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PERSISTENCE OF SOME PESTICIDES IN RICE FIELDS

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ABSTRACT

The effects of treatment with pesticides on some rice yield components were studied. Results clearly indicated that carbofuran was the most effective on the weight of grain yield/hill, weight of 1000 grain, grain yield/fed. and straw yield/hill, these values were 38.39 gm, 35.23 gm, 4.04 ton and 33.66 gm, respectively. Diazinon came after carbofuran in their effect on the yield components of rice, the weight of grain yield/hill, weight of 1000 grain, grain yield/fed. and straw yield/hill, were 36.99 gm, 32.80 gm, 3.85 ton and 30.05 gm, respectively. The herbicide thiobencarb was not effective on all components of rice yield except the effect on the weight of grain yield/hill. The persistence of pesticides in rice fields under flooded conditions were studied. The residues of carbofuran in the water samples, were: 0.003, 0.034, 0.052, 0.028 and 0.020 ppm after zero time, one, two, three and four weeks of treatment, whenever these values in soil samples were: 3.231, 2.511, 1.782, 1.352, 0.971 and 0.850 ppm after zero time, one, two, three, four weeks and two months, respectively. Diazinon residues also detected in water and soil samples during the period of experiment, these values ranged from 2.203 ppm at zero time in the soil sample to 0.0004 ppm after four weeks in the water sample. The residues of thiobencarb in the rice field water were decreased from zero time 0.8647 ppm to 0.0065 ppm after 4 weeks of treatment, while these residues in the soil samples were increased from zero time to the second week and then decreased again. The residues of the tested pesticides were not detected in all samples of rice grain.

INTRODUCTION

Rice is one of world's most important food crops. It is a staple food for more than two billion people in Asia and for hundreds of millions of people in Africa and a Latin America. Because of the large number of people that depend on rice for their sustenance, annual production must increase by five million tons a year just to keep pace with population growth. In addition, rice consumption is increasing in developed countries.

Many pests (weeds, insects, fungs and animals) attack rice under flooded conditions from the seedling stage to maturity and feed on all parts of the plant (roots, stems, leaves and grains). Pests decreases the yield and lowers grain quality. This need to use pesticides in rice pest management programs to increase rice yield and grain quality.

This study deal with the proper use of certain pesticide in pest management for controlling rice pests to increase rice yield and grain quality with respect to persistence of these pesticides in the rice environment.

MATERIALS AND METHODS

I. Pesticides:

A. Insecticides:

- Carbofuran (Furadan 10% GR): 2, 3-dihydro-2,2-di-methyl-7-bnenzofuranyl-methyl carbamate. Supplied by FMS corporation USA.
- Diazinon (10% GR): o,o-diethyl-o-(2-isopropyl-6-methyl-4-pyrimedinyl) phosphorothionate. Supplied by Siba Geigy.

B. Herbicides:

- Thiobeencarb (Satern 50% E.C.): S-(4-chlorobenzyl) N,N-diethyl thiol carbamate. supplied by Kumiai Company, Japan.

II. Field evaluation:

This paper was carried at the farm of Faculty of Agriculture, Kafr El-Sheikh, Tanta Univ. Throw year 2001. Complete randomized block design with three replicates was used. Rice variety Sakha 102 was sown in the last week of April and transplanted after 35 days at spacing 20 x 20 cm. and the plot area was (3 x 5 m^2 = 1/280 fed.). Herbicide was applied after 7 days of transplanting. The recommended rate of granular insecticides were broadcasted by hand after 50 days of transplanting. Sampling was done before any insecticidal treatment and at harvest, samples of 5 hills each were randomly taken from the four middle rows in each replicate. From each replicate weight of 1000 grains, gm/hill, grain yield (ton/fed.) and straw yield gm/hill were determined.

III. Analytical procedure:

1. Extraction:

A. Water samples:

500 ml of treated water in the field was taken, 10 gm of anhydrous sodium sulphate was added and dissolved well, then 100 ml of methylene chloride was added and shaken well for 2-3 min. then methylene chloride was filtered throw sodium sulphate. 75 ml of methylene chloride was used twice and shaken well, then the methylene chloride layer were filtered throw sodium sulphate and collected. The collected extracts were evaporated to dryness by rotary evaporator, and dissolved in ethyl acetate and diluted. The diluted was ready to determine without clean up. Recovery percentages using this method were 98% for carbofuran, 93% for diazinon and 95.97% for thiobencarb.

B. Soil samples:

100 gm of dry soil homogenized sample were mixed with 200 ml acetone, then shaken for one hour using an electric shaker, then filtered throw cotton. 100 ml from the filtered were taken and evaporated, then partitioning with 50 ml of methylene chloride, repeated twice and collect the methylene chloride layer, then evaporated to dryness and dissolved in ethyl

acetate. Recovery percentages using this procedure were 98% for carbofuran, 86.95% for diazinon and 92.36% for thiobencarb.

C. Grain samples:

Grain samples were extracted with methanol, one hundred grams of representative sample were blended with 200 ml methanol for three min. The extract was filtered throw a bad of washed cotton into a 250 ml graduated cilender. Known volume of the extract was shaken successively with 70, 70 and 50 ml of methylene chloride in separatory funnel after adding 40 ml of sodium chloride solution (20%); then the water phase was discarded. The combined methylene chloride phases were dried by filtration throw unhydrous sodium sulphate. Then, it was evaporated just dryness using a rotary evaporator. The residues was dissolved in 5 ml methanol and keep for determine. Recovery percentages using this procedure were 98% for carbofuran; 95% for diazinon and 88.5% for thiobencarb.

iII. Chromatographic technique:

A Pye Unicam 4500 gas chromatograph equipped with a flame photometric detector operated in the phosphorus mode (526 nm filter) was used for determination diazinon. The column (1.5 m x 4 mm i.d. pyrex) was packed with 4% SE-30 + 6% OV-210 on gas chromosrb 80-100 mesh); temperature degrees were 230°C for column, 240°C for detector and 350°C for injector and gas flow was 30, 30 and 30 ml/min. for nitrogen, hydrogen and air, respectively.

GC systems-HP 6890 series equipped with a flame photometric detector operated in the sulpher mode (525 nm filter) was used for determination thiobencarb. Capillary column-PAS-5 (ECD tested ultra 2 Siloxane) 25 m x 0.32 nm, 0.52 Um film thickness. Temperature degrees were 250°C for injector and detector and 350°C for oven and gas flow was 74 ml/min. for hydrogen, 100 ml/min. for air and nitrogen carrier + make up nitrogen 15 ml/min.

Carbofuran was detected and determined using knauer HPLC equipped with a variable wave length detector, set at 280 nm. A Nucleosil 5 C_{18} analytical column (25 cm x 4.6 mm i.d.) was used and the mobile phase was mixture of acetonitrile/water (60: 40). The flow rate was 1 ml/min.

Statistical analysis of data was carried out according to Duncan's multiple range test (DMRT) (Duncan, 1955)

RESULTS AND DISCUSSION

A. Effect of pesticides on rice yield components:

The effects of pesticides treatments on rice yield components and straw yield were evaluated. Data in Table (1) clearly revealed that the granular insecticide carbofuran was the most effective insecticide in increasing the grain yield/hill (38.39 gm), the granular insecticide diazinon came in the second (36.99 g). On the other hand, the herbicide thiobencarb was the least

effective on grain yield/hill (35.31 gm). Data in Table (1) also pointed that the treatment with granular insecticide carbofuran significantly
effected on the weight of 1000 grain, it was, 35.23 gm. The granular insecticide diazinon also significantly effected on the weight of 1000 grain, but it was less than carbofuran (32.80 gm) while, the herbicide thiobencarb was not effective on the weight of 1000 grain, it was less than the check one. showed that the granular insecticides carbofuran and dizinon were highly effective on the grain yield (ton)/feddan, the values were 4.04 and 3.85 ton/fed. respectively, whenever the herbicide thiobencarb also was effective in increasing the grain yield/fed., the value was 3.43 ton/fed. Straw yield/hill also was significantly increased with carbofuran insecticide treatment (33.66 gm/hill), whereas the others treatments reduced the straw yield/hill (30.51 and 30.05 gm/hill) for thiobencarb and diazinon, respectively than control. These results were in full agreements with the findings of Khorsrowshahi *et al.*, 1979; Abdalla *et al.*, 1988; Zein *et al.*, 1994.

Table (1): Effect of pesticides on rice yield components.

Treatments	Grain yield gm/hill	Weight of 1000 grain gm	Grain yield ton/feddan	Straw yield gm/hill
Control	33.32	29.2	3.15	31.78
Thiobencarb	35.31	28.55	3.43	30.51
Diazinon	36.99	32.80	3.85	30.05
Carbofuran	38.39	35.23	4.04	33.66
L.S.D. 0.05	0.437	0.311	0.278	0.626

B. Pesticide residues on rice fields:

Data in Table (2) showed that the residues of herbicide thiobencarb at zero time was 0.8647 ppm whereas this value in the soil was 0.057 ppm, this value was gradually reduced in the water and increased in the soil at the same time, it were 0.0783, 0.0147, 0.0084 and 0.0065 ppm after one, two, three and four weeks in water, respectively. These values in soil samples were 0.723, 2.939, 2.648, 0.381 and 0.83after one, two, three, four weeks and two months after treatment respectively. In the end of season the residues of thiobencarb were not detected in grain samples of rice. Data in Table (2) pointed that the residues of the granular insecticide carbofuran were 3.231 ppm at zero time in the soil samples while it was 0.003 ppm in the water samples at the same time. This values were increased in the water samples after one week and two weeks, this increased may be due to slow release of the compound from the granular formulation it were 0.034 and 0.052 ppm, then gradually reduced after three and four weeks, it became 0.028 and 0.020 ppm respectively. Whenever the residue of carbofuran in the soil samples were decreased gradually after one, two, three, four weeks and two months, these values were 2.511, 1.782, 1.352, 0.971, 0.850 ppm, respectively. The residues of carbofuran in grain samples were not detected in the end of season.

The residues of diazinon were decreased from zero time to four weeks in the water samples and two months in the soil samples, these values ranged from 0.1968 at zero time to 0.0004 ppm after four weeks in the water

samples, but these values ranged from 2.203 ppm at zero time to 0.062 ppm after two months in the soil samples. The residues of diazinon insecticide in the grain were not detected after rippining of rice yield. From these results one can say that the granular insecticide carbofuran was the most effective in increasing the weight of grain yield/hill, weight of 1000 grain, grain yield/fed. and straw yield/hill followed by the granular insecticide diazinon, while the herbicide thiobencarb was the least effective, one.

Table (2): Pesticides residues in rice field under flooded conditions.

Treatments	Thiobencarb			Diazinon			Carbofuran		
Periods	Water ppm	Soil ppm	Grain ppm	Water ppm	Soil ppm	Grain ppm	Water Ppm	Soil ppm	Grain ppm
Zero time	0.8647	0.057	-	0.1968	2.203	-	0.003	3.231	-
One week	0.0783	0.723	-	0.0112	0.749	-	0.034	2.511	-
Two weeks	0.0147	2.939	-	0.0020	0.213	-	0.052	1.782	-
Three weeks	0.0084	2.648	-	0.0006	0.096	-	0.028	1.352	-
Four weeks	0.0065	0.381	-	0.0004	0.072	-	0.020	0.971	-
Two months	-	0.083	-	-	0.062	-	-	0.850	-
End of season	-	-	N.D	-	-	N.D	-	-	N.D.

The previous results agreed with thus findings of Ram and Pathak (1986) and Sherif (1986) who reported that carbofuran was the most effective compound of rice infection with stem borer. Moreover Abdullah *et al.* (1988) reported that Furadan was more effective in reducing all symptoms of infestation with the rice stem borer than diazinon when applied with the same rate and at the same time. Ahmed (1992) found that carbofuran and diazinon were effected significantly on the rice yield components. Many authors investigated the persistence of carbofuran on the rice field. El-Hadidi *et al.* (1991, 2001) pointed that the residues of carbofuran were found in soil after 8 weeks. Fullmer (1977) reported that Furadan in natural soils and in acid soils is capable to attain near-natural pH after incubation under flooding conditions that hastens their degradation, Venkatswerlu *et al.* (1977) found that heat treatment of flooded soil perior to its incubation insecticide increased the persistence of carbofuran. El-Bassyouni *et al.* (1988) reported that carbofuran was detected in treated soil and water till 21 days after treatment. Ahmed (1992) showed that the residues of carbofuran was detected in water till four weeks and in soil till two months. Thiobencarb residues in rice water and soil samples in periods ranged from 2-45 days were detected by many authors Ishikawa *et al.*, 1976; Suzuki *et al.*, 1977; Yamada *et al.*, 1979; Chen *et al.*, 1982; Mikuriya and Miyahara, 1985 and Ahmed 1992. Diazinon stability and degradation were subjected to intensive studies by many workers. Sethunathan and MacRae (1969); Sethnathan and Yoshida (1969); Williams (1977); Sethunathan (1972); Ahmed (1992) and Salama *et al.*, 1994.

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ثبات بعض مبيدات الآفات فى حقول الارز

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**المعمل المركزى للمبيدات ـ مركز البحوث الزراعية ـ الدقى ـ الجيزه

تم دراسة تأثير المعاملة بمبيدات الآفات على بعض مكونات الإنتاج المحصولى للأرز وقد أشارت النتائج إلى أن مركب الكربوفيوران كان أكثرها تأثيرا على كل القياسات المحصولية فقد وجد أن وزن الحبوب/جوره ووزن الألف حبه والإنتاج المحصولى/فدان ووزن القش الناتج/جوره هى ٣٨,٣٩ جرام ، ٣٥,٣٢ جرام ، ٤,٠٤ طن ، ٣٣,٦٦ جرام على الترتيب بينما كان تأثير مركب الديازينون يلى تأثير مركب الكربوفيوران على مكونات الإنتاج المحصولى وكانت أوزان الحبوب/جوره ووزن الألف حبه ووزن المحصول الناتج/فدان ووزن القش/جوره هى ٣٦,٩٩ جرام ، ٣٢,٨٠ جرام ، ٣,٨٥ طن ، ٣٠,٠٥ جرام على الترتيب. أما مبيد الحشائش الثيوبينكارب فكان غير مؤثر تأثيرا معنويا على أى من مكونات الإنتاج المحصولى فيما عدا وزن الحبوب الناتجة/جوره.

كما تم دراسة ثبات المبيدات المختبرة فى حقول الأرز تحت ظروف الغمر ووجد أن متبقيات الكربوفيوران فى الماء هى: ٠,٠٠٣ ، ٠,٠٣٤ ، ٠,٠٥٢ ، ٠,٠٢٨ ، ٠,٠٢٠ جزء/مليون وذلك بعد المعاملة مباشرة واسبوع ، أثنين وثلاثة وأربعة أسابيع من المعاملة بينما كانت قيم هذه المتبقيات فى عينات التربه هى ٣.٢٣١ ، ٢,٥١١ ، ١,٧٨٢ ، ١,٣٥٢ ، ٠,٩٧١ ، ٠,٨٥٠ جزء/مليون بعد المعاملة مباشرة وواحد وأثنين وثلاثة وأربعة أسابيع وشهرين على الترتيب. تم تقدير متبقيات الديازينون فى عينات الماء والتربه خلال فترة التجربة وقد تراوحت القيم التى تم تقديرها بين ٢,٢٠٣ جزء/مليون عند بداية التجربة فى عينات التربه حتى ٠,٠٠٠٤ جزء/مليون بعد أربعة أسابيع فى عينات الماء. أما مبيد الحشائش الثيوبينكارب فقد وجد أن متبقياته إنخفضت تدريجيا من بعد المعاملة مباشرة ٠.٨٦٤٧ جزء/مليون حتى ٠.٠٠٦٥ جزء/مليون بعد أربعة أسابيع من المعاملة فى عينات الماء بينما إزدادت قيم هذه المتبقيات فى عينات التربه حتى الأسبوع الثانى بعد المعاملة ثم بدأت فى الإنخفاض مرة أخرى وقد تبين من النتائج أن كل المبيدات المختبرة لم يتم إكتشافها بواسطة الأجهزة المستخدمة فى كل عينات الحبوب.