى كلورفيل (أ) و(ب) اما التاثير على الكاروتين فكان فى بعض المعاملات معنوى وفى البعض الاخر غير معنوى. اما بالنسبى للكلورفيل الكلى فقد اظهرت النتائج ان كل المعاملات كان لها تاثير معنوى. مبيد الديكافول كان اكثر المركبات المختبرة تاثيرا اما بالنسبة للمخصبات التى تحتوى على عناصر معدنية لم يظهر لها اى تاثير معنوى.

ثانيا: تاثير المبيدات الاكاروسية والتدخل مع المواد الاخرى على المحتوى الكلورفيلى والكاروتين فى نبات فول الصويا. اوضحت النتائج ان كل المعاملات كان لها تاثير معنوى على المحتوى النباتى من كلورفيل (أ) وكلورفيل (ب) والكاروتين ما عدا بعض المعاملات القليلة. اما بالنسبة الكلورفيل الكلى فان كل المعاملات كان لها تاثير معنوى ما عدا (الزنك المخلبى + بروموبروبيليت). بينما كان افضل التاثيرات المشتركة بين مبيدات الحشائش والمبيدات الاكاروسية هى بروبارجيت (٦٨%) + فلوميتيرون و بروبارجيت (٧٣%) + اكسيفلوفين و ديكافول + فلوميترون و بروموبروبيليت + بيندميثلين بالاضافى الى فينبيروكسيمات + اكسيفلوفين.

ثالثا: تاثير المعاملات المختلفة على المحصول. فقد اوضحت النتائج ان المعاملات سواء منفردة او فى خلائط كان لها تاثير معنوى بالزيادة على المحصول النهائى وكانت افضل المعاملات هى استخدام المبيد الاكاروسى بروبارجيت (٦٨%) منفرد مع خليط من بروموبروبيليت + فلوازيفوس.