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The Effectiveness of Different Methods of Placement of Carbofuran at Root zone vs other Methods Against the Brown Planthopper, *Nilaparvate lugens* Stal in rice

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Different methods viz., 'hole method', 'toilet paper method,, 'mud ball method' and 'capsule method' @ 2.0 kg. a. i/ha applied to the root zone of rice plants in micro field plots were compared with the conventional standing water application, insecticide incorporated into the soil and puddled prior to planting and conventional root dips in 0.05% for their effectiveness and persistance against adults of brown planthopper (BPH). Placement of insecticide near the root zone by any of the four methods was more effective and persistant and was significantly superior to the other methods. Of the 4 methods of root zone placement, direct placement by hole method was significantly less persistent over the other three methods. The mud ball or toilet paper method being cheaper and feasible than the costly capsule method could be adopted with advantage for prolonged effectiveness. When considerable menace of BPH is faced right from transplanting, adoption of seedling root dip method should be adopted for effective protection for 15 days.

Due to repid microbial and chemical degradation of the insecticides in the standing water and washing out of the insecticides by rains, 3 to 4 broadcast applications are generally required to provide season long control of rice pests. The concept of root zone application of insecticides in rice pest control was developed originally at IRRI with insecticide placement in the protected reduced areas. The relative effectiveness of four different methods of placement of carbofuran at root zone were tested and compared with three other methods together with an untreated check in micro field plot trial against the BPH.

MATERIAL AND METHODS

Carbofuran @ 2.0 kg a.i/ha was applied to *Jaya* grown at 20cm × 20cm spacing in micro field plots of 2 × 2m. Each micro field plot had a bund around and was separated from the adjacent one by 0.50*m* wide channel to minimise direct seepage or flow of water from one treatment into the other. Water was kept impounded at 3-5 cm level in the micro field plots throughout the investigation period. Seven different methods of placement of carbofuran in micro field plot besidses an untreated control formed the treatments.

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Treatment:

1. Hole method: Required amount of insecticide was dropped in small holes made near the root zone of each plant and holes plugged with soil.

2. Toilet paper method : Required amount of insecticide wrapped in bits of toilet paper was pushed into the soil near the root zone of each plant.

3. Mud ball method: Small mud balls were prepared with insecticide in it. They were dried and pushed into the soil near the root zone of each plant.

4. Capsule method: Required amount of insecticide was packed in medicated capsules of '00' size and pushed into the soil near the root zone of each plant.

5. Standing water application: Insecticide was uniformly broadcast on soil water (conventional).

6. Incorporated into soil and puddled prior to planting: Insecticide was first distributed evenly on the plot, then puddled by manual labour and transplanted.

7. Root dips: (Conventional): Roots of seedlings were dipped in 0.05% solution for 12 hours prior to planting.

8. Untreated Plots: Control

A new technique for bioassay studies was adopted. Excluding border plants, three plants were randomly romoved each time from each treatment. The plants were washed thoroughly to free from field soil. The root portion was wrapped in wet cotton over which a piece of polyethylene sheet was tied. This allowed retention of the freshness of the plant parts for atleast 60 hrs. The plants thus tied were kept in glass chimneys tied at both ends with muslin cloth. Adult insect releases were made on these plants kept at regulated temperature of 26-28°C and 60-65% relative humidity in laboratory. The insecticidal persistence was evaluated on plants uprooted from field at 1,5,10. 15, 20,25.30,35, 40 and 45 days after insecticidal treatment.

Methods of analysis of data:

1. PT value: PT value which is the product of average percentage residual toxicity (T) and the period (P) for which some toxicity is observed was calculated by the method described and adopted by Saini (1959).

2. LTP 50 (in days): The time required by the insecticide deposit to degrade to the strength of causing 50% mortality of the test insect was calculated by simple regression equation $Y = y + b(x - \bar{x})$.

3. Statstical analysis of mean corrected percent mortalities for arriving at treatment differences: The corrected percentage mortalities obtained at different periods were

totalled up and divided by the maximum number of observations taken on the most persistent candidate insecticide to arrive at the replication wise mean percent corrected mortality. These were transformed to angular values which were subjected to normal analysis of variance under complete randomised block design.

RESULTS AND DISCUSSION

The results showed that the placement of insecticide through the mud ball, toilet paper and capsule methods was not immediately available in the plant as evidenced from 0 to 33.3% insect mortality obesrved at one day after treatment while all other methods gave 53.3 to 100.0% Table. The presistence in the root dip treatment was completely lost by the 25th day, while in the 'hole method' by 40th day and in all the others by the 45th day.

Based on the 'PT' values, the persistent toxicity of the different methods were in the following order: toilet paper (2851) > capsule (2817) > mud ball (2545) > hole method (2444) > incorporated into soil and puddled prior to planting (2085) > standing water application (1691) > and root dips in 0.05% concentration for 12 hours (1577). Aquino and Pathak (1976) reported more residues of carbofuran at root zone than in the broadcast method. These results also revealed similar trends of persistency of carbofuran at root zone than any other method of application. The persistence of the root dip was almost as good as the standing water application However, incorporation into soil and puddled prior to planting was some what superior to standing water application. Aquino and Pathak (1976) reported more persistence when carbofuran was incorporated into the top soil than in the standing water application which are in confirmity with these results.

Placement at root zone by any method increases its persistence considerably in comparison to the surface application. The data reveal that placement of carbofuran at root zone by any method was effective for only 35 to 40 days, while Pathak (1974). Choi (1975) and Sama and Van Halteran (1976) reported that the effectiveness of carbofuran as root zone application varied from 40 to 80 days in the fields in philippines, Korea and Indonesia, respectively. Placement at root zone through toilet paper or capsule or mud ball method was better than hole method. This was evidently because of the slower rate of release of insecticide for a prolonged period in the former over the latter.

Taking into consideration the LTP 50 values, the efficacy of the different treatments was in the following order: capsule (31.5 days) > toilet paper (31.3 days) > mud ball (29.2 days) > hole method (25.7 days) > incorporated into soil and puddled prior to planting (21.5 days) > standing water application (18.6 days) > and root dips (14.9) days.

An analysis of overall mean percent mortalities obtained till all the treatments lost their toxicity showed significant differences. Conventional root dips in 0.05% for 12 hours remained effective for only 14.9 days to give 50% mortality (LTP 50), the standing water application and insecticide incorporated into soil and puddled prior to planting remained for longer period (LTP 50-18.6 and 21.5 days). However, placement of the insecticide in the root zone either by capsule method or by toilet paper method or by mud ball technique were almost equal in effectiveness and persistence (LTP 50-29.1 to 31.5 days) and were significantly superior to the 'hole method' (LTP 50-25.7 days) and outstandingly significantly superior to the root dips, standing water application and insecticide incorporated into soil and puddled prior to planting As the empty medical capsules are costly, the mud ball or the toilet paper technique could be cheaper substitute, under Indian conditions for the root zone placements in the control of BPH.

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TABLE I Relative efficiency and persistence of different methods of application of carbonfuran against BPH adults (9-2-77 29-3-77)* Applied @ 2.0 kg. a.i/ha

Treatment	% corrected mortality/age of residue in days										'PT' value	LTP 50 in days	Mean % Mortalities	Mean angular values
	1	5	10	15	20	25	30	35	40	45				
Hole method	53.3	100.0	93.0	100.0	93.3	28.5	23.3	33.3	0	—	2443.9	25.7	58.0	49.60
Toilet paper	26.6	93.3	100.0	96.3	83.3	57.1	63.3	56.6	16.6	0	2851.0	31.3	66.0	54.33
Mud ball	0	73.3	86.6	96 2	90.0	53.5	33.3	63.3	20.0	0	2545.2	29.1	64.7	53.53
Capsule	33.3	86.6	100.0	96.2	100.0	57.1	43.3	60.0	23.3	0	2816.6	31.5	66·8	54.82
Standing (Paddy) Water application	93 3	93.3	80.0	29.5	23.3	25.0	6.6	26.6	16.6	0	1691.1	18.6	43.8	41.40
Incorporation in to soil puddled prior to planting	86.6	100.0	40.0	70.3	66.6	21.4	30.0	33.3	20.0	0	2085.3	21.5	52.9	46.57
Root dips in 0.05% for 12 hrs.	100.0	86.6	86.6	86.6	13.3	0	0	0	0	0	1556.7	14.9	41.5	40.10
% morality in control	0	0	0	10.0	0	6.6	0	0	0	0				
C. D.													(0.05) (0.01)	2.12 2.95

Max. temp. = 36.6°C
Min. temp. = 12.8°C

Mean Max. temp. = 33.3°C
Mean Min. temp. = 21.0°C
Mean RH. = 71%