

# The Intensity of Leaf Damage Caused by Attack of *Spodoptera litura* F and Seed Yield on Some Soybean Varieties in South Sulawesi Indonesia.

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## Abstract

South Sulawesi is one of the centers of soybean development in Indonesia. This study aims to determine the degree of leaf damage caused by attack of armyworm *S. litura* attack and seed yield on some soybean varieties in South Sulawesi. The research was conducted in Wajo, Soppeng, Pangkep and Maros Districts. The design was Randomized Block Design with 9 treatments (9 varieties) and 3 replications. The result showed that there are 4 varieties having low leaf damage intensity and relatively high yield of Anjasmoro variety, leaf damage intensity 10.94% to 14.16% and seed yield 1.65 to 2.71 t ha<sup>-1</sup>, Argomulyo, 10.15% to 13.84% and 1.96 to 2.10 t ha<sup>-1</sup>, Grobogan 10.18% to 12.72% and seed yields 1.64 to 2.25 t ha<sup>-1</sup>, and Burangrang 12.12% to 13.85% and seed yields 1.35 to 2.08 t ha<sup>-1</sup>. These four varieties also have large seeds (weight 100 seeds 15.12 to 18.57 g). Based on this, the varieties Anjasmoro, Argomulyo, Grobogan and Burangrang recommended be planting and developing at the level of farmers in South Sulawesi Province.

**Index Terms:** Soybean ; varieties ; leaf damage, ; and seed yield.

## I. INTRODUCTION

Armyworm *S. litura* is one of the important pests in soybeans both in Indonesia and in the world. In Brazil, *S. litura* can damage soybean leaves by about 35%. (Cristin et al., 2010). In Bangladesh, about 15-20% of total soybean production is decreased due to *S. litura* attack (Biswas, 2013). In addition to soybean, *S. litura* also attacked several other plants such as tobacco. In India, *S. litura* can result in tobacco yield loss of 35 to 50%. While in cotton plants, in India, *S. litura* can result in a yield loss of 25.8-100% (Shilpa and Remia, 2017).

In Indonesia, armyworm *S. litura* is an important pest of soybean-eating pest compared to other pests such as caterpillar (*Chrysodeixis chalcites*), helioverpa (*Heliothis armigera*) caterpillars, *Lamprosema indica*. Caterpillar armyworm, *S. litura* is a type of polypag pests that attack various types of plants including soybeans. This is in accordance with Santi and Krisnawati (2016) in Indonesia, *S. litura* is an important pest on soybean with a leaf damage rate of about 70%. According to Adie et al. (2012), the loss of soybean yield due to armyworm can reach 80% in Japan, 90% in America, and 23-45% in Indonesia. Meanwhile, according Marwoto and Suharsono (2008), the loss of results due to armyworm *S. litura* attacks in Indonesia can reach 80%. While in South Sulawesi, the level of armyworm attack on soybean leaves varies from 12.11% to 45.26% (Fattah and Hamka, 2012).

To overcome the attacks of armyworm *S. litura* on soybeans, there are several ways that can be taken, among others, planting tolerant varieties, plant rotation, and the use of insecticides. Based on this matter, so to get varieties tolerant to the attack of *S. litura* on the leaves, so conducted some varieties of soybean superior in some districts as the center of soybean development in South Sulawesi.

## II. MATERIALS AND METHODS

Research on the damage intensity of armyworm *S. litura* in several soybean varieties in South Sulawesi has been conducted in Wajo, Soppeng, Pangkep and Maros Districts. This research is aimed to get soybean varieties that are tolerant and have high seed yield in South Sulawesi. This study used a Randomized Block Design with 9 treatments (9 varieties of soybeans) and 3 replications. Plot size used 4 cm x 5 cm. Parameters observed: damage intensity of attack of armyworm *S. litura*, seed yield, plant height, number of pods, and number of branches

The leaf damage intensity was calculated based on the following formula:

$$I = \frac{\sum_{i=0}^x (n_i \times v_i)}{2 \times N} \times 100\%$$

I = Attack intensity

$n_1$  = Number of leaves observed at  $v_1$   
 $v_1$  = The value of leaf damage at the  $i$   
 $N$  = Number of leaves observed  
 $Z$  = The highest scale value of leaf

Scale Value:

- 0 = no damage to leaves
- 1 = leaf damage > 0 - 20%
- 3 = leaf damage > 20 - 40%
- 5 = leaf damage > 40 - 60%
- 7 = leaf damage > 60 - 80%
- 9 = leaf damage > 80 - 100%

Statistic Analysis

All observed data were analyzed using variance analysis (ANOVA). The data was analyzed using SAS (Statistical Analysis System). The comparison of mean leaf damage intensity caused by *S. litura* and other parameters was made using the LSD test at a 5% probability level.

III. RESULTS

1. Intensity of leaf damage caused by *S. litura* attack on some soybean varieties in South Sulawesi

Based on the results of research conducted in Wajo Regency showed that the intensity of leaf damage caused by armyworm *S. litura* attack on Kaba 17.16% varieties, followed by Detam-2, 16.14% and Gema 16.16%. While the lowest leaf damage intensity was found in Argomulyo 10.15% and Grobogan 10.18% (Figure 1) varieties. While in Pangkep Regency, the highest damage intensity in Detam-2 17.40%, followed by Detam-1 16.10% and Kaba 15.43%. While the lowest leaf damage intensity was found in 10.10% Gepak Kuning 10.40% varieties (Figure 1)

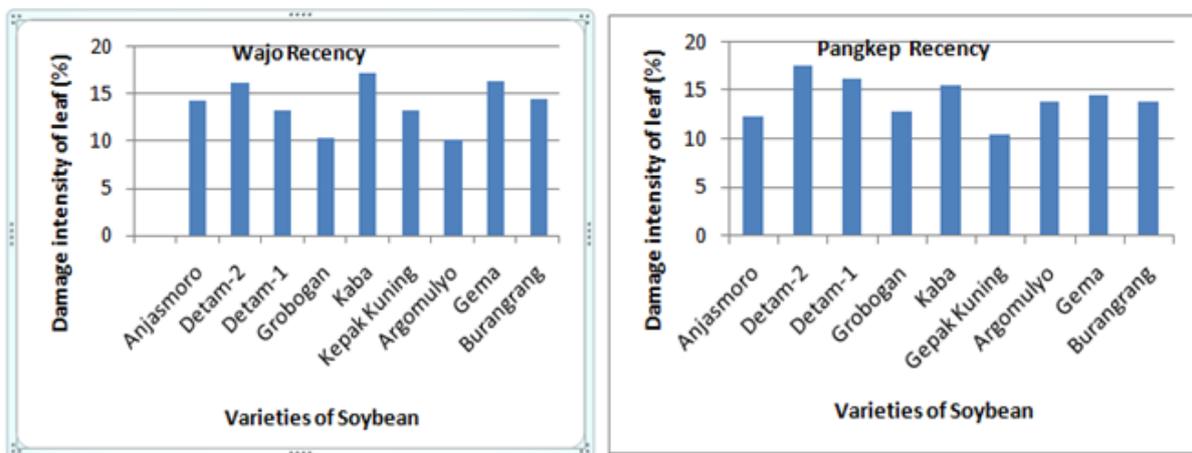
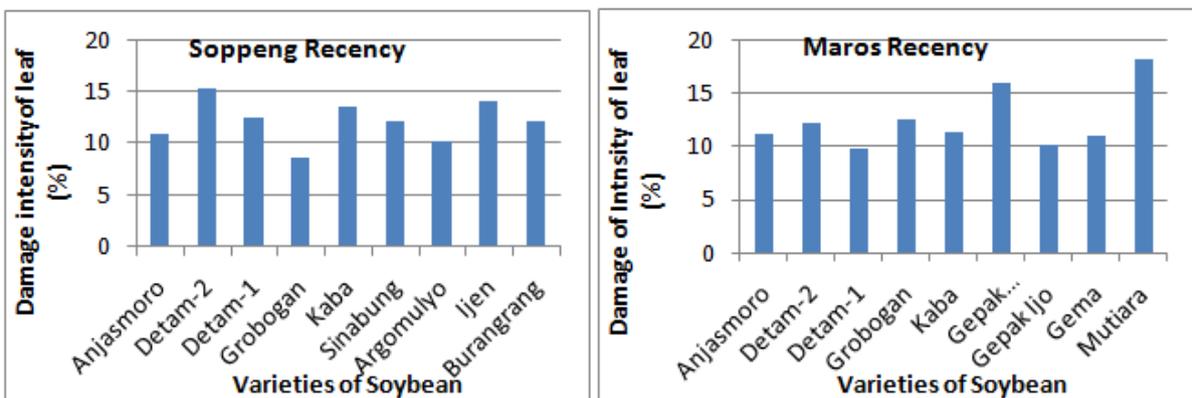


Figure 1. Damage intensity of leaf for some varieties of soybean in Wajo and Pangkep Regency

The intensity of soybean leaf damage caused by armyworm *S. litura* attack in Soppeng Regency, highest on Detam-2 15.40%. While the lowest was found in the varieties Grobogan 8.61%. In Maros Regency, the intensity of soybean leaf damage caused by armyworm *S. litura* attack on Mutiara 18.26%. While the lowest in Detam-1 varieties of 9.87% and Gepak Ijo 10.19% (Figure.2)



Resource : Fattah dan Hamka (2010)

. Figure 2. Damage intensity of leaf for some varieties of soybean in Soppeng and Maros Recency

**2. Seed yield achieved in some soybean varieties in South Sulawesi Province**

Seed results achieved in the Wajo District study were highest in the Anjasmoro variety 2.45 t ha<sup>-1</sup>, while the lowest was on the echo 1.95 t ha<sup>-1</sup>. Seed yield in each soybean varieties tested in Pangkep Regency showed that the highest varieties of Anjasmoro were 2.71 t ha<sup>-1</sup>, followed by Detam-2, 2.21 t ha<sup>-1</sup> and Gema 2.18 t ha<sup>-1</sup>. While the lowest seed yields were found in Detam-1 varieties, 1.90 t ha<sup>-1</sup> and Kaba 1.97 t ha<sup>-1</sup> (Figure 3).

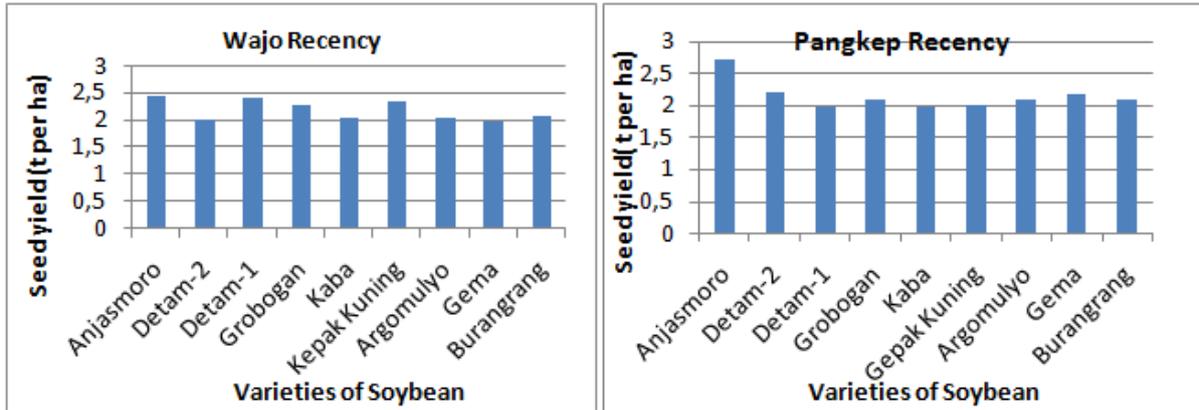
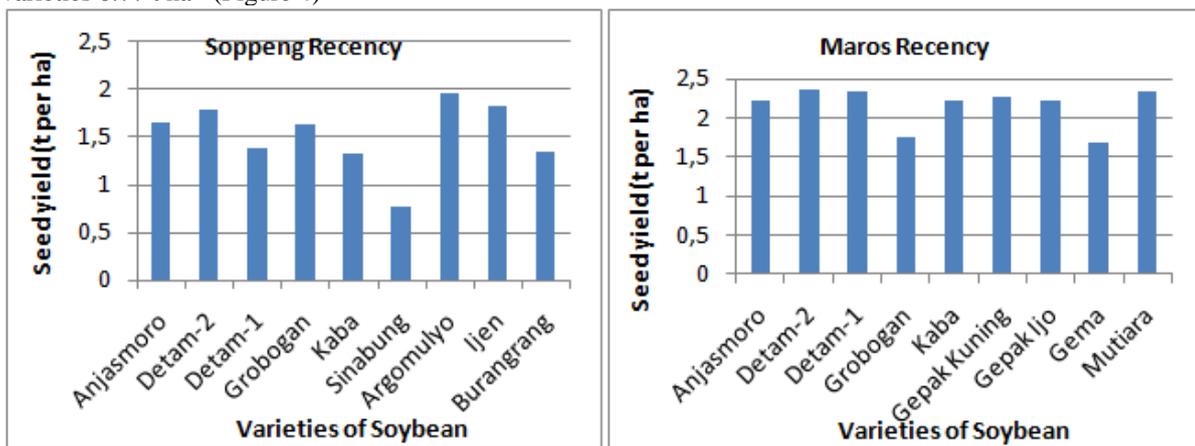


Figure 3. Seed yield for some varieties of soybean in Wajo and Pangkep Recency.

Seed yields achieved in several varieties of soybeans in Soppeng Regency were highest in Argomulyo 1.96 t ha<sup>-1</sup>, followed by Ijen 1.83 t ha<sup>-1</sup>, Anjasmoro 1.65 t ha<sup>-1</sup>, Detam-2, 1.79 t ha<sup>-1</sup> and Grobogan t 1.64 t ha<sup>-1</sup>. While the lowest on the Sinabung varieties 0.77 t ha<sup>-1</sup> (Figure 4)



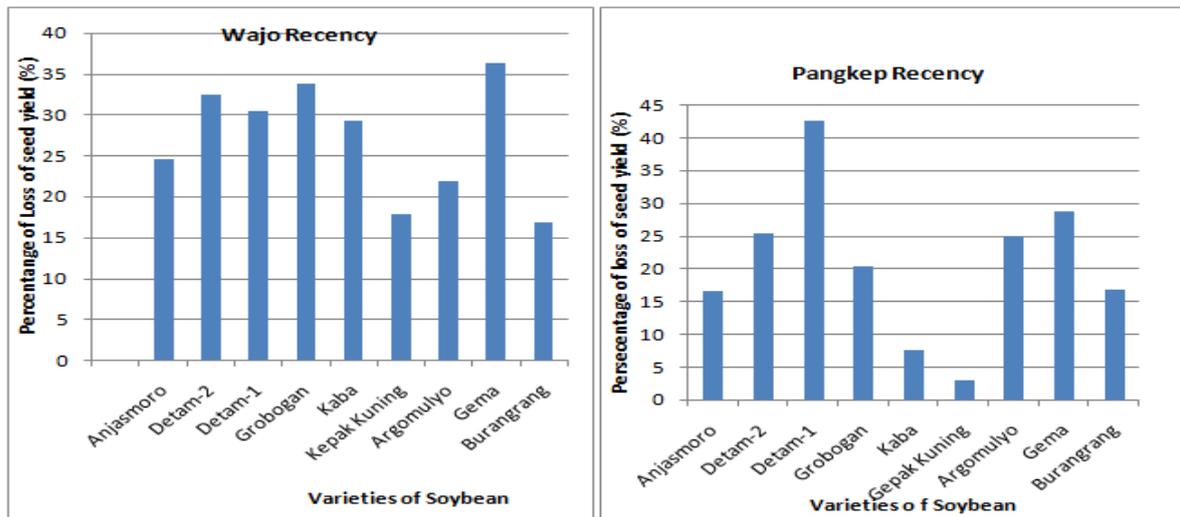
Resource : Fattah et al. (2014)

Figure 4. Seed yield for some varieties of soybean in Wajo and Pangkep Recency.

Seed yield achieved in Maros Regency was highest in Detam-2, 2.35 t ha<sup>-1</sup>, followed by Detam-1, 2.34 t ha<sup>-1</sup> and Mutiara 2.34 t ha<sup>-1</sup> varieties. While the lowest on the varieties of Gema 1.69 t ha<sup>-1</sup> and Grobogan 1.75 t ha<sup>-1</sup> (Figure 4).

**3. The percentage of yield loss in some soybean varieties in South Sulawesi Province**

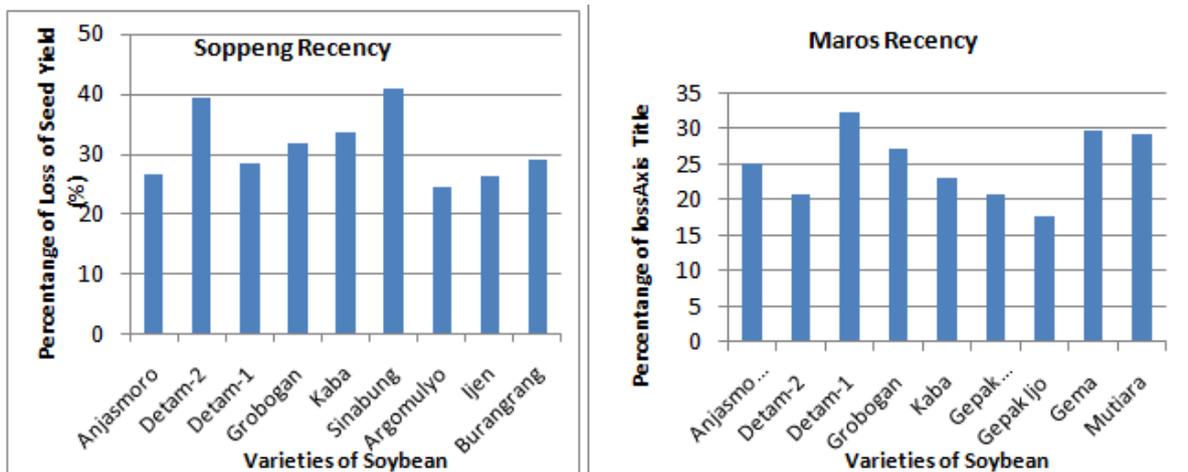
The percentage of seed loss in some soybean varieties in Wajo Regency was lowest in Burangrang 16.80%, followed by Geber Kuning 17.83%. The highest yield loss rate was found in Gema 36.27% varieties, followed by Grobogan 33.82% and Detam-2, 32.43%. The percentage of seed loss in the lowest Pangkep was found in Gepak Kuning 3.01%, followed by Kaba 7.51% varieties. The highest yield loss rate was found in Detam-1 varieties of 42.52%, followed by Gema 28.76% and Detam-2 25.34% varieties.



Resource : Fattah et al. (2014).

Figure 5. Seed yield for some varieties of soybean in Wajo and Pangkep Recency.

The percentage of seed loss in Soppeng Regency was highest in Sinabung varieties 40.76%, followed by Detam-2, 39.52% and Kaba 33.5%. While the lowest was found in Argomulyo 24.61%, followed by Anjasmoro 26.67% and Ijen 26.51% (Figure 5).



Sumber : Fattah et al. (2014).

Figure 6. Seed yield for some varieties of soybean in Wajo and Pangkep Recency.

The percentage of seed loss in some varieties of soybean in Maros Regency was highest at Detam-1, 32.17%, followed by Gema 29.58% and Mutiara 29.09%. While the lowest in Gepak Ijo varieties 17.53% (Figure 6).

#### 4. The morphology characters of several varieties of soybeans in South Sulawesi Province

Plant morphology such as plant height, number of branches, number of pods and weight of 100 seeds can affect the high yield of seeds. In Table 1, it is seen that plant height in some varieties, the highest is found in Gepak Ijo 62.20 cm and lowest in Grobogan 46.90 cm, Gepak Kuning 47.40 cm, and Detam-2, 49.00 cm. Number of branches, highest on Argomulyo 3.45, Detam-1, 3.30 and Gema 3.40, while lowest on Kaba 2.5. Number of pods per plant, highest was found in Gepak Ijo 84.90 and Gepak Kuning 84.90 varieties, while the lowest was in Gema 43.35.

Table 1. Plant height, number of branches, number of pods, and weight of 100 batches

Soybean varieties	Plant height (cm)	Number of branches plant <sup>-1</sup>	Number of pods plant <sup>-1</sup>	The weight of 100 batches (g)
Anjasmoro	56.10 efg	2.70 ab	67.20 c	15.55 c
Detam-2	49.00 ab	3.00 ab	59.60 b	14.21 c
Grobogan	46.90 a	2.80 ab	69.60 d	18.57 d
Detam-1	54.40 de	3.30 b	67.50 c	12.16 b
Kaba	50.80 bc	2.50 a	76.90 e	10.24 b
Gepak Kuning	47.40 a	2.90 ab	84.90 f	10.18 b
Argomulyo	54.48 de	3.45 b	67.30 c	15.63 c

Gema	58.80 fg	3.40 b	43.35 a	11.56 b
Burangrang	56.15 efg	2.75 ab	67.23 c	15.12 c
Ijen	58.60 fg	3.10 ab	67.00 c	11.35 b
Gepak Ijo	62.20 h	2.90 ab	84.90 f	7.06 a

Sumber : Fattah et al. (2014).

The weight of 100 seeds was highest in Grobogan 18.57 g, followed by Anjasmoro varieties 15.55 g, Argmulyo 15.63 g, Burangrang 15.12 g and Detam-2, 14.21 g

#### IV. DISCUSSION

##### 1. The Intensity of leaf damage due to armyworm *S. litura* attack on some soybean varieties in South Sulawesi

The results of research conducted in Wajo District, the level of leaf damage due to grayak *S. litura* caterpillars varied greatly between varieties and highest on Kaba, followed by Detam-2 and Gema, while the lowest was in Argomulyo and Grobogan. The difference of leaf stool level due to *S. litura* attack on soybean varieties one of the causes is the protein content of each variety. The content of Kaba and Detam-2 varieties is higher (44.0% and 45.58%) than Argomulyo which only reached 39.40% (RIPT Malang, 2013). Further Tuan et al. (2015) of *S. litura* larvae consumed more protein containing (0.267g /) and nitrogen (0.070 g / l) than the protein content (0.080 g per l) and nitrogen (0.030 g per l). Furthermore, Xue et al. (2010), from 4 types of plants tested, sweet potatoes provide the highest survival (99.0%) in *S. litura* larvae and the lowest in tobacco (80.10%). The results of Kalyan and Ameta (2017), RKS-24 varieties have the lowest symptoms of *S. litura* attack (3.59 larvae per 5 plants) and highest in JS-35 (6.39 larvae per 5 plants). Saveer (2012), the appropriate food and shelter is one of the decisive factors in the sustainability of the reproductive system and the fecundity of grayak worms. Furthermore it is said that appropriate food and shelter is one of the decisive factors in the sustainability of the reproductive system and the fecundity of armyworms

Similarly, the level of leaf damage caused by armyworms in Soppeng and Maros Districts showed different results. The rate of leaf damage in Soppeng Regency is highest in Detam-2 whereas in Maros regency, the highest in Mutiara. The difference of leaf damage rate due to *S. litura* attack in each district, besides influenced by differences in climatic conditions is also due to differences in the nature of the genotype and the adaptability of each varieties. According to Arifin and Tengkanu (2008), the level of leaf damage caused by pest attack is determined by genotype varieties factor. In addition to genotype factors, morphological factors that influence the rate of leaf damage due to armyworms *S. litura* attacks include plant height. This is consistent with the degree of leaf damage to the lower Grobogan compared to other varieties (Figs 1 and 2), then when associated with plant height (Table 1), Grobogan and Gepak Kuning varieties have the lowest plant height. This is in accordance with Nugrahaeni et al. (2013), strains with shorter stem size (44.50 cm) are more resistant to armyworms attacks than strains that have longer stem length (50.30 cm).

##### 2. Soybean yield achieved in some soybean varieties in South Sulawesi Province

Seed results achieved on Anjasmoro variety are relatively high and stable in 3 districts of Wajo, Pangkep, and Soppeng. This is also influenced by the level of armyworm pest attack on relatively leafy leaves, also supported by morphological appearance including plant height, number of branches, number of pods, and 100 seed weight is relatively high. In contrast to Grobogan varieties that have low levels of leaf damage, but the yields of seeds achieved are also low, because they have a short plant height and a relatively low number of pods. While Kaba varieties have a moderate intensity of leaf attack, but the seed yield obtained is also relatively moderate in each district. This is due to the weight of 100 seeds and the low number of branches.

##### 3. The percentage of seed loss in each variety in South Sulawesi

The rate of seed loss in each variety varies greatly between varieties in each district. The rate of yield loss in addition to being influenced by the low yield of the seeds achieved in each variety is also influenced by the potential yield of seeds in each variety. The lowest seed loss rate was found in Gepak Kuning, Gepak Ijo, and Ijen varieties, in addition to being affected by relatively low levels of damage also affected pontesi relatively low yield 2.49 to 2.86 t ha<sup>-1</sup> (Description of varieties in Malang, 2013). Different in Grobogan varieties that have relatively high seed yield, but the yield rate of seed loss is relatively high because it has a high yield potential of 3.40 t ha<sup>-1</sup> (Description of soybean varieties in Malang, 2013).

#### V. CONCLUSIONS

The varieties that have relatively low intensity of leaf damage and have a fairly high yield of seeds in 4 districts are Anjasmoro, Argomulyo, Grobogan, and Burangrang. These four varieties, in addition to having relatively high seed yields, also have a large seed, so liked by farmers to be planted. Based on this, the four varieties are recommended to be developed at the farm level

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