REDUCING PESTICIDE COSTS IN RICE USING TUNGRO RESISTANT VARIETIES¹¹

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ABSTRACT

Insecticide-sprayed and unsprayed IR64, rice variety susceptible to tungro virus had very poor growth and very low yield compared to the intermediate and resistant varieties. As a result, higher net profit was observed on PSB Rc18 (resistant variety) during the dry season, while a negative profit per cropping was obtained on the sprayed and unsprayed susceptible variety. The study implies that cypermethrin is not effective in controlling rice tungro disease, thus the use of resistant varieties is more effective and profitable.

KEY WORDS: Reduced pesticide used. Rice. Tungro. Resistant varieties.

¹¹ *Part of the M.S. thesis of the senior author*

INTRODUCTION

New varieties with different agronomic characteristics, yield and pest resistance potential have been approved and released for commercial production by the International Rice Research Institute (IRRI) and Philippine Rice Research Institute (PhilRice). However, one of the many diseases that has always been a threat to the rice farmers is the rice tungro virus disease. It is now considered as the most common and destructive among the different rice diseases.

To date, tungro resistant rice varieties are available and released by the Rice Varietal Improvement Group (RVIG) of the Philippine Seedboard (PSB) for commercial production. However, many farmers were unaware of the advantages of using these varieties, thus, this study was conducted with the following objectives: 1) to monitor the green leafhopper population and correlate it with tungro incidence, 2) to evaluate the effectiveness of insecticide sprays commonly used by rice farmers for the control of the rice tungro virus, and 3) to determine the economics of these control measures against tungro disease,

METHODOLOGY

Field experiments were conducted for two cropping seasons in a 3,600m² paddy. About 5 kg of the tungro susceptible IR64 variety and 1 kg of IR 60, IR72, IR74 and PSB Rc 18 were obtained from PhilRice. A wetbed method of raising seedlings was followed. Susceptible/infectior plants were planted 2 weeks ahead of the test plants to ensure rice tungro disease infection in the area. Two to three seedlings were planted per hill with a distance of 20 cm x 20 cm in a 4 m x 4 m plot, consisting of 20 hills x 25 hills or a total of 500 hills per plot.

Nine treatments with 3 replications were used in this experiment: IR64 (S) no spraying, IR64 (S) sprayed at ETL, IR64 (S) sprayed weekly, IR64 (S) sprayed bi-weekly, IR64 (S) sprayed monthly, IR60 (I) no spraying, IR72 (I) no spraying, IR74 (R) no spraying and PSB Rc 18 (R) no spraying. The insecticide sprayed was Cymbush EC (cypermethrin®).

Data collection was done on the green leafhopper (GLH) population and disease parameters like rice tungro disease onset and percent disease incidence. Yield and yield components per plot were also gathered using the formula:

$$\text{Yield (t ha}^{-1}\text{)} = \frac{\text{APY (gm)}}{\text{APS (sq.m.)}} \times \frac{10,000 \text{ (sq.m.)}}{1 \text{ (ha)}} \times \frac{1 \text{ (kg)}}{1000 \text{ (g)}} \times \frac{\text{(ton)}}{100 \text{ (kg)}}$$

Where:

APY = Actual Plot Yield
APS = Actual Plot Size

The cost and return analysis was calculated to determine the economics of each control tactic used. All production costs with emphasis on each control tactics were recorded. Returns were calculated by multiplying the yield (kg) of the crop with the current price per kg produced less all production costs.

RESULTS AND DISCUSSION

Correlation of Leafhopper Population and Tungro Incidence

GLH population counts based on 5 sweeps per plot showed no significant differences between treatment during the early tillering, maximum tillering and flowering stages of the crops on sprayed and unsprayed susceptible IR64 variety. However, higher counts of GLH was observed on maximum tillering stage, which suggests that GLH population is at its peak during this stage. This maybe attributed to the dense plant tillers which favored the increased in GLH population. Nasu (1963) reported that favorable microclimate in the host plant and available food supply increase leafhopper population.

The GLH population counts show that cypermethrin spraying was not effective in reducing their population (Table 1). Thus, susceptible IR64 sprayed weekly consistently showed higher insect counts from early tillering up to the flowering stages of the crop while the resistant (PSB Rc18) with no spraying treatments showed lower population counts at each stage of the crop.

Effect of Insecticides in Tungro

Generally, susceptible IR64 (no spraying and sprayed at varying frequencies) showed relatively high disease incidence starting 2 weeks after transplanting (WAT) until the 7 WAT (Fig. 1); some of the sprayed treatments had slight variation but no trend was observed to show the effectiveness of using cypermethrin in reducing the tungro incidence. The same trend was also observed during the dry season cropping. This result showed that since the tungro disease was already established in the susceptible IR64 variety, spraying with cypermethrin

Table 1. Green leafhopper (GLH) population count on susceptible IR 64 sprayed with Cypermethrin at varying frequencies and unsprayed intermediate and resistant varieties.

Wet Season

Treatment	Crop Stage		
	Early Tillering	Maximum Tillering	Flowering
No spraying-IR 64 (S)	4.00	5.33	4.00
Sprayed at ETL-IR 64 (S)	5.33	5.00	3.00
Sprayed Weekly – IR 64 (S)	5.00	4.67	5.00
Sprayed Bi-weekly-IR 64 (S)	4.00	5.33	2.67
Sprayed Monthly-IR 64 (S)	3.67	5.00	4.00
No Spraying-IR 60 (I)	3.00	5.00	2.67
No Spraying-IR 72 (I)	3.33	4.33	3.00
No Spraying-IR 74 (I)	2.33	3.67	2.67
No Spraying-PSB Rc 18 R	3.00	3.67	2.67
C.V. (%)	46.49	37.04	44.32

^{1/} Average count at 5 sweeps per plot, mean of 3 replications

Dry Season

Treatment	Crop Stage		
	Early Tillering	Maximum Tillering	Flowering
No spraying-IR 64 (S)	4.33ab	8.33a	4.00abc
Sprayed at ETL-IR 64 (S)	4.33ab	7.00abc	4.00abc
Sprayed Weekly – IR 64 (S)	5.33a	9.00a	6.00a
Sprayed Bi-weekly-IR 64 (S)	4.00ab	8.33a	4.67abc
Sprayed Monthly-IR 64 (S)	5.00a	7.33ab	5.00ab
No Spraying-IR 60 (I)	3.67ab	5.33bcd	2.67bc
No Spraying-IR 72 (I)	4.00ab	5.00cd	3.33bc
No Spraying-IR 74 (I)	2.33b	4.67de	2.33c
No Spraying-PSB Rc 18 R	2.33b	2.67e	2.33c
C.V. (%)	33.52	19.00	37.50

^{1/} Average count at 5 sweeps per plot, mean of 3 replications

Means followed by a common letter in a column are not significantly different at 5% level by DMRT.

Wet Season

Dry Season

Figure 1. Comparative tungro incidence (%) at weekly interval of susceptible IR 64 sprayed with Cypermethrin at varying frequencies and intermediate and resistant varieties.

did not lower disease incidence. Most probably a portion of the GLH population was left unaffected by spraying, since the neighboring plots were planted with intermediate and resistant varieties. The insects were forced to stay or return to the susceptible variety which was preferred for feeding. Reports from IRRI (1974) showed that insecticide spraying would not be effective unless it was sprayed over a wide area.

Moreover, unsprayed intermediate and resistant varieties showed significantly lower weekly disease incidence rating. As a result of continuing search for resistant rice varieties, (Pathak, Cheng and Fortuno, 1969) found that some varieties are resistant to the vectors and to the tungro virus.

Yield and Yield Components of Rice

No significant differences were observed on the various yield parameters of susceptible IR64 variety (Tables 3 & 4). However, among intermediate (IR72) and resistant (IR74 and PSB Rc18) varieties, the number of productive tillers significantly differed with the IR 60 and IR 64 treatments. The number of non-productive tillers of IR72, IR74 and PSB Rc18 (No spraying) treatments varied significantly with IR64 (No spraying, sprayed at ETL and weekly spraying). For the number of filled grains per panicle, PSB Rc18 (No spraying) treatments had the highest, followed by IR 74. With regard to the weight of 1000 seeds, the highest was observed on IR74, followed by PSB Rc18 and IR72, while significantly low weights were observed on IR64 (No spraying and sprayed treatments) because of high tungro infection in all these treatments. Observation on yield showed the PSB Rc18 (no spraying) treatment had the highest yield, followed by IR74 (no spraying) and IR72 (no spraying).

The yield parameters such as number of filled and unfilled grains per panicle, weight of 1000 seeds in grams and yield in tons per hectare have shown that PSB Rc 18 had the highest yield, followed by IR 74 and IR 72. A very low yield was obtained from IR 64 (no spraying) treatment. Moreover, higher weight of 1000 seeds and yield produced per hectare on PSB Rc18 was noted.

Tablé 3. Yield and yield component of susceptible IR 64, sprayed with Cypermethrin at varying frequencies and unsprayed intermediate and resistant varieties (Wet season)^{1/}.

Treatment	Yield Components					
	Tiller No./hill		Grain/Panicle		1,000 Grain Seed Wt. (g)	Yield (t ha ⁻¹)
	Productive	Non-productive	Filled	Unfilled		
No spraying -IR 64 (S)	6.33c	7.67ab	47.50d	29.33a	18.02cd	1.46e
Sprayed at ETL-IR 64 (S)	6.67bc	8.67a	51.16d	23.33b	18.43cd	1.52e
Sprayed Weekly-IR 64 (S)	6.67bc	7.67ab	50.28d	21.00b	16.68d	1.87de
Sprayed Bi-Weekly-IR 64 (S)	8.67bc	6.00bc	52.77d	20.67b	18.67cd	1.67e
Sprayed Monthly-IR 64 (S)	7.33bc	6.33abc	54.73d	23.67b	19.41c	1.35e
No Spraying-IR 64 (I)	9.00b	5.33bc	69.65c	15.67c	19.84bc	2.55ed
No Spraying-IR 72 (I)	13.33a	4.00c	83.77d	13.67c	21.69ab	2.95bc
No Spraying-IR 74 (I)	14.33a	4.67c	91.23ab	13.00c	23.55a	3.54ab
No Spraying-PSB Rc 18 R	15.33a	4.00c	97.93a	12.33c	22.00a	4.04a
C.V (%)	13.51	21.09	10.11	11.32	5.99	17.39

^{1/} Mean of three replications.

Means followed by a common letter are not significantly different at 5% level (DMRT).

Table 4. Yield and yield component of susceptible IR 64, sprayed with Cypermethrin at varying frequencies and unsprayed intermediate and resistant varieties (Dry season)^{1/}.

Treatment	Yield Components					
	Tiller No./hill		Grain/Panicle		1,000 Grain Seed Wt. (g)	Yield (t ha ⁻¹)
	Productive	Non-productive	Filled	Unfilled		
No spraying -IR 64 (S)	8.33e	7.33a	50.67d	25.33a	17.28e	1.12e
Sprayed at ETL-IR 64 (S)	10.00e	6.67ab	50.33d	21.33a	17.68de	1.39de
Sprayed Weekly-IR 64 (S)	12.00c-e	5.33bc	50.67d	24.00a	18.22ce	1.23de
Sprayed Bi-Weekly-IR 64 (S)	11.67de	5.33bc	52.67d	23.33a	18.93be	1.69de
Sprayed Monthly-IR 64 (S)	12.00c-e	4.67c	54.33d	21.67a	19.35b-e	1.74de
No Spraying-IR 64 (I)	14.67b-c	4.00cd	76.67c	16.67b	20.87a-c	2.28cd
No Spraying-IR 72 (I)	15.67a-c	2.33a	87.67b	13.67b	20.17a-d	3.03bc
No Spraying-IR 74 (I)	16.00ab	2.67de	93.33b	12.67b	22.60a	3.39b
No Spraying-PSB Rc 18 R	18.67a	2.33e	103.33	13.33b	21.65ab	4.84a
C.V (%)	15.41	18.93	15.26	13.93	7.57	24.63

^{1/} Mean of three replications.

Means followed by a common letter are not significantly different at 5% level (DMRT).

Economics of Control of Tungro

The susceptible IR64 variety which was sprayed monthly showed a very low gross income while the highest gross income was obtained on unsprayed resistant variety PB Rc18 (Table 5). The lowest gross income was from unsprayed susceptible IR64 variety (P8,960/ha) and the highest on resistant PSB Rc18 (P32,220/ha) during the dry season cropping. The intermediate and resistant varieties have incurred the same gross expenses (P12,135/ha). It was also noted that the gross expense of all susceptible IR64 treatments was higher than the gross income, thus a negative net profit was obtained.

The highest net profit was obtained on PSB Rc18 (P20,185/ha) during the wet season and (P26,585.00/ha) during the dry season. Thus, the use of intermediate and resistant rice varieties were profitable even without spraying insecticides.

Table 5. Cost and return analysis of susceptible IR 64 sprayed with Cypermethrin at varying frequencies and intermediate and resistant varieties for wet and dry season, ViSCA, Baybay, Leyte.

Treatment	Grain Yield t ha ⁻¹		Gross Income ^{1/}		Gross Expense (P) Wet/Dry	Net Profit/(Loss) (P)		Average Profit/ (Loss) (P)
	Wet	Dry	Wet	Dry		Wet	Dry	
No spraying - IR 64 (S)	1.46	1.12	11680.00	8960.00	12135.00	(455.00)	(3175.00)	(1815.00)
Sprayed at ETL- IR 64 (S)	1.52	1.39	12160.00	11120.00	13612.00	(1452.00)	(2492.50)	(1972.50)
Sprayed Weekly - IR 64 (S)	1.87	1.23	14960.00	9840.00	18757.50	(3797.50)	(8917.50)	(6357.50)
Sprayed Bi-Weekly- IR 64 (S)	1.67	1.69	13360.00	13520.00	15090.00	(1730.00)	(1570.00)	(1650.00)
Sprayed Monthly- IR 64 (S)	1.35	1.74	10800.00	13920.00	14351.25	(3551.25)	25	(1991.00)
No Spraying- IR 60 (I)	2.55	2.28	20400.00	18240.00	12135.00	8265.00	6105.00	7185.00
No Spraying- IR 72 (I)	2.95	3.03	23600.00	24240.00	12135.00	11465.00	12105.00	11785.00
No Spraying- IR 74 (I)	3.54	3.39	28320.00	27120.00	12135.00	16185.00	14985.00	15585.00
No Spraying- PSB Rc 18 R	4.04	4.84	32320.00	38720.00	12135.00	20185.00	26585.00	23385.00

^{1/} Based on current price of palay (P8.00/kg)

CONCLUSION AND RECOMMENDATION

The use of insecticide (cypermethrin) for the control of the tungro virus was not effective, especially if it was sprayed to small plots only with abundant sources of inoculum.

Using resistant varieties was more advantageous than spraying susceptible varieties to prevent infection of the rice tungro virus.

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The author finished his Bachelor of Science in Agriculture major in Entomology from the University of Eastern Philippines (UEP) at Catarman, Northern Samar under the Study Now Pay Later Plan Program. He has a Master of Science in Plant Protection and distinguishes himself as an expert in rice research having served as Science Research

Assistant of the Leyte State University and PhilRice-NCT project for more than twenty years. Being a man who loves his work as an agriculturist, he was able to serve and help the rice farmers by extending and conducting field demonstrations on new and resistant varieties against insect pests and diseases, which are now currently adapted by rice farmers.

The co-author is a professor of the Department of Pest Management.