MANAGEMENT OF BACTERIAL LEAF BLIGHT DISEASE OF SALINAS RICE VARIETY USING ORGANIC BASED TEAS UNDER ADVERSED CONDITION OF LIGUASAN MARSH, PHILIPPINES

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ABSTRACT

Organic-based teas are proven to make environmental friendly, less cost and readily available compared to synthetic chemical pesticides. Likewise, application of organic tea enhances soil fertility, sustains productivity and provides efficient control of plant pathogens. This study was conducted to effectively manage through an *in vivo* test the bacterial leaf blight (BLB) of rice in adverse condition of Liguasan marsh from February to August 2012. Of the organic pesticides tested against BLB of rice causing Xanthomonas Oryzae Pv. oryzae, Vermi tea was found effective (E) and was comparable to Antica (commercial check) while Kamantigue(*Impatiens balsamina Linn*) Plant Juice (KPJ) and Effective Microorganism (EM) were moderately effective (ME). Plants applied with Antica (commercial check) had the highest yield of 5.0 t ha^{-1} but comparable to plants applied with Vermi Tea (4.9 t ha^{-1}). Plants applied with EM and KPJ had comparable yield of 4.8 and 4.7 t ha^{-1}, respectively. Cost-efficacy of treatments usage for a hectare of rice gave a high return of investment (ROI%) in VT (118.4%), EM (113.9%), KPJ (109.5%), and Antica (11.5%), respectively. The low cost and significant effect action provided by the different biopesticides employed increased the ROI of rice production per hectare under adverse condition of Liguasan marsh.

Keywords: Organic-based teas, bacterial leaf blight

1 INTRODUCTION

Salinas rice (NSIC Rc 194) is grown in an estuarine areas, resulting in a humid microclimate that favors disease development. Thus, resistance against a few targeted diseases offers only a partial solution to rice disease problems. To those diseases caused by specialized and non-specialized pathogens, no useful management strategies have been developed to improve the rice production.

Increasing cost of inorganic inputs and attendant problems to the environment, promoting an organic based control against plant disease is a complementary approach in managing BLB of rice. Bacterial leaf blight disease of rice caused by *Xanthomonas Oryzae Pv. oryzae* (Xoo) is a major barrier of high and sustaining rice productivity (FAO 2006). Strains in tropical areas are more virulent than that of temperate region (Nyval 1999). BLB is reported to have reduced Asian's annual rice production by as much as 60%. Further, recent survey indicated that an estimated annual yield loss from 40% to 50% was due to BLB disease (FAO 2006).

Moreover, organic-based teas are proven to make ecological and economic sense. Unlike chemical fungicides that indiscriminately kill both pathogenic and beneficial microorganisms, the organic teas function on an entirely different principle. Application of organic tea produces valuable plant compounds as growth hormones, plant growth regulators, supply soluble nutrients that enhances soil fertility, sustains productivity (Pant et. al. 2011; Pant et. al. 2009; Hargreaves et. al. 2009; Aracon et. al. 2006; Dick & McCoy 1993; Maynard 1994) and provides efficient control of plant pathogens (FAQ 2013; Pane et. al. 2012; Schilder et. al. 2011; Diver 2010; Joshi et. al. 2009; Reuveni et. al. 2009; Hoitink & Boehm 1999; Stone et. al. 2004).

Therefore, evaluation of these organic based teas is a practical and economical approach in suppressing bacterial leaf blight disease of rice. This necessitated the introduction of organic based tea to reduce bacterial leaf blight in adverse condition of Liguasan marsh.

2 MATERIALS AND METHODS

Field test of the protective efficacy of organic-based teas against BLB caused by (*Xoo*) was conducted in estuarine areas in Liguasan marsh from January to June, 2013. Randomized Block Design with five treatments replicated four times were used and analyzed through DMRT. Thirty-day-old rice seedlings were planted in a 4m x 5m per plot with planting distance 25 cm x 15 cm.

Standard cultural practices in rice production were observed. The biopesticides applied were Antica (Commercial check) at the rate of 320 ml/16 L^{-1} of water. One (1.0) kg of kamantigue plant (*Impatiens balsamina* Linn) parts was mixed with one (1.0) kg of muscovado sugar and brewed in 16 L^{-1} of water for 3 days. After three days the juice was strained and sprayed at the rate of 320ml/16 L^{-1} of water. Likewise, one kg of vermicast was mixed with one kilogram of muscovado sugar and brewed in 16 L^{-1} of water for 3 days and tea was harvested 3 days thereafter and sprayed at the rate of 70ml/16 L^{-1} of water. Effective microorganism was prepared following the standard procedures and sprayed at the rate of 1000ml/16 L^{-1} of water.

These organic pesticides were applied as spray protectants at 15 days after planting (DAT). Spraying was done at 7 days interval until flowering stage (80 DAT). The first occurrence of disease symptoms and severity infection of BLB of rice was assessed and at weekly interval thereafter.

Percentage degree of control (%DC) was done after six weekly assessments of BLB of rice. Agronomic parameters such as number of productive and unproductive tillers/hill, percentage filled and unfilled grains, plant height, length of panicle, thousand seed weight and grain yield were gathered.

3 RESULT AND DISCUSSIONS

3.1 Percentage DI, DC and DE of BLB of Rice

A non-significant result among treatment means in % DI at 14 DAT on BLB of rice (Table 1). However, %DI final rating (80 DAT) after six spray applications of KPJ and EM gave a comparable result followed by Vermi Tea (organic check) while Antica (commercial check) had the least %DI. The control plants exhibited the highest % DI. Protective biopesticides against BLB afforded higher % DI compared to control but lower compared to Antica (commercial check).This finding corroborated the findings of Diver (2010) that organic tea supply soluble nutrients and organic control agents, which can be used as liquid amendments that control pathogens.

Consequently, the % DC of protective biopesticides afforded promising results in Salinas NSIC Rc 194 (Table 1). Vermi tea (organic check) application gave higher degree of control compared to KPJ- and EM, respectively. Antica (commercial check) application gave the highest % DC.

Moreover, the DE (Table 1) revealed that protective effective (E) in Antica (commercial check) and Vermi Tea, while KPJ and EM were moderately effective (ME), respectively. Protective biopesticides reduced BLB of rice in adverse condition. This conforms to the observations of Contisano (1994) that organic or compost tea simply concentrates these beneficial microbes and allows the grower to apply them in a convenient, concentrated form as nutrients and for resistance and disease control. In addition, it likewise lends support to the observation of Defago (1993) who reported that the microbes in compost or compost tea bring about the suppression of plant pathogens using various mechanisms such as production of chemical inhibitors as well as induction of resistance against pathogens.

Table 1: Percentage disease severity (%DI) of BLB of rice, %DC and DE as influenced by four organic pesticides under adverse condition of Liguasan marsh

Organic Pesticides	**% Disease Index (Initial^{ns})**	**% Disease Index (Final*)**	**% Disease Control**	**% Disease Effectiveness**
Antica	43.13	16.00^{c}	62.90^{a}E	
I. balsamina Based Tea	43.00	24.03^{b}	44.12^{b}	ME
Effective Microorganic	43.10	24.00^{b}	44.31^{b}	ME
Vermi Tea	43.00	17.10^{c}	60.23^{a}	E
Control	43.00	47.75^{a}	-	-

* Common letter superscript in a column is not significantly different at 5% level, DMRT.

ns- not significant

E-Effective and ME- Moderately Effective

3.2 Agronomic Characteristics

Plant Height (cm). Antica (commercial check) applied in Salinas rice obtained the tallest height which comparable to Vermi Tea (organic check) application, respectively, were observed followed by EM- and KPJ-plants with comparable plant height (Table 2). The shortest plant was measured in control. This support the findings of Chen, et al. (1998) that organic teas stimulate healthy plant growth as a foliar nutritional source, translating into healthier plants, which are more resistant to disease attack.

Number of Productive Tillers. Similarly, Antica – and Vermi Tea -treated plants had comparable number of productive tiller higher than KPJ- treated plants (Table 2). The untreated plants had the least number of productive tillers. The result indicates that these biopesticides can produce more productive tillers/hill which could contribute to increase yield. This supports the findings of PhilRice (2009) which reported that plants with high number of tillers were more likely to have greater spread of grain size which resulted to an increased yield.

Number of Unproductive Tillers. Antica-treated plants had lesser number of unproductive tillers comparable to Vermi Tea-treated plants (Table 2). EM-and KPJ-treated plants had comparable number of unproductive tillers while the control plants had the highest number of unproductive tillers. The above finding implies that plants with lesser number of unproductive tiller/hill had more number of productive tillers/hill which resulted to more production of panicles and eventually higher yield.

Table 2: Agronomic characteristics of salinas rice as influenced by four organic pesticides under adverse condition of Liguasan marsh

Organic Pesticides	Plt.H (cm)	NPT	NUPT	PL	%FG (cm)	%UFG	TSW (g)	GY (t/ha^{-1})
Antica	104.68^{a}	18.88^{a}	2.00^{c}	26.40^{a}	96.50^{a}	3.50^{c}	42.38^{a}	5.0^{a}
I. balsamina Based Tea	103.20^{b}	14.48^{c}	3.80^{b}	25.65^{b}	93.96^{b}	6.03^{b}	40.30^{d}	4.9^{b}
Effective Microorganic	101.98^{b}	13.60^{b}	3.10^{b}	25.60^{b}	94.10^{b}	5.40^{b}	41.38^{c}	4.8^{b}
Vermi Tea	104.40^{a}	18.80^{a}	2.20^{c}	26.10^{a}	96.41^{a}	2.84^{c}	42.10^{b}	4.7^{a}
Control	93.81^{c}	9.20^{d}	4.80^{a}	23.85^{c}	89.51^{c}	10.60^{a}	37.65^{b}	3.6^{c}

* Common letter superscript in a column is not significantly different at 5% level, DMRT.
Plt.H.- Plant height, NPT- Number of productive tillers, NUPT- Number of unproductive tillers, PL- Panicle length, %FG- Filled grain, %Unfilled grain, TSW- Thousand weight seeds, and GY- Grain yield.

Panicle Length (cm). Moreover, salinas (NSIC Rc194) applied with Antica (commercial check) had the longest panicle followed by plants applied with Vermi Tea, EM, and KPJ, respectively, while untreated plants had the shortest panicle (Table 2).

Percentage Filled Grains. Antica- and Vermi Tea- applied plants had comparable % filled grain, respectively, had significantly higher % filled grains compared to EM- and KPJ treated plants with comparable result, respectively (Table 2). The lowest % filled grains/panicle was obtained in untreated control plants. Differences observed among the two factors based on % filled grain/panicle are due to inherent character. This parameter is one of the yield components that contributed to yield increase.

Percentage Unfilled Grain. EM- KPJ- treated plants (Table 2) obtained with comparable % unfilled grains/panicle, respectively, and compared to Vermi Tea and Antica-treated plants with comparable % unfilled grains/panicle, respectively. The untreated control plants had the highest % unfilled grains/panicle. Lower percentage of unfilled grains has higher percentage of filled grains and vice- versa.

Thousand Seed Weight (g). Of the five organic pesticides, Antica-treated plants (Table 2) significantly gave heavier 1000 grains followed by Vermi Tea-EM- and KPJ-treated plants while lightest 1000 grain was observed on control plants. Difference in thousand grain weight is an inherent character of the plant. A heavier grain is an indication of a good biopesticides because it is one of the parameters that determine yield. The result further suggests that longer panicles and higher percentage of filled grains/panicle means heavier grain weight, hence, higher yield. The observations in this study corroborated with the observation of Dick and McCoy (1993) that organic teas are concentrated with both liquid and inocula of beneficial microbes as well as compounds which could be used in crop production for control of plant pathogen and enhance growth of host plants. Also that of Kumar et al. (2013), who stressed that leaf disease like BLB reduce the photosynthetic area of the crop, which directly reduce the amount of stem sugar available for the developing grains. It further stated that management strategies such as variety and stubbles management should be employed to reduce the level of leaf disease and finally increase filled grains which also lead to the increase of grain weight.

*Grain Yield ($t\ ha^{-1}$).*Likewise, plants applied with Antica (commercial check) had the highest yield of 5.0 $t\ ha^{-1}$ but comparable to plants applied with Vermi Tea (4.9 $t\ ha^{-1}$). Plants applied with EM and KPJ had comparable yield of 4.7 and 4.8 $t\ ha^{-1}$, respectively. The lowest yield was obtained on control plants with 3.6 $t\ ha^{-1}$ (Table 2). Biopesticides employed were contributory factors to producing high yield. These results lend support to the observation of Scheuerell and Mahaffee (2006) that the use of organic teas have shown modest to major control of plant diseases and Orozco (1996) that percentage increase of filled grains which a parameter for a good harvest.

Profitability analysis. Profitability analysis of treatments usage of 6 cycle protective sprays of a hectare production of salinas rice within six months production period (Fig. 1).Cost-efficacy of treatments usage for a hectare of rice gave a high return of investment (ROI%) in VT (118.4%), EM (113.9%), KPJ (109.5%), and Antica (11.5%), respectively. The low cost and significant effect action provided by the different biopesticides employed increased the ROI of rice production per hectare under adverse condition of Liguasan marsh.

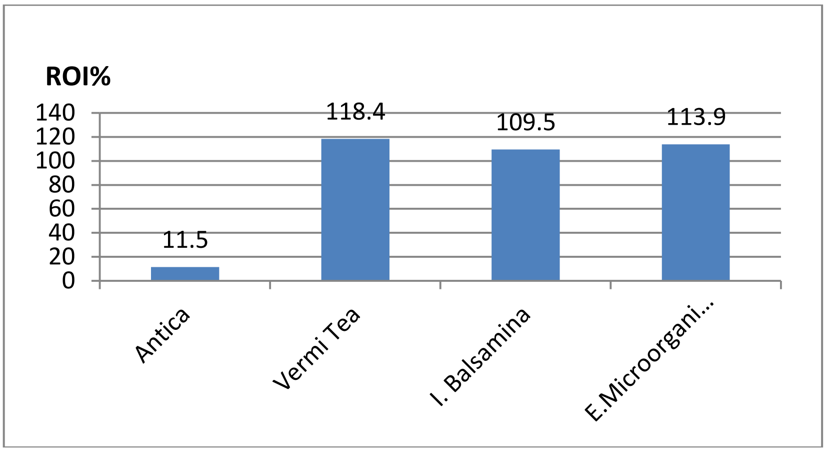

Figure 1: Profitability analysis of treatments usage of 6 cycle protection application for hectare production of salinas rice

4 SUMMARY

Field efficacy evaluation of the four biopesticides revealed effective (E) action of Vermi tea and was comparable to Antica (commercial check), while KPJ and EM spray applications were moderately effective (ME) against BLB of salinas rice variety. Yield and agronomic characters of rice were significantly influenced by the four organic based teas employed. Profitability of treatments usage for a hectare of rice production revealed highest ROI on VT (118.4%), EM (113.9%), KPJ (109.5%), and Antica (11.5%), respectively.

5 CONCLUSION

Application of organic based teas exerted significant influence in terms of increased yield for rice as well as on the effectiveness of the biopesticides for the management of rice BLB. Organic based teas (biopesticides) demonstrated cost-effectiveness indicated by high ROI for treatments usage for a hectare rice production.

6 RECOMMENDATIONS

Concerned agencies particularly where the study was conducted should come up policies to strengthen appropriate strategies in controlling BLB such as: proper irrigation system, advocacy on the importance of using organic approaches not only in the management of BLB but on the use of organic fertilizers as well and further site verification for promotion of the use of organic tea pesticides against BLB disease of rice in other estuarine areas.

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