Population Management Strategy Implementation Brown Planthopper *Nilaparvata lugens* Stal. (Homoptera: Delphacidae) Integrated

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Abstract: ***Research on the application of the population strategy of brown planthopper Nilaparvata lugens Stal. (Homoptera: Delphacidae) carried out in an integrated with the aim to determine the effect of the application of integrated pest management (IPM) to control brown planthoppers and the growth of rice plants. The experiment was conducted in the village of Kerumut, Pringgabaya District, East Lombok, West Nusa Tenggara and in pest Laboratory, Department of Plant Pests and Diseases, Faculty of Agriculture, Brawijaya University in January 2013 until July 2013. The research method used was experimental method. Observation variables include brown stem planthopper populations, natural enemies of brown planthopper, the intensity of the attacks, and the growth of rice plants. In this research, data were analyzed using t-test by comparing the observations between IPM treatment with conventional treatment. Observations and discussions indicate that 1) brown planthopper populations on IPM treatment was lower than the conventional treatment, 2) population of brown planthopper natural enemies higher and significantly different in the IPM treatment than conventional treatment, 3) the intensity of the attacks on IPM treatment lower and significantly different than conventional treatment, and 4) the growth of rice plants with IPM treatment lower than conventional treatments. The results concluded that the population of brown planthopper lower on IPM treatment than conventional treatment, population of brown planthopper natural enemies higher in IPM treatment than conventional treatment, the low population of brown planthopper on IPM treatment effect on the damage to rice crops, the IPM treatment attack intensity is lower than conventional treatment. Growth and production on the IPM treatment was lower than conventional treatment.***

Keywords: Rice, *Nilaparvata lugens* Stal.

1. Introduction

Rice is the main carbohydrate source and has a high position in Indonesian society. This led to efforts to increase rice production a top priority in maintaining self-sufficiency in rice, but still there are constraints in efforts to increase rice production, one of which is an insect pest. Major pest in rice is brown stem planthopper *Nilaparvata lugens* Stal. (Homoptera, Delphacidae). Brown stem planthopper pests in 1971-1980 covering 3,093,593 ha, 458,038 ha was recorded in 1981-1990, in 1991-2000 reached 312,610 ha and its attacks on the 2001-2010 brown planthopper attacks reach 351,748 ha (Effendi, 2011)[1].

Use a high nitrogen fertilizer is one trigger brown planthoppers attacks. Nitrogen fertilizer application of the higher (increased) may affect or improve the life capability nymph, adult, fecundity, and egg hatchability brown planthopper (Xian *et.al*, 2009)[2]. While the influence of rice plant nitrogen fertilizer causes rice plant excessive physical force will be reduced, leaf and stem of the rice thins, so the brown planthopper easy piercing and sucking plant fluid (Yoshida, Navasero, Rarnirez, 1969 in Soepardi, 1986)[3]. In addition the use of high nitrogen fertilizers, use of pesticides that are not according to the rules could cause an explosion brown planthoppers. Pesticide applications by farmers as scheduled, regardless of pest attack, and improper manner (target, type, time, dose/concentration, and how) , so it can have negative effects on soil, crop and pest. Bad influence of uncontrolled use of pesticides can leave residue on the soil, plants, and the occurrence of pest resistance and resurgence (Khalid and Ali, 2009)[4].

To overcome this, it is necessary to apply the concept of eco-friendly pest management is Integrated Pest Management (IPM). IPM implementation in Indonesia is mainly driven by the outstretched hands of the Government, in this case is the issuance of Presidential Instruction No. 3 of 1986. These instructions concerning: (i) protection of plants using the IPM approach, (ii) the prohibition of the use of 57 types of insecticides used for rice crop protection, and (iii) removal of pesticide subsidies by the government. IPM approach to integrate preventive measures and corrective to pest maintain order not to cause problem, with minimal risk or a danger to humans and their environment components. The main goal of IPM is degrading rate of the average abundance of pest populations so that the frequency in units of time and space can be eliminated (Mudjiono, 2013)[5].

2. Research Objectives

This research aimed to determine the effect of the application of Integrated Pest Management (IPM) in the control of brow planthopper in rice.

3. Research Benefit

The result is expected to be useful as information on the effect of the application of integrated pest management and preemptive measures to strengthen the implementation of pest management especially brown planthopper pest integrated so as to improve the efficiency of agricultural cultivation is environmentally friendly.

4. Materials and Methods

The research was conducted on rice cultivation land located in the village of Kerumut, Pringgabaya District, East Lombok, West Nusa Tenggara. Identification of natural enemies in Pest Laboratory, Department of Plant Pests and Diseases, Faculty of Agriculture, Brawijaya University, Malang. The experiment was conducted during the rainy season (RS) 2012/2013 ie from January 2013 to July 2013.

The method used was an experimental method, to determine the population of brown planthopper, population of brown planthopper natural enemies, the intensity of the attacks (damage to crops), and the growth of rice plants. In this research, data were analyzed using t-test by comparing IPM treatment and conventional treatment each with an area of ± 2,000 m^2.

5. Results and Discussion

5.1 Population of Brown planthopper

Adult population observations illustrate the generally population of brown planthopper in rice IPM treatment and conventional treatment. Brown planthopper population growth in IPM treatment and conventional treatment are presented in Figure 1.

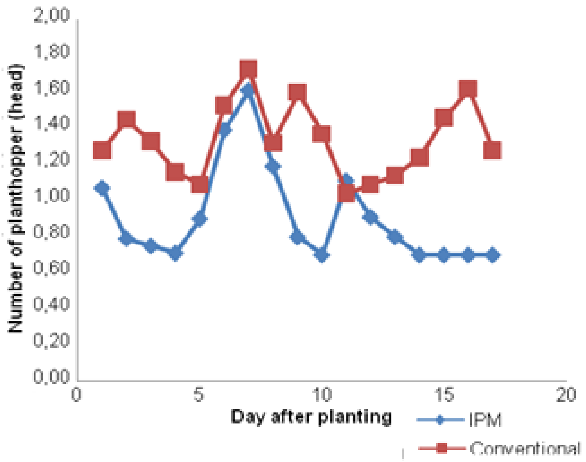

Figure 1 : Graph the number of brown planthopper in rice with IPM treatment and conventional treatment

Based on Figure 1, it is known that the population of adult brown planthopper on IPM treatment and conventional treatment began in the observations 1. The difference of brown planthopper population in both treatments, by reason of the availability of natural enemies population in the IPM treatment and conventional treatment. In the conventional treatment of high population of brown planthopper due to lower natural enemies population. While at IPM treatment low brown planthopper, due to the high abundance of natural enemies in IPM treatment, resulting in predation and parasitism process that led to the mortality of the brown planthopper in IPM treatment. Natural enemies have a tremendous influence in an ecosystem because it is able to contribute to the maintenance of biodiversity (Ramani, 2013)[6]. In the IPM treatment natural enemies was very effective in controlling brown planthopper, especially predatory arthropods (insects and spiders) are a natural enemy of the most instrumental in suppressing the population of brown planthoppers. For example, generalist predators such as spiders Lycosidae capable of consuming brown planthopper 20 insects/day so that these predators play an important role in the control of brown planthopper (Gallagher, *et.al* , 2002)[7] .

5.2 Populations of natural enemies of brown planthopper

The results of natural enemy species were found to be composed of predators and parasitoids. Predators are found in both treatments are the spider *Lycosa* sp., Needle dragonfly *Agriocnemis femina femina*, Staphylinidae beetles *Paederus fuscipes*, beetle *Micraspis* sp., Ladybugs mirid *Cyrtorhinus lividipenis*, and grasshoppers *Conocephalus longipennis*. In addition predators there is also a parasitoid brown planthopper are *Anagrus* sp., *Anatrichus pygmaeus*, and *Drynus grimaldii*.

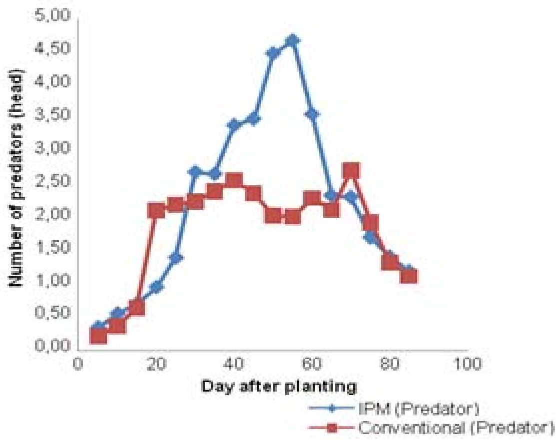

Figure 2 : Graph the numberof brown planthopper predators in rice IPM treatment and conventional treatment

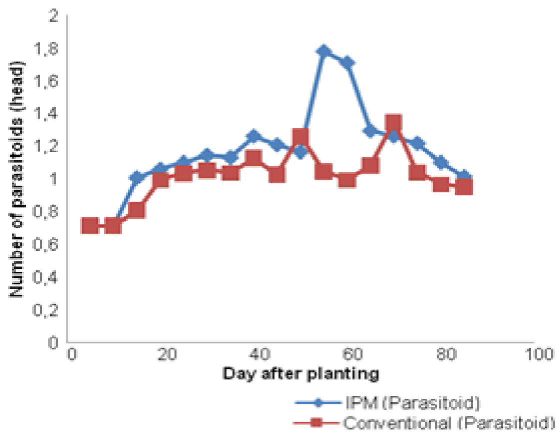

Figure 3 : Graphs the number of brown planthopper parasitoids in rice IPM treatment and conventional treatment

Application of pesticides on conventional treatment is carried out scheduled without considering the pests attack, pesticide application is still being done even though the population the brown planthopper has not reached the economic threshold. Control thereby creating a less than optimal conditions for the life of the living organisms in the ecosystem, especially its natural enemies will die first than the target pest when there is application of pesticides. Intensive application of pesticides may increase the sensitivity of rice to brown planthopper, increasing the viability of populations of planthopper nymphs and adults of brown planthopper, and killing natural enemies of brown planthopper (Jin-cai, *et.al*, 2001)[8]. Therefore, action needs to be selective in the use of pesticides in order to maintain the sustainability of natural enemies of but deadly targets pests so that pest populations not explosion.

5.3 Intensity of Brown Planthopper

Statistically significant effect of IPM and conventional treatment on the intensity attacks showed a significant difference. The average intensity of attack shown at Table 1.

Table 1 : The average attacks intensity of the brown planthopper per hill in rice IPM and conventional treatment

Treatment	*The mean intensity of brown planthopper (%)*
PHT	1,82
Conventional	2,18*

Statement : * signifikan
Level signifikan 0,05

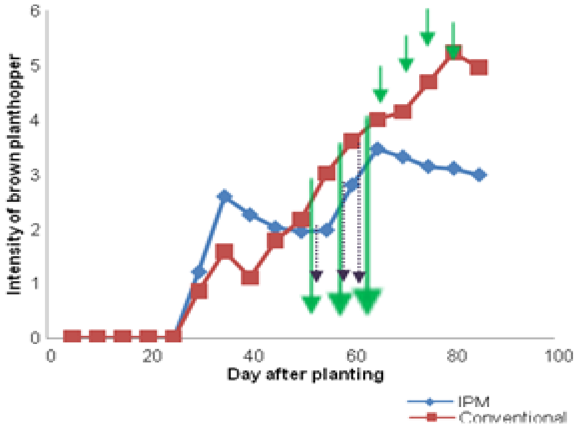

Figure 4 : Graph intensity of brown planthopper per hill in rice plants treated with IPM and conventional treatments

Description:
brown planthopper nymph (conventional treatment)
brown planthopper nymph (IPM treatment)

In Figure 4 that the damage to the plant by the brown planthopper in IPM treatment and conventional treatment occurred in the observation at the age of 30 day after plant . Difference in the level of attacks on IPM and conventional treatments due to how cultivate (control measures) that differ in the two treatments. In the conventional treatment control measures carried out intensively with synthetic pesticides, and therefore contributes to the development of brown planthopper. This is consistent with the statement Visarto *et. al* (2006), Krutmuang (2011)[9] that the application of insecticides (such as imidacloprid, chlorpyrifos and abamectin) routinely and effectively result in more pest resistance. Increased crop damage in the conventional treatment allegedly due to the discovery of the nymph on the observation at the age of 55 day after plant until just before harvest, allegedly due to the presence of nymphs resurgence of the brown planthopper pesticides used by farmers triggering level damage to rice crops. The trial results are applied Heinrichs (1984)[10] that the application of insecticides at the age of 50 and 60 DAP will produce eggs that increase brown planthopper nymph populations and reaches a peak at age 80 DAP.

5.4 Rice Growth

To determine the growth of rice plants carried out plant height measurements and calculate the amount of rice tillers. Statistically based on the results of the t test that plant height and number of tillers there are significant differences in the treatment of IPM and conventional treatments.

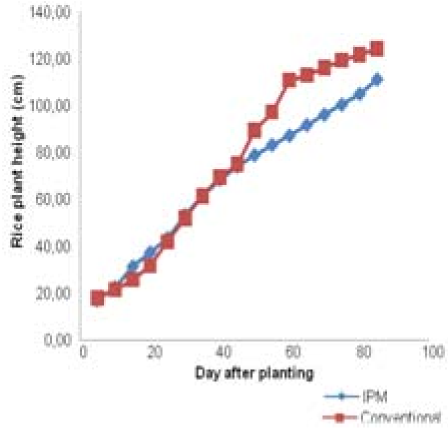

Figure 5 : Chart of rice height on the land with IPM treatment and conventional treatment

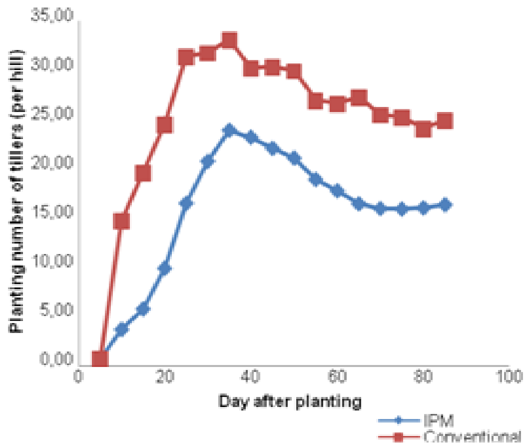

Figure 6 : Chart the planting number of tillers per hill of rice plants on land with IPM treatment and conventional treatment

On observations seen that the pattern of growth of plant height and the number of tillers in IPM treatment and conventional treatment is almost the same, only the conventional treatment had higher growth than the IPM treatment. Number of rice tillers per hill on observations at the age of 35 day after plant is the culmination of seedling growth IPM treatment and conventional treatment. Number of tillers on IPM treatment and conventional treatment decreased the observations at the age of 40 day after plant , due to the observation at the age of 40 day after plants generative phase. In the reproductive phase is characterized by a reduced number of tillers (unproductive tillers will die), mature, flag leaf emergence, prolonged some of the top segment of the stem of plants, and flowering (Makarim and Suhartatik, 2009)[11].

Differences in plant growth in both treatments because the conventional treatment dose of inorganic fertilizer (urea) applied higher than IPM treatment, but it also farmers apply inorganic growth regulators to stimulate plant growth. In the

IPM treatment fertilizer according to the results of soil analysis whereas conventional fertilizer treatment in accordance with the previous planting season, ie urea 500 kg urea/ha and 250 kg NPK/ha while the IPM treatment of urea 100 kg/ha and 225 kg NPK/ha. High fertilizer and inorganic PGR application triggers the growth of rice plants significantly in conventional treatments. This is consistent with the statement (Triadiati *et.al*, 2012)[12] that the provision of fertilizers, such as urea fertilizer affects the growth of rice plants, that the higher the dose given urea plant growth tends to increase.

In terms of physical (power plants) in the treatment of IPM stronger until the harvest while the conventional treatment of the physical plant (power plant) is reduced, this looks one week before harvest crops began to fall. The falling rice plants affected by rain, wind, lack of sunlight during "panicle initiation" or panicle primordia, N fertilization with high doses, the spacing is too tight, long stem, damage due to pests and diseases (Vergara, 1992 in Hafsah, 2000)[13]. In addition to easily fall crop, rice crop in conventional treatment are susceptible to brown planthopper attack. This is consistent with the statement Mudjiono (2013)[14] that excessive nitrogen fertilization on rice could cause brown planthoppers explosion. The growth of rice plants in IPM and conventional treatments are presented in Figure 7.

IPM Treatment Convensional Treatment

Figure 7: Treatment difference IPM and conventional treatments

5.5 Rice Production

5.5.1 Rice Productive Tillers

Plant growth in IPM and conventional treatments are different, affects the number of productive tillers (panicles) in rice plants. Average numbers of productive tillers are presented in Figure 8.

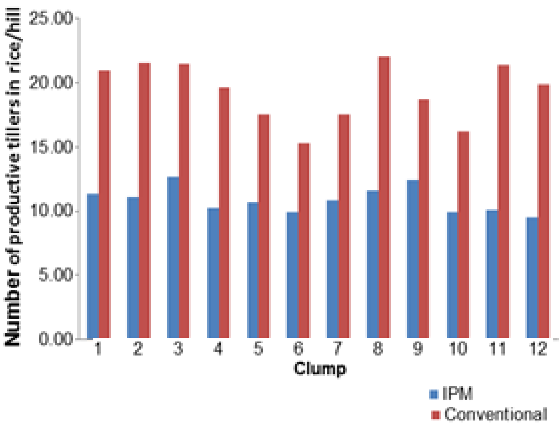

Figure 8. Graph the number of productive tillers in rice at IPM treatment and conventio1nal treatment

On the observation seen that the pattern in the number of productive tillers at IPM and conventional treatment is similar. Figure 8 shows that the number of productive tillers in conventional treatment was significantly higher than IPM treatment. The high number of tillers maximum at conventional treatment affects the formation of productive tiller number, as the opinion of Kuswara and Alik (2003)[15] which states that the maximum number of tillers will affect the number of productive tillers which affect grain yield.

5.5.2 Grain Yield

In this research performed calculations for grain yield in IPM treatment and conventional treatment. On grain yield calculation of the amount of grain by 25 kg on each of three replications IPM and conventional treatments. Observed on grain yield is the ratio of harvest dry grain and dry milled grain. Statistically that the grain yield significantly different IPM treatment with grain yield in conventional treatment.

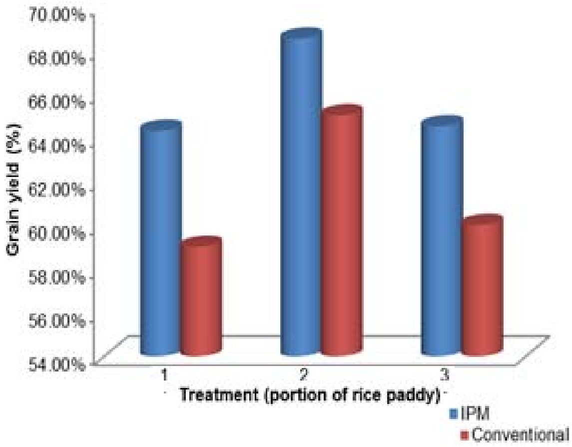

Figure 9 : Graph of grain yield in rice IPM treatment and conventional treatment

Figure 9 shows that the yield of grain in the IPM treatment was higher than in the conventional treatment, this can be due to solid organic fertilizer (cow compost and goat manure) and the addition of liquid compost fertilizer to the plant. This is consistent with the statement Rochman and Sugiyanta (2010)[16] that the nitrogen contained in solid organic fertilizers available on treatment for the treatment plant but due to the addition of liquid organic fertilizer which is expected to overcome the shortcomings of solid organic fertilizer, it did not significantly affect plants but can increase the weight of grain.

Different cultivation system on both treatments affect grain yield results, but it also affects the harvest time is carried out in both treatments, harvesting age for IPM treatment carried out at the age of 104 days after sowing, whereas conventional farming is carried out when the plant 118 days after sowing. This shows that the time of harvest IPM method proved faster than conventional, with time savings of as much as 13 days.

5.6 Analysis of Farming

To find out how much revenue the costs incurred or benefits economically carried out an analysis of the farm during one year the planting season in IPM and conventional treatments. The analysis result shows that the dry grain yield of rice in

IPM treatment was lower than dry grain yield of rice in the conventional treatment. Rice production in the IPM treatment was 3,960 kg/ha, while the total production of the conventional treatment of 5,610 kg/ha. From the analysis of farm that the production of harvests dry grain the IPM treatment was lower than the production of harvest dry grain in conventional treatment, thus affecting net income in the both treatments is the treatment of IPM net income total was Rp. 3.386.400 whereas the conventional treatment was Rp. 88.026.200. IPM rice farming treatment issued an average cash cost (cost of production) is lower than conventional treatment, especially for the cost of seeds, fertilizers, and pesticides, while the average selling price of harvest dry grain (HDG) for both the treatments of farm unchanged at Rp. 3000/kg.

6. Conclusions and Recomendations

6.1 Conclusions

Based on the research results, we can conclude some of the following:

1. The population of brown planthopper lower in IPM treatment than conventional treatment.
2. The population of natural enemies of brown planthopper higher in IPM treatment than conventional treatment.
3. Growth of rice plants was higher in IPM treatment than conventional treatment.
4. The attack intensity of the brown planthopper in IPM treatment was lower than conventional treatment.
5. The result of grain yield was higher in IPM treatment than conventional treatments but harvest dry grain yield (HDG) was higher in IPM treatment than conventional treatment.

6.2 Recomendations

Based on the research conclusions, it can be drawn some recomendations, that are:

1. Implementation of IPM in the planting season have not been able to restore and enhance biodiversity, so as to restore and enhance biodiversity as before the IPM needs to be applied continuously in subsequent seasons.
2. To increase production and protect rice crops from harmful pests attacks, efforts need to be carried out to maintain the IPM method as ecologically farming system that are able to control or suppress pest attack, especially the brown planthopper.
3. The results of this research indicate that the IPM treatment is effective in suppressing the growth of brown planthopper population, although not able to suppress the development of disease, therefore for the next season it is necessary when it is advisable to use a pesticide meet appropriate guidelines.

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