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RESEARCH ARTICLE

NUTRIENT MANAGER PROGRAM FOR RICE: A QUICK GUIDE FOR FERTILIZER RECOMMENDATIONS

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ABSTRACT

A field trial on Nutrient Manager Program For Rice was conducted at New Ilocos, Magsaysay, Davao del Sur, Philippines to determine its influence on the agronomic characteristics of PSBRc72H rice variety, severity of bacterial blight disease, its yield and yield components, and the total added benefit (TAB). The study was carried out in Randomized Complete Block Design (RCBD) replicated three times. The treatments were as follows: T1 – NPK application based on soil test results, T2 – NPK application based on NM given fertilizer guide (all synthetic fertilizer), T3 – NPK application based on NM given fertilizer guide (synthetic + Organic fertilizer) and T4 –Farmers' practice. Results showed no significant difference on the yield. This was attributed to no significant difference on the number of productive tillers/hill and number of filled grains/ panicle; parameters that highly influenced yield. The severity (%) of bacterial blight disease was enhanced by the greater amount of Nitrogen applied at booting stage. A total added benefit of PhP5, 681.40 was obtained using Nutrient Manager Fertilizer guide applied 100% synthetic fertilizer and only PhP3, 306.00 was obtained to plots applied in combination with organic fertilizer. Based on the results, it is recommended that the questionnaire must be filled up honestly by the rice farmer for the program solely depends on it in generating fertilizer application guide. Besides, field monitoring of the crop stand before the second or third fertilizer application must be done to decide whether increase or decrease the specified amount of fertilizer recommended by the NM fertilizer program, and no two scheduled fertilizer application be applied once for it enhances disease severity.

INTRODUCTION

Intensification of rice production had been continuously given emphasis. This type of production entails more fertilizer inputs. But many problems on declining productivity can be traced to improper use of nutrients. Improper nutrient management has resulted in the nutrient imbalances in the soil affecting the physiology of the crop making more attractive as a host for pests (Dent, 1995). Tools were developed to facilitate nutrient management in rice such as Leaf color chart (LCC) and minus one element technique (MOET). Now, the International Rice Research Institute (IRRI) developed "Nutrient Manager for Rice ", an interactive computer –based decision support tool, which provide a fertilizer guide line for a rice field based on the response to easy-to-answer multiple choice questions about the rice field. The fertilizer guidelines indicate the amount of fertilizer sources, selected by the user, to be applied at specified times to the rice field of a size specified by the user.

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Besides, computes also fertilizer guide to adjusted higher yields.Attributes of Nutrient Manager for Rice are of great help to rice farmers manage nutrients, however, no field verification trials conducted in Mindanao (Castillo, 2008). Thus, a study was conducted. The objective of the study was to determine any significant difference on the agronomic characteristics, yield components and yield, determine any significant difference on the severity of bacterial leaf blight disease and determine total added benefit (TAB).

MATERIALS AND METHODS

The materials used were as follows: rice seeds (PSBRc72H), inorganic fertilizer, organic fertilizer, pesticides, soil auger, sprayer and area for the trial. The field trial was conducted at New Ilocos, Magsaysay, Davao del Sur, Philippines. The study was carried out in Randomized Complete Block Design (RCBD) replicated three times. The treatments were as follows:

T1 – NPK application based on soil test results
T2 – NPK application based on NM given fertilizer guide (all synthetic fertilizer)

T3 – NPK application based on NM given fertilizer guide (synthetic + Organic fertilizer)
T4 –Farmers' practice

Figure 1. Field lay out

Crop Establishment

Seed Soaking and Incubation

Seeds were washed in clean water and soaked for 12 – 24 hours in clean water, washed again and removed from water. The water adhering the seeds was allowed to drip for 30 minutes and the seeds were incubated for 12 – 24 hours. Then the seeds were kept warm and moist during incubation by using rice straws.

Seedbed Preparation

Three seedbeds measured at 1 x 20 cm were prepared. Seedbeds were raised in 5 – 10 cm with one meter wide and twenty meters length. One bag of organic materials was equally applied and incorporated on the three seedbeds to make the soil friable to facilitate pulling of seedlings and minimize root damage.

Seed Sowing and Care of Seedlings

Seeds were sown on the seedbed at the rate of one kilo per twenty square meters. Young seedlings were protected by hand picking of golden apple snails, installation of buntings against birds and broadcasting 100 grams granular insecticide against stem borer. Three hundred grams ammonium phosphate (16 – 20 – 0) was applied ten days after seeding. Water was maintained at 1 – 2 cm depth and was increased as the seedlings grow taller.

Field Preparation and Lay Outing

The field was prepared three weeks before transplanting by plowing and harrowing repeatedly to decompose weeds and rice stubbles. Leveling was done properly to ensure equal water level during irrigation. To avoid drainage, double collapsible dikes were constructed to contain the different fertilizer levels and water treatments within plots, two weeks before transplanting. Lay outing was done a day before transplanting using bamboo stakes and wooden marker.

Transplanting

Twenty two days after sowing (DAS), seedlings were carefully pulled to avoid mechanical wounds and transplanted at 1 – 2 seedlings per hill, spaced 20 cm x 20 cm. With a plot size of 6 m x 8 m. Replanting of missing hills was done within 3 – 5 days after transplanting.

Figure 2. Criss-cross planting

Fertilization

For treatment 1, fertilizer application was based on the result of soil analysis, Treatments 2 and 3 were based on the fertilizer application guide generated from Nutrient Manager Program and treatment 4 was based on the farmers practice.

Water Management

Intermittent irrigation that is on and off irrigation up to hard dough stage was done.

Assessment of Bacterial Blight Incidence

Severity rating was done at hard dough stage on ten flag leaves at random per subplot using the scale (IRRI, 1996) below:

Scale (% lesion area)
10 - 3
24 – 6
37 – 12
413 – 25
526 – 50
651 – 75
776 – 87
888 – 94
995 – 100

Percent severity was computed using the disease index formula below:

$$\text{Disease Index (DI)} = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5 + 6n_6 + 7n_7 + 8n_8 + 9n_9}{9N} \times 100$$

where:

N – number of samples (10 samples)
9 – represents the highest scale
$n_1+n_2+n_3+n_4+n_5+n_6+n_7+n_8+n_9$ – number of leaf showing the scale of 1, 2, 3, 4, 5, 6, 7, 8, and 9.

Figure 3. Hard dough stage

Agronomic Characteristics

Data on agronomic characters below were determined. These were taken from four adjacent hills per subplot.

1. **Number of tillers** – this was taken by counting the number of tillers at 30 days after transplanting.

2. **Number of productive tillers** – this was taken by counting the panicle – bearing tillers at harvest.

3. **Plant height** – this was taken by measuring the rice plant at harvest in centimeters from the ground level up to the tip of the panicle, excluding awns.

Harvesting, Threshing, and Drying

The crop was harvested when 80% of the grains were already matured. The spikelets at the panicle base were still a bit green but already hard. It was threshed and dried immediately.

Yield Components

Yield components were determined by collecting ten panicles from each subplot for the following data:

1. Panicle length – this was taken by measuring in centimeters from the last internode of the panicle up to the tip.

2. Number of filled spikelets per panicle – this was taken by counting the filled spikelets excluding unfilled and half – filled spikelets in a panicle.

3. 1,000 seed weight (g) – this was taken by counting and weighing 1,000 seeds.

Grain Yield

The actual grain yield was determined by harvesting the middle rows in the sub-plot excluding one hill at each row ends; numbers of harvested hills were recorded. Grains was threshed, dried and cleaned before weighing. Corrected plot yield (grams) and yield (kilogram / hectare) were computed as follows:

$$\text{Corrected plot yield (g)} = \frac{\text{wt. of harvest (g)}}{\text{no. of hills harvested}} \times \text{no. of possible hills / subplot}$$

$$\text{Grain yield (kg/ha)} = \frac{\text{corrected plot yield (g)}}{\text{1,000 g / kg}} \times \frac{\text{10,000 m}^2}{\text{harvested plot area (m}^2\text{)}} \times \text{MF}$$

where: MF - is the moisture factor so that yield would be based on 14% moisture.

$$\text{MF} = \frac{\text{100 - moisture content at weighing time}}{86}$$

Total added benefit

Partial budget analysis was made to determine total added benefit

Data Gathered

1. Number of tillers per hill at 30 DAT
2. Number of productive tillers/hill
3. Percent severity bacterial blight
4. Plant height (cm)
6. Length of panicle (cm)
7. Number of filled grains per panicle
8. 1,000 grain weight (g)
9. Grain yield (tons/ hectare)
10. Total Added Benefit

Statistical Analysis

All data gathered from the study were analyzed and interpreted using the analysis of variance (ANOVA) Randomized Complete Block Design. The Duncan Multiple Range Test (DMRT) was used to determine the significant differences among treatment means.

RESULTS AND DISCUSSION

Number of Tillers/hill at 30 DAT

Table 1 showed the number of tillers per hill of PSBRc72H applied with fertilizer based on nutrient manager guide. No significant differences were observed among treatments during the wet season planting however, a significant observation was noted during the dry season. The highest number of tillers was observed in T3 (NPK based on NM guide (synthetic + organic fertilizer) at 21.33 tillers/hill followed by T2 (NPK based on NM guide (all synthetic fertilizer) with 15.75 tillers/hill and T1 (NPK based on soil analysis) and T4 (Farmer's Practice) with uniform number of tillers/hill at 10.25 each.

Number of Productive Tillers/hill

The number of productive tillers for both wet and dry season planting showed no significant differences among treatments

(Table 1). This implies that production of productive tillers was not affected by the different recommended fertilizer based on the different fertilizer guides.

Plant Height (cm)

There was significant difference among treatments observed on plant height during the wet season while plants had more or less uniform height during the dry season Table 1). Taller plants were observed in treatments 2 (NPK based on NM guide (all synthetic fertilizer) at 117 cm, 3 (NPK based on NM guide (synthetic + organic fertilizer) at 112.58 cm and 4 (Farmer's Practice) at 114.50 cm. This can be attributed to the amount of nutrients especially nitrogen which is a constituent in all metabolic processes in plants supplied by the different fertilizer recommendations (T2 – 110.03 kg of N/ha, T3 – 110.73 kg of N/ha, and T4 – 130.25 kg N/ha as well as the availability of water supply during vegetative growth.

BLB Severity (%)

In terms of BLB infection, high infection rate was observed in T4 which is 42%, followed by T3 and T4 with 25.50% and 22% (Table 2). The lowest was observed in T1 with only 7.16%. The high infection rate from T4 as well as the 25% rate of infection in T3 and T2 can be attributed to the high amount of nitrogen fertilizer which made the plants look very healthy but very attractive to disease.

Yield Components

Panicle Length (cm)

Table 3 showed the panicle length of PSBRc72H as applied with recommended fertilizer using the nutrient manager guide. Panicle length of PSBRc72H was significantly affected by the different treatments both in wet and dry season planting (Table 2).

Table 1. Agronomic characteristics of PSBRc72H

Treatments	Number of Tillers per Hill at 30 DAT		Number of Productive Tillers/Hill		Plant Height (cm)	
	Wet Season^{ns}	**Dry Season****	**Wet Season^{ns}**	**Dry Season^{ns}**	**Wet Season***	**Dry Season^{ns}**
T1 – NPK based on soil analysis	13.67	10.25^{c}	9.33	9.83	109.67^{b}	105.33
T2 – NPK based on NM guide (all synthetic fertilizer)	15.50	15.75^{b}	9.58	9.83	117.00^{a}	111.67
T3 - NPK based on NM guide (synthetic + organic fertilizer)	13.08	21.33^{a}	9.25	8.50	112.58^{a}	109.92
T4 – Farmers' Practice	12.83	10.25^{c}	8.92	10.08	114.50^{a}	108.25
CV =	7.94%	8.70%	11.69	6.88%	1.44%	2.82%

** - highly significant *- significant ns - not significant

Table 2. Bacterial blight disease severity (%) of PSBRc72H

Treatments	**BLB severity (%)**
	WS**
T1 – NPK application based on soil test results	7.16^{c}
T2 – NPK application based on NM given fertilizer guide(all synthetic fertilizer)	22.00^{b}
T3 – NPK application based on NM given fertilizer guide(synthetic + Organic fertilizer)	25.5^{b}
T4 –Farmers' practice	42.00^{a}

CV = 3.5%**- highly significant

Table 3. Yield components of PSBRc72H

Treatments	**Panicle Length (cm)**		**Number of Filled Grains/Panicle**		**Thousand Seed Weight (g)**	
	Wet Season*	Dry Season*	Wet Season^{ns}	Dry Season^{ns}	Wet Season*	Dry Season*
T1 – NPK based on soil analysis	27.07^{b}	28.98^{a}	101.43	142.46	28.47^{b}	35.40^{a}
T2 – NPK based on NM guide (all synthetic fertilizer)	27.70^{b}	26.88^{b}	100.43	147.41	26.00^{b}	33.83^{b}
T3 - NPK based on NM guide (synthetic + organic fertilizer)	27.24^{b}	26.68^{b}	102.23	135.97	32.60^{a}	33.80^{b}
T4 – Farmers' Practice	28.66^{a}	29.64^{a}	102.27	140.33	26.06^{b}	34.57^{a}
CV =	1.86%	2.69%	6.07%	6.07%	6.07%	1.50%

* - significant ns – not significant

Table 4. Yield (t/ha) of PSBRc72H

Treatments	**Yield(t/ha)**	
	WS^{ns}	DS*
T1 – NPK application based on soil test results	6.28	6.18^{b}
T2 – NPK application based on NM given fertilizer guide(all synthetic fertilizer)	6.70	6.96^{a}
T3 – NPK application based on NM given fertilizer guide(synthetic + Organic fertilizer)	6.56	6.94^{a}
T4 –Farmers' practice	6.56	6.70^{a}
CV =	3.36%	4.30%

Table 5. Partial Budget Analysis (All synthetic fertilizer applied based on NM fertilizer guide versus farmers practice)

Added Cost				Added Benefit			
Qty (50kg/bag)	Fertilizer source	Price/unit	Amount	Qty (50kg/bag)	Fertilizer source	Price/unit	Amount
				Fertilizer:			
				0.83	14-14-14	960.00	813.40
Fertilizer:				1.22	46.00	800.00	976.00
1.8 bag	16-20-0	860.00	1,548.00	1.75	0-0-60	1,280.00	2,240.00
				Yield increase:	200 kg	16.00/kilo	3,200.00
						Total:	7,229.40
						Less	1,548.00
				Total Added Benefit		5,681.40	

Table 6. Partial Budget Analysis (ten bags OF + synthetic fertilizer applied based on NM fertilizer guide versus farmers practice)

Added Cost				Added Benefit			
Qty (50kg/bag)	Fert. source	Price/unit	Amount	Qty (50kg/bag)	Fert. source	Price/unit	Amount
				Fertilizer:			
				2.25	14-14-14	960.00	2,160.00
Fertilizer:				1.31	46-0-0	800.00	1,048.00
1.7 bag	16-20-0	1,462.00	1,548.00	1.75	0-0-60	1,280.00	2,240.00
10 bags	OF	160.00	2,600.00	Yield increase:	1200 kg	16.00/kilo	1,920.00
		Total:	4,062.00			Total:	7,368.00
						Less	4,062.00
					Total Added Benefit		3,306.00

During the wet season planting, longest panicle length were observed in plots applied with T_4 (Farmer's Practice). During the dry season, plots applied with fertilizers based on soil analysis and farmer's practice produced significantly longer panicle than plots applied with fertilizer using the nutrient manager guide.

Number of Filled Grains/panicle

Number of filled grains did not differ significantly among treatments and between wet and dry seasons (Table 3). However numerical values showed that more filled grains were observed during the dry season and was noted at T_2 subplots applied with NPK based on NM guide (all synthetic fertilizer).

Thousand Seed Weight (g)

Table 3 presented the thousand seed weight obtained from PSBRc72H applied with recommended fertilizer based on the nutrient manager guide. There were significant differences among treatments observed on both wet and dry season planting. During the wet season, heaviest thousand seeds were observed from plots applied with T3 - NPK based on NM guide (synthetic + organic fertilizer) at 32.60 g while during the dry season planting, plots applied with T1 - NPK based on soil analysis registered with the heaviest thousand seeds at 35.40g and T4 - Farmer's Practice at 34.57 g. These results can be attributed to high percentage amount of phosphorus and Potassium fertilizers.

Yield (t/ha)

Table 4 presented the yield obtained from PSBRc72H applied with recommended fertilizer based on the nutrient manager guide. No significant difference was observed on the wet season planting but significant difference was observed during the dry season planting. High yield were registered in plots using the nutrient manager guide at 6.94 t/ha (T2) followed very closely by T3 with 6.94 t/ha and T4 with 6.70 t/ha. The lowest was taken from T1 with 6.18 t/ha. The net income from the different types of fertilizer applied showed no significant differences among treatments. However, numerical values showed that plots applied with NPK based on NM guide (all synthetic fertilizer) gave the highest net income in both wet and dry season planting followed very closely by plots applied with NPK based on NM guide (synthetic + organic fertilizer).

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