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Persistence of Cyanofenphos on Chinese Cabbage

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배추中 Cyanofenphos의 殘留消長

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Abstract

Persistence of cyanofenphos on Chinese cabbage under the different climate conditions was studied by spraying the insecticide at the rate of 0.5 and 0.75 kg AI/ha at 22 and 36 days after transplanting and monitoring its residues upto 35 days after the final spray. At both spraying rates the degradation patterns of the insecticide, regardless of climate condition, showed similar trends; cyanofenphos residues on Chinese cabbage declined rapidly upto 14 days after the final spray but more slowly thereafter. Half-life for cyanofenphos on Chinese cabbage was 6~7 days. The half-life was little affected by the spraying rate and time.

Based on the FAO/WHO maximum residue limit of cyanofenphos on common cabbage (2 ppm), it is recommended that the pre-harvest intervels of the insecticide on Chinese cabbage could be 16 and 19 days for 0.5 and 0.75 kg AI/ha, respectively.

Introduction

Chinese cabbage, *Brassica campestris* ssp, *perkinensis* Rupr., is an important vegetable crop in several Asian countries. This crop is attacked by various insect pests, such as diamond back moth, cabbage worm, cabbage looper, and aphids[1]. Farmers in this region in general, use large quantities of various insecticides throughout the growing season to protect their crop because some of these pests, at times, cause total destruction. Often, the chemicals or the quantities of these chemicals used by the farmers are neither registered nor recommended. As a result, products contaminated with excessive amounts of residues may reach the market.

Since the cyanofenphos is relatively new insecticide to be used for the control of Chinese cabbage insect pests, maximum residue limit and acceptable daily intake (ADI) have not yet been established in Taiwan and other Asian countries. Therefore, there is a particular need for establishing guideline for the safe use of this insecticide.

This paper reports the results of field experiments conducted at the Asian Vegetable Research and

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Development Center(AVRDC), Shanhua(12°17′E longitude and 23°07′N latitude) to obtain more information on the persistence of cyanofenphos on Chinese cabbage.

Materials and Methods

Cyanofenphos(O-P-cyanophenyl O-ethyl phenyl-phosphonothioate) 25 EC was obtained locally. Gifts of analytical grade cyanofenphos was obtained from Sumitomo Co., Osaka, Japan.

Chinese cabbage (cv. New King) seedlings were planted in twelve, 3.3×4.5 m plots on December 30, 1981. Each plot consisted of three 1.5 m wide and 3.3 m long beds and Chinese cabbage seedlings were transplanted in two rows on the top of each bed. After transplanting the plots were covered with rice straw mulch and irrigated.

Pesticide application: Pirimicarb 50 WP was sprayed at the rate of 0.5 kg AI/ha at 7 and 14 days after transplanting to control aphids. Dithane M 45 was also sprayed at the rate of 3.5 kg AI/ha every 10 days starting 7 days after transplanting to protect against diseases. Twelve plots were divided into three treatments each with four replicates. Cyanofenphos 25 EC was diluted 1 : 500 in a tankful of water and sprayed evently at the rate of 0.5 and 0.75 kg AI/ha at 22 (Jan. 21, 1982) and 36 (Feb. 4, 1982) days after transplanting. Before spraying, the equipments were calibrated to deliver accurate spray volume per plot at predetermined time. Control plots did not receive any cyanofenphos application.

Since the weather conditions affect the persistence of pesticide in the biological systems, an additional identical field experiment was conducted after the final harvest of the first. Cyanofenphos was sprayed at the rate of 0.5 and 0.75 kg AI/ha at 22 (Mar. 19, 1982) and 36 (Apr. 2, 1982) days after transplanting. All other management practices were identical to the first experiment.

Sampling: After second spray, four cabbage heads were taken from each plot at random on 0, 1, 3, 7, 14, 21, 28, and 35 days. Dried and diseased leaves were discarded and the heads from each plot were chopped in a Hobart Hood chopper and the plant material stored in polyethylene bags at −20°C until extraction and analysis for residues. Details of air temperature, relative humidity and rainfall during the experimental period were recorded.

Extraction of residues: Redistilled methanol-acetone-benzene(M : A : B), 1 : 1 : 1, solvent mixture was used to extract residues on Chinese cabbage.[2] The chopped plant material was thawed at room temperature, and a 50 g sample was weighed in an extraction thimble. Residues were quantiatively extracted using a 250 ml of M : A : B in a Soxhlet extraction apparatus for 12 hr at a rate of 8 solvent exchanges per hour. The extract was concentrated in a rotary flash evaporator at 35°C until most of the solvent had evaported. Residues were partitioned in benzene as described by Lichtenstein *et al.*[3] For the GLC analysis, the benzene phases were dried in flash evaporator at 30°C and adjusted to 50 ml with ethyl acetate.

Gas chromatography: Residues were analyzed on a Tracor Model 550 GC equipped with a Melpar flame photometric detector operated at 750 V and made sensitive to phosphorus by using a 526 nm interference filter. A 1.84 m×4 mm ID pyrex glass column packed with 10% DC 200 on 80~100 mesh Gas Chrom Q was preconditioned at 225°C for 72 hr before use. Gas flow rates in ml/min were N_2(Carrier) : 50, H_2 : 50, and air : 80. Temperatures were 200, 215, and 205°C for column, injector, and detector, respectively.

Procedural recovery tests were conducted to study the adequacy of the analytical method of cyanofenphos residues. Samples of chopped untreated Chinese cabbage leaves were fortified individually with analytical grade cyanofenphos to give a concentration of 0.05 and 0.1 ppm. The fortified samples were then extracted and analyzed in the same manner as the field Chinese cabbage samples. Average % recoveries were 94.5 and 92.7% for 0.05 and 0.1 ppm level, respectively. Residue values were not corrected for the recovery losses.

Results and Discussion

Fig. 1 shows the persistence pattern of cyanofenphos residues on Chinese cabbage at designated time after final spray. Persistence patterns at both application rates were similar. When sprayed at the rate

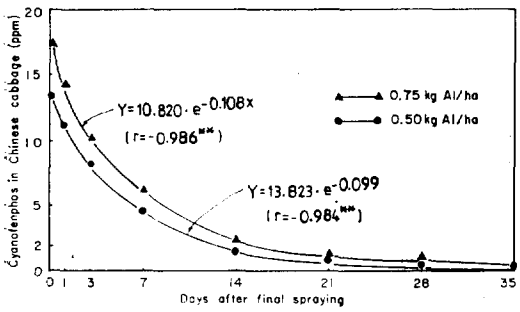

Fig. 1. Persistence of cyanofenphos residues on Chinese cabbage Final spraying date: Feb. 4, 1982

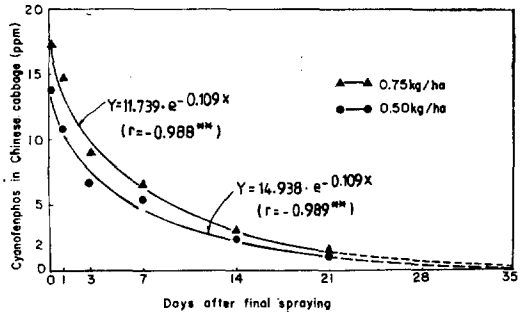

Fig. 3. Persistence of cyanofenphos residues on Chinese cabbage
Final spraying date: April 2, 1982

of 0.5 kg AI/ha, concentration of cyanofenphos reached to 4.575 ppm in 7 days, thereafter residues decreased rapidly, resulting 0.887 and 0.270 ppm for 21 and 35 days after final spray, respectively. In case of 0.75 kg AI/ha, amount of cyanofenphos residues on Chinese cabbage reached to 6.231 ppm in 7 days, thereafter declined to 1.260 in 21 days and then to 0.476 ppm when monitoring was discontinued at 35 days after final spray. Actually, there was no precipitation upto 10 days after final spray. But it rained 19 mm on 11th day after the final spray(Fig. 2). This results were different from the reports by Talekar *et al.*[4] They reported that when sprayed at the rate of 0.5 kg AI/ha, only 0.28 ppm of cyanofenphos residues remained in Chinese cabbage 7 days after final spray.

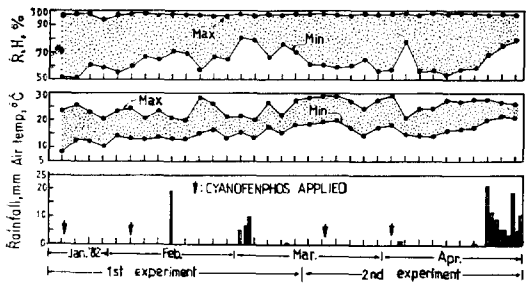

Fig. 2. Relative humidity, air temperature and rainfall during the experimental period

Fig. 3 shows the results of 2nd experiment conducted in the same field as the 1st experiment. There was no significant difference in persistence patterns of cyanofenphos on Chinese cabbage compared to the 1st experiment. Since the crop was severely damaged by the heavy rain from 21st day after final spray (Fig. 2), we could not monitor residues thereafter. The mean temperature and relative humidity upto 21 days after the final spray were 21.3°C and 78.9% and total rainfall was 3.56 mm (Fig. 2). Half-life for cyanofenphos on Chinese cabbage was 6~7 days. The half-life was little affected by the spraying rate and time (Table 1).

Table 1. Half-lives and pre-harvest intervals (days) for cyanofenphos on Chinese cabbage[a]

Application rate	Half-life		Pre-harvest interval	
	Experiment			
(kg AI/ha)	1st	2nd	1st	2nd
0.5	6.4	6.3	15.6	16.2
0.75	7.0	6.4	19.5	18.5

. Maximum residue limit for cyanofenphos on common cabbage: 2 ppm(FAO/WHO, 1975)

Based on the FAO/WHO maximum residue limit of cyanofenphos on common cabbage (2 ppm),[5] it is suggested that the pre-harvest intervals of the insecticide on Chinese cabbage could be 16 and 19 days for 0.5 and 0.75 kg AI/ha, respectively.

As the cyanofenphos is relatively new insecticide so far as control of Chinese cabbage insect pests is concerned, maximum residue limit has not yet been established in Taiwan and other Asian countries. Therefore, these data could serve a useful information in establishing guideline for the safe use of cyanofenphos.

要 約

배추中 cyanofenphos의 殘留消長을 栽培時期를 달리하여 調査하였다. 배추 移植後 22日과 36日에 cyanofenphos 25EC를 0.5와 0.75 kg AI/ha의 比率로 各各 撒布하고 最終撒布後 35日까지 殘留量을 調査한 結果, cyanofenphos의 分解樣相은 栽培時期와는 無關하게 兩藥量水準에서 비슷한 傾向을 보였다. 즉 最終撒布後 14日까지는 배추中 cyanofenphos가 急激히 減少하였으나 그 후로는 比較的 徐徐히 減少하였다. 배추中 cyanofenphos의 半減期는 6~7日이었으며, 撒布時期와 撒布率에 따른 差異는 별로 없었다.

洋배추中 cyanofenphos의 殘留許容量인 2 ppm을 基準하여 볼때, 收穫前 撒布日은 0.5와 0.75 kg AI/ha에서 各各 16, 17日로 추정된다.

References

1. Asian Vegetable Research and Development Center (1978): *Vegetable Pest Control, Insecticide Evaluation Tests.*
2. Lichtenstein, E. P., Fuhreman, T. W., Schultz, K. R. and Liang, T. T. (1973): Effects of field application methods on the persistence and metabolism of phorate in soils and its translocation into crops, *J. Econ. Entomol.*, **66**, 863.
3. Lichtenstein, E. P., Schultz, K. R. and Fuhreman, T. W. (1972): Movement and fate of Dyfonate in soils under leaching and nonleaching conditions, *J. Econ Entomol.*, **20**, 831.
4. Talekar, N. S., Sun, L. T., Lee, E. M., Chen, J. S., Lee, T. M. and Lu, S. (1977): Residual behavior of several insecticides on Chinese cabbage, *J. Econ. Entomol.*, **70**, 689.
5. FAO/WHO (1976): *Report of the 1975 joint FAO-/WHO Meeting on Pesticide Residues in Food*, Food and Agriculture Organization of the United Nations, Rome, 27p.