Impact Of Different Time Planting In Soybeans And Neem Seed Extract Application To Insect Population On Rice Field

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Abstract: The purpose of research is to study impact of different time planting of soybean and neem seed extract application to pest insect population on rice field. The research was used Random Block Design in three treatment of insecticides application i.e: neem seed extract together with rice planting, neem seed extract on soybean 17 days after rice planting, synthetic insecticides on 17 days after rice planting (Delthametrin on soybean and Chlorpyrifos on rice), respectively. Research was conducted in rice fields with irrigation channels. The land area is 0.8 hectares with extensive experiments each rice terraces approximately 900 m² with separate by rice terraces for every treatment. Each treatment consisted of three groups and using nine rice terraces. Samples of the rice plant population is 25 plants per sample unit. The results showed treatment by neem seed extract with different time planting of soybeans able to reduce number of pest insects populations such as : N. virens (80.38%), N. lugens (67.17%), S. incertulas (66.5 %), and L. oratorius (93.46%) when compared to treatment with synthetic insecticides (Delthamethrin and Chlorpyrifos).

Keywords: soybean, rice, neem seed extract, pest population, Delthametrin, Chlorpyrifos

1 INTRODUCTION
Rice (Oryza sativa L.) is an agricultural important crop for half world population (FAO, 2004) [7]. Rice was growth approximately on 145 million hectare in 110 country (Pathak and Khan, 1994) [15]. About 90% rice were growth and consumption in Asia. Overall, rice to be an important staple food for 2 billion people on development country (FAO, 1995) [6]. In 2014, Indonesian rice productivity was reduced 0.63% than 2013. In the recent years, the decreasing of rice harvest because reduced of productivity amount 0.33% (BPS, 2015) [3]. Commonly the main factor reduced of rice harvest is presence of pest insects and diseases. The one of human effort against pest insects is insecticides application.

Unfortunately, synthetic insecticides as the plant protection material has a negative effect. Synthetic insecticides playing important role as the source of poison in ecosystem, increasing pest insects resistance, resurgence and endangered status of natural enemies. Currently, botanical insecticide as the solution to control pest insects development. The advantages of botanical insecticides is: low toxicity on mammals, safety for human health and environment, avoid resistance, non toxic for beneficial insects, improve plant health, cheaper and easy to apply (Shepard et al., 1987; Prakash et al., 2008) [20] [16]. Neem seed as the famous botanical insecticides can be used against pest insects (Abdullah et al., 2001) [1]. Schmutterer (1990) [18] suggested that neem (Azadirachta indica A. Juss.) family Meliaceae as the important botanical insecticides to control pest insects on the tropic. Extract of neem seed contain azadirachtin have been reported to disrupt normal feeding behavior of several insect species, reduced reproduction system, neuroendocrine system, cultur cells and protein synthesis (Mordue, 2004) [10]. Commonly, a part of neem such as leaves, fruit, seed, root and bark contain azadiractin, salalin, mechantiol and triterpenoid (liminoid) as broad spectrum secondary metabolite. They are as poison materials for pest insects development (Parrotta and Chatureddi, 1994) [14]. Overall, secondary metabolite from neem against pest insects is low toxicity for mammals, safety residue and simple extraction process (Morgan, 2004) [11]. Therefore, this study focus to neem seed extract as a botanical insecticide at rice crops in order to determine its impact on different planting time of soybean against pest insects populations in rice.

2 METHODOLOGY
Research was conducted at the rice crops in village Balleanging-Balocci, Pangkajene islands District, South Sulawesi on March until August 2014. Pest insects from field were carried out and identified in Pest Laboratory, Pests and Plant Diseases Dept., Faculty of Agriculture, Hasanuddin University Makassar, Indonesia.

2.1. Land Preparation and Cultivation of Soybeans and Rice
The study was conducted in rice fields with fine irrigation channels. Extensive field trials was held in areas 0.8 ha. Measurement of each rice terrace is 900 m². The study was used nine rice field separated by one rice field for each treatment. Rice is planted at the same time for each treatment. We were used Cihereang rice seed with direct seedling methods. Rice distance between one to another plant uniform for each treatment, measurement 20 cm × 20 cm. Soybean planting in the terraces was held by two different planting time : soybeans planted in conjunction with cultivation of rice and
soybeans planted after 17 days of rice planting. We were used Anjasmor soybean seed with uniform spacing for each treatment, measurement 20 cm x 20 cm. Soybean planting on the terraces edge and one lines of soybean plants in each terraces with length 52 cm. Fertilizing is giving once when rice plants age 30 days with a dosage of urea 300 kg/hectare, KCl 100 kg/hectare and 150 kg NPK/hectare. Fertilization of soybean one time after its age 14 days with Phonska and urea 250 kg/hectare, respectively.

2.2. Preparing of neem seed extract
Neem seed extract obtained by soaking 750 g of dried neem seeds in water (1.5 L) during a week. Marinade as the result of neem seed extract was filtered for 50% concentration. Neem seed extract will be applied into the crops by spraying diluted extract 1.5 L added water 13.5 L in order to obtain the concentration of extract to 5%.

2.3. Research implementation
Study was conducted in Randomized Block Design with three treatments and each treatment consisted three replications : neem seed extract in similar time for rice in field and soybean, neem seed extract in rice and soybean 17 day after rice planting, synthetic insecticides application contain active ingredients Delthametrin on soybean and Chlorpyrifos on rice 17 day after planting, respectively. Time spraying of neem seed extract together with synthetic insecticides. Spraying insecticide was done two times during the observation after rice crops aged 71 and 86 day after planting with similar time and concentration for each treatment i.e 15 mL/ 15 L of water.

2.4. Observation
Before D-vac pump began, we put the sample plant inside body was made from plastic pipe and cover of tile cloth (length = 1m, width = 1m, height = 1.5m) to avoid insects escape. Pest insects populations in rice plants was collected by D-vac pump with powered from battery. We were sucking pest insects with D-vac start from top of cover until near the roots of sample plant. The result of D-vac were put into plastik for identification in laboratory. We were used four units samples in each fields. One observation sample unit contain 25 rice clumps in a box (1m x 1m). Two units of samples has distance 0.5 m and two another units with distance 2.5 m from terraces. The distance between sample unit is adjusted to the observation of rice fields. Observations began when rice aged 65 day after planting. Observations were carried out six times with span of observations once a week (65, 72, 79, 83, 92 and 100 day after planting).

2.5. Data Analysis
Data analysis of pest insects population, we were used SPSS at Analysis of Variance (ANOVA) with DMRT level 95% (α = 0.05).

3 RESULT AND DISCUSSION
The result was showed pest insects populations which dominant found on rice is : N. virescens, N. lugens, S. incertulas and L. oratorius (Tables 1). Another type of insect pests such as C. chalcites not presented here because their population is very low.

Table 1. The Number of Pest Insect Population (individual/m²) with Neem Seed Extract and Synthetic Pesticides.

*NMeans followed by the same letters are not significantly different at the 5% level by Duncan’s multiple range test.

Nephotettix virescens D

N. virescens is a vector infectious viral tungro disease in rice. Tungro disease is an endemic at several provinces in Indonesia (Widiarta et al., 2014) [22]. The results was showed neem seed extract treatment for rice cultivation is able to inhibit development of N. virescens when compared to synthetic insecticides (Delthamethrin and Chlorpyrifos). The results of ANOVA was showed on 72 days after rice planting, neem seed extract treatment can suppress growth of N. virescens about 60% compared to synthetic insecticide. The best treatment to suppress growth and development of N. virescens is the neem seed extract combined different planting time of soybean. The observation in 76 days after planting was showing reducing growth of N. virescens up to 6.67 individual compared neem seed extract and synthetic insecticides is 30.00 and 34.00 individual, respectively. Pathak and Khan (1994) [15] state that cultivation of legumes after rice planting is recommended to reduce leafhopper and planthopper infestation.

Nilaparvata lugens S

N. lugens (planthoppers) and leafhoppers are vectors viral diseases in rice. The optimum growth temperature ranges from 25 - 30°C, N. lugens can adapting in high temperatures, but less fertile and their eggs can not hatch (Pathak and Khan, 1994) [15]. Total population of N. lugens were found lower than N. virescens. The results was showed better treatment of neem seed extract and its combination with a treatment different planting time of soybean is able to suppress the growth of N. lugens. The treatment was showed results better than synthetic insecticides. Results of analysis of ANOVA in 79 days after planting showed growth reduction occurred of N. lugens amount 53.74% and 67.17%, respectively. According to Senthil-Nathan et al. (2009) [19] neem extract causes decreasing the amount of food ingested and assimilated by N. lugens. The utilization of neem extracts can be used effectively to inhibit the growth and resilience of N. lugens.
S. incertulas
Commonly S. incertulas major distributed in the tropics, in addition, also found in areas with temperatures above 100°C . S. incertulas larvae act as the rice stem borer. These species are found in Bangladesh, India, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam and some in Indonesia areas (Pathak and Khan, 1994) [15]. The results was showed the observation of 93 days after planting, a synthetic insecticide is able to reduce growth and development of S. incertulas (0.67 individual/m²) compared to neem seed extract (4.33 individual/m²). However, ANOVA on 100 days after planting was showed neem seed extract and different planting time of soybean against S. incertulas growth higher than synthetic insecticide treatment. Nboyine et al., (2013) [12] state that neem seed effective against pest insects in cotton. Growth reduction of S. incertulas indicates that neem seed extract has great capability and potential reduce growth of disease-causing S. incertulas on rice stem borer. The same research results have been reported by Islam et al. (2013) [8] as neem extracts can be used as an effective plant to threat diseases in rice stem borer. Similarly, results of the study reported by Justin and Preetha (2014) [9] showed the percentage reduction neem oil is good against rice stem borer S. incertulas on rice.

Leptocorisa oratorius F
L. oratorius is the most important of rice crops in sub-tropical and tropical areas. Their living on range 30 - 50 days and up to 110 - 115 days (Pathak and Khan, 1994) [15]. The result was showed two treatments neem seed extract and its combination with different time planting of soybean gives better results in reducing growth of L. oratorius. The results of ANOVA in 100 days after planting, neem seed extract could reduce the growth of L. oratorius to 80.32 % while the combination treatment of neem seed extract and different planting time of soybean reduce growth of L. oratorius up 93.46%. Results indicate that neem seed extract capable and can be used as an alternative in tackling the rice plant diseases caused by the growth of L. oratorius. Similar result study have been reported by Chakraborthy (2011) [4] that neem extract from seed, leaves, root, and bark is able to decreasing disease that caused by Leptocorisa. Commonly whole plant extracts of neem is able to inhibit growth on nymph and adult.

Chrysodeixis chalcites E
C. chalcites has the lowest pest populations in rice field. The results was showed no significant difference to total population of C. chalcites in observed of the three types of treatment given. This indicates the neem seed extract as an alternative to natural insecticides have been able to suppress growth of C. chalcites population. According Chakraborthy (2011) [4], the characteristic flavour of neem capable of interfering resistance and cause disease in insects, mainly the content of alkaloid.

4 Conclusion
Neem seed extract can be used as the botanical insecticide to inhibit growth of pest insect in rice. Extract treatment with different time planting of soybeans is able to reduce the number of pest insect populations i.e.: N. virescens (80.38 %), N. lugens (67.17 %), S. incertulas (66.5 %) and L. oratorius (93.46%) when compared with synthetic insecticides (Delthamethrin and Chlorpyrifos ).

References


