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## Growth and Yield of Soybean (*Glycine max* (L.) Merrill) Anjasmoro Cultivar with the Treatment of Compost Fertilizer that Grow with the Weeds

Sumarmi<sup>1</sup> and Kharis Triyono<sup>2</sup>

<sup>1</sup>Laboratory of Biology <sup>2</sup>Laboratory of Ecology  
Faculty of Agricultural Universitas Slamet Riyadi

*Corresponding author: felt.sumarmi@gmail.com*

### ABSTRACT

One of the inhibiting components of soybean production is the growth of weeds. This study aims to observe the growth of weeds in the growth of soybean plants that are given compost. Anjasmoro soybean varieties were planted in the Mojosongo research field, Surakarta, on April 14, 2020. There are 4 types of treatment, they are given compost made from tobacco, soursop leaves, a mixture of tobacco dry and soursop, and without being given fertilizer. Weeds were allowed to grow together with soybeans in 10 polybags, each treatment. At fourth weeks and at harvest time, weeds that grow are observed. The results found 9 kinds of weeds consisting of 5 species of Monocots and 4 types of Dicotyles. Soybean plant height growth increased after four week because all weeds had been removed, so began flowering, then developed into pods. The total wet weight of weeds was 1,539 grams, while the wet weight of the soybean crop at harvest was 858.4 grams. Soybean seems to dry out at harvest time, while weeds stay fresh when removed. Wet weed weight in the control treatment was 284,8 grams, the least compared to other treatments. The biggest wet weight treatment of weeds was on soybean plants which were given mixed compost, 514.8 grams. The number of pods per plant ranges from 17 to 26. The average number of seeds every plant in giving mixed compost is at most 98 seeds. A mixture of tobacco leaf and soursop compost was able to increase Anjasmoro's soybean yields.

Key word: soybeans, compost, soursop, tobacco, weeds

### INTRODUCTION

National soybean production in 2019 reached 1,419,046 tons. The planting area for soybeans in Indonesia is currently recorded at 620,000 ha with a productivity per ha of 1.5 tons. Actually, the total requirement for soybeans is 2.3 million tons. The Indonesian government is trying to increase soybean productivity in various ways and efforts (Elisabeth and Suhartina, 2019). The Indonesian Ministry of Agriculture continues to increase soybean production, but is still constrained by problems such as soil conditions, insufficient land and weed disturbances (Basri 2018, Taufiq and Wijanarko, 2012). Soybeans are an important source of food because they are useful for addressing the protein needs of malnourished sufferers (Swami et al. 2019). The quality and quantity of soybean yields will decrease if during plant growth there are weeds (Kilkoda, et al. 2015).

Most of the soybean planting in Indonesia is carried out at the end of the dry season (June / July until September / October). This results in the harvest occurring at the peak of the dry season. The crop of soybean pods becomes very dry and some of the seeds fall into the planting area. Anjasmoro is a soybean

variety that is widely known and liked by farmers. Anjasmoro soybean variety shows quite resistant and resistant properties to changes in environmental temperature (Krisnawati and Adie 2017).

The main problem associated with soybean production in tropical ecology is poor soil fertility. Future efforts to overcome this problem can be done by using fertilizers (Togun, et al. 2014). Fertilizer is needed to maintain or increase soybean crop yields. Organic fertilizers can be made from animal waste, called manure and plants: compost. Research on rice fields with the addition of organic carbon compared to conventional rice fields showed a soil pH of 6.9 which was better than ordinary land because the soil pH was acidic, namely 5.8. Carbon and nitrogen with organic management were also higher, namely 2.4 and 0.41%, while conventional land was lower, namely 1.8% C and 0.28% N. This indicates that the use of organic fertilizers is better than chemical fertilizers. The use of chemical fertilizers can gradually increase land toxicity due to the addition of chemical compound residues in the soil (Supriyadi et al. 2020). Organic matter is an important element in growing soil fertility, especially on dry land, because it can improve the physical structure of the soil (Erita et al. 2020). Organic fertilizers will release nutrients rather slowly and steadily over a long period of time. Compost can also increase soil fertility status by activating soil microbial biomass. The use of large amounts of organic fertilizers is needed to meet the nutritional needs of plants (Adeyeye, 2017). The use of compost on soybean plants is needed so that the soil conditions become more loose.

Compost can be made from readily available materials such as poultry manure, wild sunflower (*Tithonia diversifolia*), broad leaf weeds, neem tree leaves (*Azadiracta indica*), corn cobs, cassava shells, cajeput leaves and the like (Ruth et al. 2017). Tobacco and soursop leaves have not been widely used to make compost. Tobacco leaves contain nicotine, alkaloids and terpenes, which can be used to make organic pesticides that can suppress pests and diseases in cultivated plants (Fitri and Migunani, 2014). Tobacco has a high nicotine content (Djajadi and Syaputra, 2020). Nicotine, water-soluble compounds, with the composting process simultaneous bioremediation will reduce toxicity. This can be one of the best options to prevent environmental pollution (Briski, 2012). One of the plants that can be used as a vegetable herbicide is soursop (*Annona muricata*, L). Soursop leaves and seeds can act as an insecticide, larvicide, repellent (insect repellent), and antifeedant (food inhibitor) by working as a contact poison and stomach poison (Kurniasih et al. 2015). There has not been much research on the application of soursop and tobacco leaves to make compost.

Weeds will take elements of N, P and K which are actually needed for the growth and development of soybean plants. Competition in absorbing nutrients between weeds and staple crops will affect yields. Weeds on soybean plants can reduce 17-55% yields (Setyowati, et al. 2005). The type of weed can affect the yield of soybean pod formation (Christia et al. 2016). Three soybean planting locations in Banyuwangi show that the yields are grown by 0.6 t/ ha of weeds, whereas if the weeds are removed it increases to 1.87

t/ ha (Harsono, et al. 2019). This study aims to make an analysis of the growth and yield of Anjasmoro soybean plants by treating compost from soursop leaves, tobacco and a mixture of both growing with weeds.

## MATERIAL AND METHODS

Ingredients for making compost: fresh soursop leaves, 250 grams of sliced dried tobacco leaves, rice bran, How to make compost: 500 grams of fresh soursop leaves are cut, put in a jar. Added 2 liters of water, given 250 grams of bran and 250 grams of brown sugar cut into small pieces. All ingredients are stirred evenly, then closed tightly and stored for one month, every week it is opened, stirred then closed again tightly. The same is done for making fertilizers with dry tobacco leaf material. Mixed organic fertilizer is made from 250 grams of fresh soursop leaves plus 125 grams of dried tobacco leaves. Furthermore, fermentation is carried out in the same way.

Soybean seeds Anjasmoro variety are obtained from the Research Institute for Legumes and Tubers, Malang. Poly bag size 25 x 30 cm for soil media from the former planting of soybeans, as many as 40 pieces for 4 types of treatment, namely given soursop leaf compost, tobacco leaf compost, mixed and not given fertilizer.

How it works: compost plus 1500 ml of water, 20 kg of former soybean plant soil mixed with semi-solid compost made from leaf material, then put in 10 polybags that have been prepared. Furthermore, the poly bag is poured with the remaining compost in the form of liquid, each polybag is 400 ml and stirred evenly. The control treatment was not given fertilizers and only sprinkled with water.

How to plant soybeans, each poly bag is given 3 soybean seeds, immersed in each polybag in one cm. Each polybag is labeled with a treatment to make it easier to make observational notes. Planting soybean seeds in Mojosongo, Solo research field, at 15<sup>th</sup> April 2020, harvesting is done after the plants are 90 days old. Observations on soybean and weed crops. Observation of weeds at the age of 6 weeks of soybean plants and at harvest. Weeds are removed, weighed each treatment and identified to know the name of the species. Soybean plant observations were carried out by measuring plant height, counting the number of leaves, number of pods, number of seeds, weighing soybean seeds per plant for each treatment, converting the weight of 100 soybeans. Analysis by tabulating the data, made an average and performed the T test.

## RESULTS AND DISCUSSION

### 1. Soybean plant height growth

Each soybean variety is characterized by a different plant height range from one another. Plant height growth is influenced by several factors of care and environmental conditions during planting.

Anjasmoro soybean variety is one of the superior varieties with the characteristics of uniform plant height growth, weight of 100 soybean seeds 14.8-15.3 grams and high yields of 2.25 tons per hectare. In research with compost treatment, it turned out that it produced almost the same plant height from the beginning of growth to the end of harvest. The plant height at harvest for all treatments ranged from 40.7 to 44.4 cm (Figure 1). This can be mentioned because the soybeans are allowed to grow together with weeds, so that the height growth of Anjasmoro's soybean plant cannot be maximized. As a comparison of Anjasmoro soybeans planted in Sriagung village, Tanjung Jabung, Jambi, the plant height reaches 50.57 cm, even though it is planted in drought conditions (Jumakir and Endrizal, 2014). The results of this study indicate that the growth of weeds will inhibit the height growth of soybean plants. Treatment of soybean plants that are not fertilized is almost the same as that of compost. This is due to the fact that the soil used is the former soybean plant which still contains a lot of nutrients.

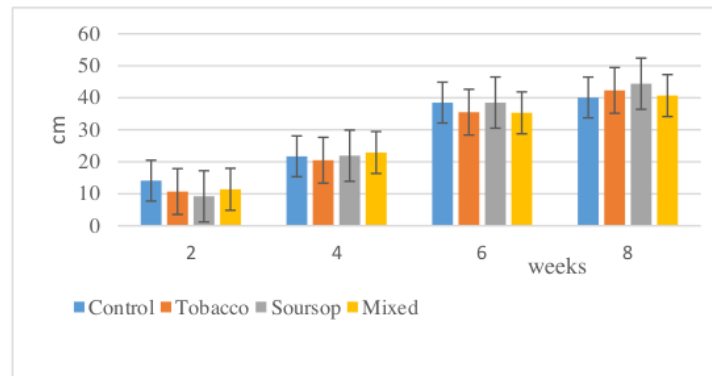


Figure 1. Graph of height growth of Anjasmoro soybean plants with compost treatment

Each soybean variety has a characteristic plant height. According to the description from the Balitkabi, Anjasmoro soybean growth reaches 64-68 cm. The growth of weeds that are left on soybean plants causes the plant's height to only reach 65% of the growth it should have. The growth of soybean from good seeds will show uniformity, but environmental conditions will have a major effect on plant height variability, for example in research using black soybeans. The results of research by Kuswanto, et al (2018) on Detam2 black soybeans planted in the research area of Jambegede, Malang with an altitude of 308 m above sea level, showed that the height of soybean plants ranged from 49.87 to 98.09 cm with an average of 70.5 cm. The study showed a fairly wide range of plant heights. In the Anjasmoro soybean study, although it was disturbed by the presence of weeds, it did not significantly affect plant height.

## 2. Amount of leaves

The number of soybean leaves when the plant is 8 weeks old ranges from 14 to 16 pieces. The leaves have an important function during soybean growth. The number of leaves indicates whether the plant is fertile or not. The number and area of leaves are important factors in soybean crop production because

they affect the amount of solar radiation absorbed. The number of leaves can affect plant growth and yield (Gutiérrez-Boem and Thomas. 2001). An important function of leaves, the vegetative organs of plants, is especially in the process of photosynthesis (Julia, et. al., 2019).

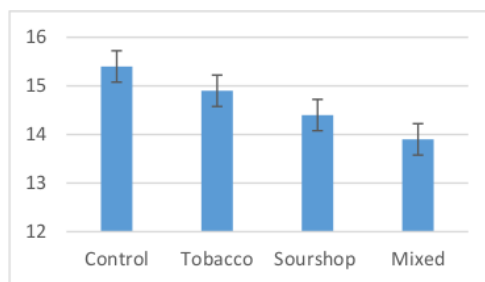


Figure 2. Amount of soybean leaves

The number of leaves from this study is less relevant for measuring plant fertility. The number of leaves in the control treatment was the largest but the area of each leaf had not been measured. Treat it with the least amount of mixed fertilizer but the leaves are wide and long, so the plant looks healthy (Figure 2). Number of leaves Anjasmoro cultivar had 75 sheets, the highest compared to Grobogan, Argomulyo and Dega-1 cultivars if grow at the right season (Srihartanto & Indradewa. 2019). The number of leaves planted with polybags is very different than when planted in fertile land. The area of soybean leaves is more important than the number of leaves, because it will affect the formation of pods. Lack of phosphorus (P) and dryness can inhibit the development of leaf area in soybean (*Glycine max* (L.) Merr.) (Gutiérrez-Boem and Thomas. 2001). Phosphorus deficiency in legumes causes a reduction in leaf area, decreases the number of leaves, nodes branches and thus, yield decreases (Alam, et al. 2019). This happened in the control treatment.

### 3. Weeds on soybean plants

There are nine species of weeds that grow together with soybean plants treated with compost (Table 1). In this study, the same weeds were found between one treatment and another. There are five types of grassy weeds in the Monocot class, characterized by very many fiber roots. There are four species of broadleaf weeds, and one that stands out is the thorn spinach (*Amaranthus spinosus* L.) because it grows denser than the soybean plant.

Table 1. Species of weeds that found along with soybean plants

No.	Monocotil	Dicotil
1..	<i>Cyperus rotundus</i>	<i>Amaranthus spinosus</i>
2.	<i>Imperata cylindrica</i>	<i>Portulacca oleracea</i>
3.	<i>Cynodon dactylus</i>	<i>Phylanthus niruri</i>
4.	<i>Eleusin indica</i>	<i>Euphorbia hirta.</i>
5.	<i>Panicum repen.</i>	

The kinds of weeds found in this study were less than other studies. There are 15 species of weeds that grow on black soybean fields in coastal sand fields, consisting of 9 broadleaf weeds and 6 types of grass. The five dominant species are *Panicum maximum*, *Eleusine indica*, *Amaranthus spinosus*, *Ipomea reptans*, and *Clidemia hirta* (Pumamasari, et.al. 2016). *Imperata cylindrica* actually has the potential to make ethanol by fermentation process for 7 days using *Zymomonas mobilis* bacteria (Kartikasari, et al., 2013). One of the reasons that can be mentioned is because the weeds identified are only those that grow in polybags along with soybean plants.

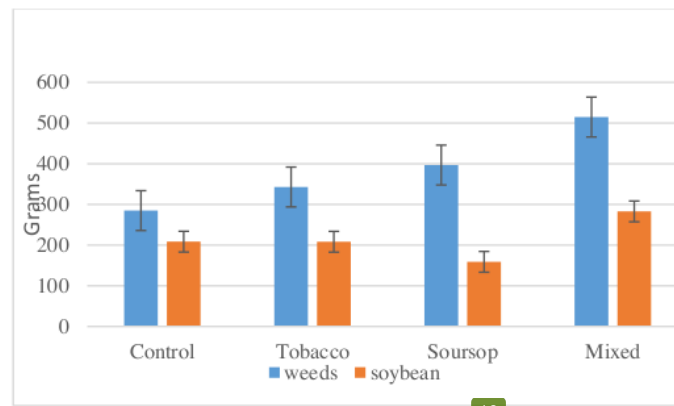


Figure 3. The weed's and soybean wet weight

The wet weight of the soybean plant is only 56% compared to the weight of fresh weed. Weed wet weight is almost twice the wet weight of the soybean plant at harvest (Figure 3). At harvest time, the soybean crop starts to dry out while the weed conditions are fresh. The color of the leaves of the soybean plants at harvest is brownish yellow, while the color of the weeds is green. Weeds have been removed when the soybean plants are 6 (six) weeks old, but new weeds still grow. The question is where do these weeds come from? Weeds can come from seeds and rhizomes in the soybean growing medium. The teapot has branches that make it easy to grow and is difficult to turn off. Weeds also come from dry grass seeds that are carried away by the wind and fall on the ground in soybean polybags, then grow there.

In the control treatment, not given fertilizer, it turned out that the weeds were low, even the wet weight of the weeds was the smallest compared to other treatments. Treatment with mixed compost causes rapid weed growth. The wet weight of mixed compost treatment was the highest compared to other treatments. In simple terms, it can be explained that compost increases the fertility of all plants, main crops and weeds. Usually weeds that grow together with food crops can reduce crop yields.

The weight of soybean plants treated with soursop fertilizer is the smallest compared to other treatments. This is of particular note because compost made from fresh soursop leaves is not capable of being a good organic fertilizer for soybean plants. Soursop leaves contain acetogenin, annocatacin,

annocatalin, annohexocin, annonacin, anomuricin, anomurine, ananol, caclourine, gentisic acid, gigantetronin, linoleic acid and muricapentocin (Kurniasih, et al. 2015).

#### 4. Number of pods and seeds

Soil fertility affects the productivity of soybeans planted in polybags. One way to increase soil fertility is by applying organic matter. Research shows that soybean productivity increases by applying organic matter to the soil.

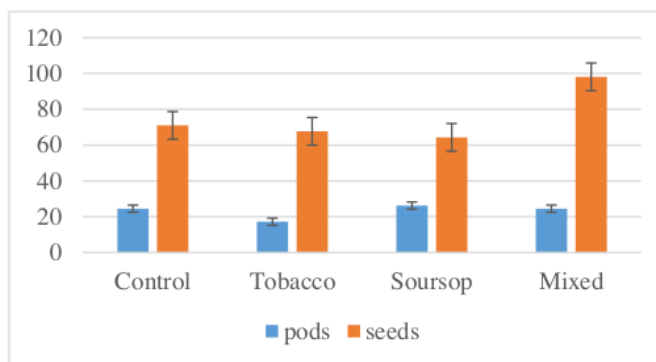


Figure 5. Total of pods and soybean seeds

The number of pods per soybean plant ranges from 17 to 26, each pod containing 1 to 4 seeds. Each soybean plant produces 64 to 98 seeds (Figure 5). The treatment of soursop leaf compost produced 26 pods, but each contained less than 3 seeds per pod. This yield is worse than the treatment without fertilizer. It can be said that the compost from soursop leaves is not suitable for the growth of pods and seeds of soybean plants. The best treatment of mixed compost because it produces 24 pods with the highest number of seeds, namely 98 seeds. Compost that contains organic minerals is useful to replace some of the chemical fertilizers, proven to be validly improving sustainable agronomic processes in bean crops (Rady, et.al. 2016). Compost provides useful compounds that play an important role in improving physical, chemical and biological properties by increasing water holding capacity, soil N content and soil microbial populations (Suryanto et al. 2020).

#### 5. Weight of soybean seeds every plant

The main product expected from planting soybeans is seeds. The number of seeds per plant consecutively from the least was the treatment of tailings leaf compost: 64.3 seeds, tobacco compost: 67.7 seeds, without fertilizer treatment: 71 seeds and the highest was mixed compost treatment: 98.1 seeds. It can be said that compost from fresh tailings leaves is not recommended because it inhibits soybean seed yield. According to the data in Table 2, the amount of weed weight in the compost treatment from soursop leaves is the least, but the seed yield is the least too. Based on the theory, it is expected that a small number of weeds will increase the yield of soybean seeds, but in this study it is not proven. Actually, the number of



soybean seeds in each plant is not very small when considering that it comes from only one seed, but what is expected is the treatment with the highest yield.

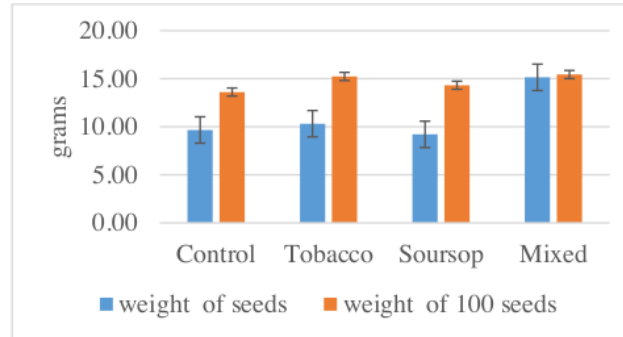


Figure 6. Weight of soybean seeds every plant and 100 seeds

The compost treatment from soursop leaves produced the lowest weight of soybean seeds, even smaller than the treatment without fertilizer. Anjasmoro soybean plants mixed compost fertilizer treatment, per plant at harvest time can produce the highest average number of seeds. The yield of seed crops is influenced by the presence of organic fertilizers in the soil. All plants need organic matter for the process of forming and replenishing seeds. Apart from soybeans, organic fertilizers can also increase yields in green bean harvests, compared to plants that are not given organic fertilizers (Hastuti, et al. 2018). The addition of organic fertilizers to soybean plants that have been given 50% NPK fertilizer can increase soil fertility, further improving the quality and quantity of crop yields of legumes including soybeans (Wahyudin, et al. 2017).

These results were less than the research on the Grobogan soybean cultivar which was overgrown with *Borreria alata* weeds which could reach 108 seeds per plant (Kilkoda, et al. 2015). Grobogan variety was slightly higher in yield than Anjasmoro soybean with the same treatment, which was inhibited by weeds.

The weight of 100 Anjasmoro soybeans planted in Ngawi, East Java is 14.59 grams, almost the same as the results of this study which were given mixed fertilizer (Krisnawati & Adie. 2018). Research by Anggrainy et al (2018) on soybeans in Jatikerto Village, Malang Regency produced 47.17 seeds per plant, because they were planted in the rainy season from November to February. It can be said that soybean yields remain high when planted in the right season. Many soybean varieties are not resistant to standing water or a lack of sunlight, so production is low when planted during the rainy season.

## CONCLUSION

The growth pattern of soybean was almost the same for the four kinds of compost treatment. Soybean plant growth becomes rapid after weeds are removed and cleaned at week six. Soybean plant height at 8 weeks of age ranges from 40.7 cm to 44.4 cm.

There are 9 types of weeds that grow together with soybean plants, consisting of 5 species in the form of grasses (Monocot) and 4 types of weeds in the form of woody shrubs, broad-leaved, tap root (Dicotyl class group). The origin of nuisance plants from rhizomes or residual roots that are already in the planting medium, or dry weed seeds carried by the wind. The treatment of mixed soursop and soybean compost produced the most weeds. At the end of the soybean harvest, the wet weight of all weeds is almost twice the weight of all soybean crops. The weeds remain fresh green until the end of the harvest, but the soybean plants are starting to dry out.

Soybean plants still produce seeds, even though they live together with weeds. The treatment of compost from fresh soursop leaves resulted in 64.3 seeds of soybean per plant. The mixed fertilizer treatment between soursop and soybean resulted in the highest number of soybean seeds per plant, namely 98.1 seeds.

## ACKNOWLEDGEMENT

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