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# The Yield of Soybean [*Glycine max* (L.) Merrill] Anjasmoro Cultivars with Compost Treatment from Soursop or Tobacco Leaves and Weeds Growth

## ABSTRACT

An important component of soybean production is the weed growth. 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 Surakarta, on April 14, 2020. There are 4 types of treatment, they are given compost made from soursop, tobacco, mix of two kinds of leaves, and control. Weeds were allowed to grow together with soybeans in 15 polybags, each treatment. Observations and identification of weeds were carried out twice, 4 weeks after planting and at harvest time. The results found 9 kinds of weeds consisting of 5 species of Monocots and 4 types of Dicotiles. The total wet weight of weeds was 1,539 grams, while the wet weight of the soybean crop at harvest was 858.4 grams. Wet weed weight in the control treatment was 284.1 grams. The wet weight of weeds in soybean plants was the largest mixture fertilizer treatment that is 514.8 grams. Amount of pods ranges from 17 to 26. The sum of seeds per soybean plant in giving mixed compost is at most 98 grains. Mixed fertilizer treatment can increase the yield of Anjasmoro soybean, although weed growth up.

## KEYWORDS

soybeans, compost, soursop, tobacco, weeds

## INTRODUCTION

The realization of national soybean production in 2019 reached 1,419,046 tons. Currently the productivity of soybeans grown in Indonesia is 1.5 tons per hectare. The total planted area of soybeans is 620,000 ha. In fact, the total demand for soybeans is 2.3 million tons. The Indonesian government is trying to increase soybean productivity in various ways and effort (Elisabeth & 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, 2019). 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).

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 (Adeyeye A.S, Togun, A. O., Akanbi W. B., Adepoju, I. O., Ibirinde, 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 displayed 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 condition of chemical compound residues in the soil (Supriyadi et al., 2020). Organic fertilizers will release nutrients rather slowly and steadily over a long period of time. Compost can also increase soil fertility by activating soil microbial biomass. The use of large amounts of organic fertilizers is needed to meet the nutritional needs of plants (AS et al., 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, cage for nuts and the like (Ruth et al., 2017). Tobacco and soursop leaves have not been widely used to make compost. Tobacco has a high nicotine content (Djajadi & Syaputra, 2019). 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 (Briški et al., 2012). One of the plants that can be used as a vegetable herbicide is soursop (*Annona muricata*, L). There has not been much research on the application of soursop and tobacco leaves to make compost.

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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. 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). Weeds can reduce 45% main crop yield [Razfar et al. 2022]. 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.

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## MATERIALS 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 15th 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. 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.

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 Kuswantoro et al.,



(2018) on Detam2 black soybeans planted in the research area of Jambegede, Malang with an allit 18 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. Another study showed that soybeans given 2.5 tons of organic fertilizer per hectare did not differ in height (57.0 cm) with plants without organic fertilizer (56.8 cm) ( et al., 2018).

## 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 & Thomas, 2001). An important function of leaves, the vegetative organs of plants, is especially in the process of photosynthesis (Julia et al., 2019).

Number of leaves Anjasmoro cultivar had 75 sheets, the highest compared to Grobogan, Argomulyo and Dega-1 cultivars if grow at the right season (Sihartanto & Indradewa, 2019). The number of leaves planted with polybags 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 development of leaf area in soybean (*Glycine max* (L.) Merr.) (Gutiérrez-Boem & 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.

Leaves play an important role in the process of photosynthesis. The results of photosynthesis affect the growth process of soybean plants. Wide weed leaves can hinder the photosynthesis process of soybeans, because it reduces the intensity of sunlight. Soybean plants exposed to shade *Albizia chinensis* contained less chlorophyll and thinner leaves than plants without shade (Affandi et al., 2019).

## 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.

Weed detection is needed to analyze the absorption of various nutrients and water in the main crop. Currently, manual weed detection methods are still used, although there are other, more sophisticated methods (Razfar et al. 2022). 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 and 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* (Purnamasari et al., 2016). One of the reasons that can be mentioned is because the weeds identified are only those that grow in polybags along with soybean plants.

Actually, *Cyperus rotundus*, *Amaranthus spinosus* and *Ageratum conyzoides* can be used as crude extracts to reduce the intensity of leaf rust disease on peanuts of the Bima cultivar. The weed extract contains phenolic and flavonoid which can be used as biofungicide (Yusnawan & Inayati, 2018).

The wet weight of soybean plants is only 56% compared to the wet weight of weeds. 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.

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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, annomuricin, 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 bags. One way to increase soil fertility is by applying organic matter. Research demonstrations that soybean productivity increases by applying organic matter to the soil.

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. 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 1, 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.

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.

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 in Maros, South Sulawesi, Indonesia using soybean seeds of the Demas 1 variety from July to September 2020, soybean yields increased if watering was carried out starting 15 days after planting (Aminah et al., 2021).

### CONCLUSIONS AND SUGGESTION

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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, taproot (Dikotil 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.

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#### Figures and Tables

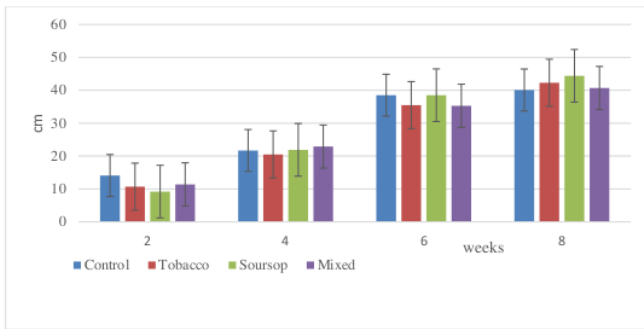


Figure 1. Graph of height growth of Anjasmoro soybean plants with compost treatment

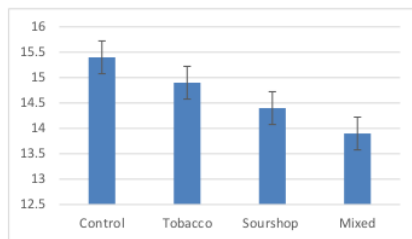


Figure 2. Amount of soybean leaves

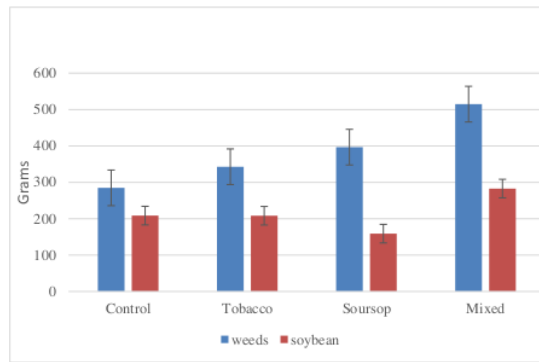


Figure 3. The weed's and soybean wet weight

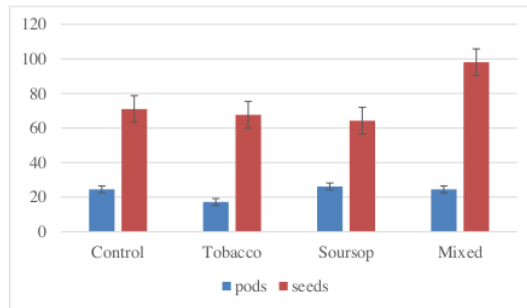


Figure 5. Total of pods and soybean seeds

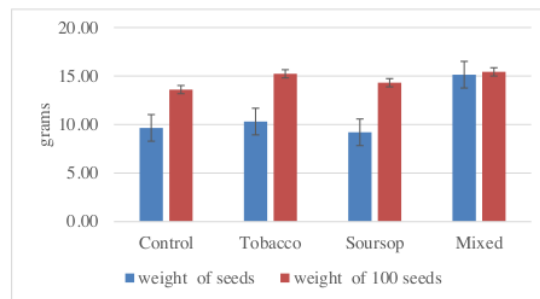


Figure 6. Weight of soybean seeds every plant and 100 seeds

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>Phyllanthus niruri</i>
4.	<i>Eleusin indica</i>	<i>Euphorbia hirta.</i>
5.	<i>Panicum repen.</i>	

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