Levels of soybean pest attacks on study of soya plant technology package in acid dry land soils in South Lampung

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Abstract. One obstacle in soybean cultivation is the presence of pests and diseases. The concept of IPM is a concept of pest control that arises and develops due to human awareness of the dangers of pesticide use that continues to increase both for the environment and public health. This study aimed to determine the intensity of attack by major plant diseases and the number of natural enemies in soybean plants on acid dry land and the population of natural enemies in Lampung. This research was conducted in Margototo Village, Metro Kibang District, East Lampung Regency. This study used a randomized block design (RBD) and 10 replications, the treatment plot size was 500 m² by 30 plots. In each treatment 10 random sample plants were determined with 3 technology packages, which are technology for farmers (A), specific location technology (B), recommendations technology (C). Data analysis used Minitab. The results showed that at plant age 35 Days After Planting (DAP) for armyworm attacks ranged between 17.6 - 18.4%, however there was no significant difference between treatments. The attack of leaf folding ranged between 0.8 - 7.6% and the highest in treatment A was significantly different from treatment B and C. In general, the highest intensity of pest and disease attacks (gray, leaf folding and leaf rust) was in treatment A and significantly different from treatment B and C. While the existence of the highest natural spider enemies in treatment B and C, compared to treatment A. However, the existence of natural enemies, Menochilus sp., was not significantly different between treatments.

1. Introduction

As the raw material for Indonesian food such as tempeh and tofu, soybean is one of the most needed food crops in Indonesia. In addition, soybeans are also used as the raw material for animal feed industry and other industry. These cause the demand for soybeans continue to increase, far beyond domestic production. National needs for soybeans reach 2.2 million tons per year. For this amount, domestic production is only able to provide 35–40%, therefore the shortfall (60–65%) is met by imports [6].

The potential for acid dry land in Lampung Province is 2,650,413 million ha and is suitable for food crops covering an area of 912,609 ha, therefore the contribution of Lampung Province is large enough to increase soybean production on acid dry land. Community consumption reaches 2.5 million tons of dried soybeans per year, which consists of direct population consumption of 2 million tons, animal feed of 3,000 tons, seeds of 39,000 tons, non-food industries of 446,000 tons, and milk of 49,000 tons [4]. With this production, nationally there is still a shortage of production of around 1.5 million tons of dried soybean seeds, while soybean productivity is still relatively low at 0.09 - 0.14 quintal per hectare.

The strategy to increase national soybean production can also be pursued through a program to expand planting/harvesting areas and increase productivity to support the soybean self-sufficiency
program. The expansion of the soybean harvest area is considered capable of making a real contribution to the increase in national soybean production [3, 5].

One obstacle in soybean cultivation is the presence of pests and diseases. Soybean plants are one of the plants that can be attacked by pests since they start growing until the harvest. In Indonesia there are more than 111 Arthropod species which are pests, 53 species are not targets, 61 predator species and 41 parasitoid species [8]. There are 17 types of pests that can cause damage and losses to soybean plants. Some of the main pests that are often found are bean flies (Ophiomya phaseoli), armyworms (Spodoptera litura), soybean beetles (Phaedonia inclusa), pod borer (Etiella zinckenella), pod suckers (Riptortus linearis), and green ladybugs (Nezara viridula). In an effort to control pests, farmers are still relying on insecticides, because other methods such as the use of resistant varieties and natural enemies have not been widely used. Pest control using insecticides is common, but failure to deal with pests is still common. The use of insecticides without the knowledge of pest bioecology and correct application techniques results in the failure to achieve control objectives, and can even lead to resurgence and resistance [6].

To reduce the negative impact of the use of pesticides, chemical control of pests began to be abandoned and shifted to control based on the concept of Integrated Pest Management (IPM). The concept of IPM is a concept of pest control that arises and develops due to human awareness of the dangers of pesticide use that continues to increase both for the environment and public health.

The concept of IPM is very much in line with sustainable agriculture, which is agriculture that meets current needs without negatively impacting existing physical resources, so that it does not jeopardize the capacity and potential of future agriculture to satisfy the aspirations of future material and environmental aspirations [4]. Natural enemies in a good natural balance always manage to control pest populations and are below the economic threshold. Therefore, by giving natural enemies the opportunity to work means reducing the use of pesticides. The role of predators and parasitoid in suppressing pest populations naturally is quite important, so efforts to conserve natural enemies in the field need to be considered. This study aimed to determine the intensity of attack by major plant diseases and the number of natural enemies in soybean plants on acid dry land and the population of natural enemies in Lampung.

2. Materials and Methods
Soybean planting is carried out during the early dry season (MK-I) in May - August 2018 in Margototo Village, Metro Kibang District, East Lampung Regency, from May to December 2018. This study used a randomized block design (RBD) and 10 replications, plot size treatment of 500 m2 by 30 plots. In each treatment, 10 sample plants were randomly assigned with the technology package used consisting of 3 technology packages, which are: farmers technology package (A), specific location technology package (B), and recommended technology package (C). Data analysis used Minitab.

| Component of Technology | Farmers Technology Package (A) | Specific Location Technology Packages (B) | Recommended Technology Package (C) |
|-------------------------|--------------------------------|------------------------------------------|-----------------------------------|
| Variety                 | Local                          | new superior varieties (Demas-1)         | new superior varieties with dry land acids tolerance (Demas-1) |
| Seed                    | original                       | superior, certified                      | superior, certified               |
| Land preparation        | No tillage                     | Perfect Tillage (1-2 plow time)          | 1-2 times tillage (depend on soil condition) |
| Planting                | Plant by making holes, spacing 40 cm x 20 cm, 2 seed/hole | Plant by making holes, spacing 40 cm x 15 cm, 2 seed/hole | Plant by making holes, spacing 40 x 15 cm atau 30 x 20 cm, 2 seed/hole. |
| Calcification/Amelioration | Fertilization | Dolomite 1.5 ton/ha | dolomite $\frac{1}{2}$ x AL-dd |
|--------------------------|--------------|---------------------|-----------------------------|
| No dolomite              | Urea 50 kg/ha, SP-36 50 kg/ha | NPK 150 kg/ha + local organic fertilizer 2 ton/ha | Urea 75 kg, SP-36 100 kg, and KCl 100 kg/ha. |
| Seed treatment           | not done     | Agrisoy 6 package/ha (40 g/8 kg seed) | On land that has never been planted with soybeans, the seeds are mixed with Agrisoy 40 g/8 kg seed, if it is not available, use the former soybean planting area that is sown on the row of plants carried out. |
| Weed Control             | Herbicide    | Weeding at the age of 15 and 45 days after planting (DAP) or using herbicide according to the recommended dosage | Use of rice straw mulch: If it is necessary, use 5 tons of rice straw / ha as mulch by spreading evenly, thickness <10 cm. Use it in early soybean growth. |
| irrigation               | not done     | Making drainage ditches every 4 meters with a trench width of 30 cm as deep as 20-25 cm throughout the plot. Giving water in critical phases (at the beginning of the growth of the age of 15-21 days, when flowering ages 25-35 days, when filling pods aged 55-70 days), if there is no rain. | Making drainage channels every 4 meters with a trench width of 30 cm as deep as 20-25 cm throughout the plot. Giving water in critical phases, if there is no rain. |
| Pest Control             | Used chemical insecticides | Based on control threshold monitoring | Used the principle of IPM |
| Disease Control          | Chemical pesticides | Used liquid smoke, depending on plant conditions | IPM / fungicide according to recommended dosage uses liquid smoke, depending on plant conditions |
| Harvest and Post Harvest| used a sickle when 90% pods are brown and dry. The crop is dried in the ground and immediately used thresher or using a manual tool. | done if 95% of the pods on the main stem are brownish yellow. Harvest starts at 9:00 a.m., when the dewdrop is gone. Using a sickle, by cutting the base of the stem and immediately dried the seeds, then stored in thick plastic bags / using airtight plastic bottle | done if 95% of the pods on the main stem are brownish yellow. Harvest starts at 9:00 a.m., when the dewdrop is gone. Using a sickle, by cutting the base of the stem and harvesting, it is dried a few days later, then threshered. Seed is stored in a thick plastic bag / using an airtight plastic bottle |
3. Results and Discussion

The results of the study showed the difference between packages A, B, and C for the level of pest and disease attacks. From the initial vegetative growth to the generative growth phase, pests and diseases that attack plants to harvest are seen in tables 2, 3 and 4.

Table 2. Percentage of major pest and disease attacks at the age of 30 DAP.

| Treatment | Armyworm attack (%) | Seed flies attack (%) | Leaf folders attack (%) | Leaf rust attack (%) | Population Menochilus sp (tail) | Spider Population |
|-----------|----------------------|-----------------------|------------------------|----------------------|-------------------------------|------------------|
| Package A | 17.6a                | 3.2a                  | 10.8a                  | 7.6a                 | 1.0a                          | 1.0b             |
| Package B | 18.4a                | 4.4a                  | 6.8 b                  | 0.8b                 | 2.0a                          | 4.0ab            |
| Package C | 17.6a                | 5.2a                  | 7.2 b                  | 0.8b                 | 4.0a                          | 6.0a             |

Table 3. Percentage of major pests and diseases at age 45 DAP.

| Treatment | Armyworm attack (%) | Leaf folders attack (%) | Leaf rust attack (%) | Population Menochilus sp (tail) |
|-----------|----------------------|------------------------|----------------------|-------------------------------|
| Package A | 32.8a                | 14.4a                  | 5.2a                 | 0.1a                          |
| Package B | 16.0b                | 6.0b                   | 0.0b                 | 0.1a                          |
| Package C | 15.2b                | 7.2b                   | 0.8b                 | 0.2a                          |

Table 4. Percentage of major pests and diseases at age 60 DAP.

| Treatment | Armyworm attack (%) | Leaf folders attack (%) | Leaf rust attack (%) | Population Menochilus sp (tail) |
|-----------|----------------------|------------------------|----------------------|-------------------------------|
| Package A | 20.8a                | 5.2a                   | 2.0a                 | 2.0a                          |
| Package B | 12.4a                | 2ab                    | 1.2b                 | 3.0a                          |
| Package C | 11.2a                | 0.0b                   | 1.2b                 | 2.0a                          |

When plants aged 30 DAP, armyworm attacks ranged from 17.6 - 18.4%, but between treatments were not significantly different. The attack of leaf folding ranged between 0.8-7.6% and the highest in treatment A was significantly different from treatment B and C, while treatment B and C with each other were not significantly different. Likewise, with the attack of leaves rust, the highest percentage in treatment A and significantly different from treatment B and C. At the time the plant was 45 DAP, it was seen that armyworm attacks ranged from 15.2 to 32.8% and that which was higher in treatment A, while for leaf folding attacks ranging from 6-14.4% showed that the highest treatment A was significantly different from treatment B and C. The highest attack of leaves rust in treatment A and significantly different from treatment B and C. The natural enemy of pests observed is Menochilus sp. and spiders. In 10 clumps of plants found Menochilus sp. ranging from 1 to 4 tails, between treatments not significantly different. Whereas spiders as natural enemies of soybean pests are found in 1-6 heads per ten plant clumps, and between treatments there are significant differences. The lowest treatment of the existence of natural enemies and significantly different from treatment A, but not significantly different from treatment B.

Army caterpillar attacks, leaf folding and leaf rust disease were still found when the plants were 30 DAP and 60 DAP. In general, the attack percentage was highest in treatment A and significantly different from treatment B and C. Natural enemies were observed when plants were 30 days old and 60 days old only Menochilus sp. and the amount between treatments is not significantly different. Broken pods are more predominantly caused by pod borer attacks, because during observation we see pod borers. The percentage of damaged pods in this activity is very high ranging between 51.18 - 71.53% and between treatments is not significantly different. The level of damage caused by pod attack on
soybean plants is determined by various factors such as high and low population, plant growth phase, crop response to pests, planted varieties and control measures taken [2].

Increased attack on field pests is thought to be related to the wider extent of soybean planting and the availability of continuous host plants [1];[11]. According to Marwoto and Indiati [8], pest attacks will increase when the land lacks water and the temperature increases. The high pest attack in this activity is probably due to lack of water, because rainfall is only 87.7 mm for 11 days during the planting season.

4. Conclusion
In general, the intensity of pest and disease attacks (gray, leaf folding and leaf rust) was highest in treatment A and significantly different from treatment B and C. While the existence of the highest natural spider enemies in treatment B and C was compared to treatment A. But the existence of natural enemies Menochilus sp. not significantly different between treatments. To find out the intensity of attacks regularly there needs to be further research.

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References
[1] Baliadi Y, W Tengkano & Marwoto. 2008. Borer Soy Borer, Etiella Zinckenella Treitschke (Lepidoptera: Pyralidae) And Its Control Strategy in Indonesia. Journal of Agricultural Research and Development. 27 (4): 113-123.
[2] Bayu MSYI. 2015. Level of Attack on Various Pod Pests in Soybean Germplasm. PROS SEM BIODIV INDON MASV. Vol. 1 (4) July: 878-883.
[3] Direktorat Perlindungan Hortikultura. 2018. http://ditlin.hortikultura.pertanian.go.id/index.php
[4] Harsono A and Subandi. 2013. Opportunities for Soybean Development in Cassava Planting Areas in Acid Dry Land. Food Crop Science and Technology Journal 8 (1): 31-38.
[5] Hasdi. 2015. Prospects for soybean consumption and imports in Indonesia. Journal of Economic Studies 3 (5): 1-8.
[6] Jusniati, 2013. About and Results of Soybean (Glycine Max L.) Varieties in Peatlands at Various Shade Levels. Faculty of Agriculture, Tamanisawa University, Pasaman.
[7] Marwoto. 1992. Problems of Effectiveness of Soybean Pest Control at the Farmer Level. Minutes of Soybean Integrated Plant Pest Control Workshop. Balittan. Poor. Thing 37-43.
[8] Marwoto and SW Indiati. 2008. Strategy and Components of armyworm Control Technology (Spodoptera litura Fabricius) in Soybean Plants. Agricultural Research Journal, 27 (4): 131-136.
[9] Marwoto and SW Indiati. 2009. Soybean Pest Control Strategy in the Era of Global Climate Change. Crop Science and Technology. Vol. 4 (1): 94-103.
[10] Okada, T., W. Tengkano and T. Djuwarso. 1988. An Outline of Soybean Pest In Indonesia In Faunistic Aspect. Inside: BORIF Seminar; Bogor, December 6, 1988. Bogor: BIORIF p.37.
[11] Samosisir S, Marheni & Syahrial O. 2015. Test the Green Ladybug Preference for Nezara viridula L. (Hemiptera: Pentatomidae) in Soybean and Long Beans in the Laboratory. Online Journal of Agroekoteknologi Vol. 3 (2), March: 772-778.