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The Effect of Oil Palm Empty Fruit Bunches on Rice Production *(Oryza sativa L.)* With a Flood Height of 10 Cm Below Soil Surface

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ABSTRACT

Improper processing of rice field systems and lack of organic matter in the soil to meet the nutrient needs of rice plants resulted in low rice production. Increased production of rice plants can be overcome by giving compost of palm oil empty fruit bunches (TKKS) with the system of rice intensifications (SRI) method, because the organic matter contained in the compost can improve the physical properties of the soil. This study aims to obtain the best dose of empty fruit bunch (*EFB*) compost and to see its effect on the production of lowland rice (*Oryza sativa L.*) by using the modified SRI method. The research was conducted from January-April 2019 at the UPT Experimental Garden, Faperta, Riau University. This study applied a completely randomized design (CRD) consisting of 5 treatment levels. They are 0 gr.polybag^{-1}, 50 gr.polybag^{-1}, 75gr.polybag^{-1}, 100 gr.polybag^{-1} and 125 gr.polybag^{-1}. The results showed that giving empty fruit bunch (*EFB*) compost with the SRI method gave an effect on productive tillers, pithy grain per panicle and grain weight, but did not affect panicle exit age, harvest age, percentage of pithy grain per panicle and 1000 grain weight of pithy grain. The best treatment dose was found at a dose of 20 ton.ha^{-1} because it could increase several components of lowland rice production of the Batang Piaman variety.

Keywords: *Paddy Rice, SRI Method, Compost, Oil Palm Fruit Bunches*

1. INTRODUCTION

Lowland rice (Oryza sativa L.) was included in the group of food crop commodities that were very much needed in Indonesia. The demand for rice in Indonesia was increasing every year. This was due to the increase in population every year, but it was not always followed by sufficient production. Central Bureau of Statistics Riau (2019) showed that, in 2018 rice production in Riau Province reached 266,375 tons with a productivity of 3,728 tons.ha^{-1} while rice production in 2019 decreased to 230,873 tons with a productivity of 3,656 tons.ha^{-1}.

Lowland rice cultivation that is generally done by farmers can only meet their daily needs. This is because lowland rice cultivation is not profitable for farmers because the results obtained are less than optimal. The low productivity of lowland rice is caused by several factors. That is the dose of fertilizer used is not as recommended for fertilization in rice plants, the inappropriate use of paddy processing systems, and the lack of organic matter that used to meet the required nutrients.

According to Central Bureau of Statistics (2019), the area of oil palm plantations in Riau Province had increased every year, in 2019 the land area reached 2,808,700 ha, with a total production of 9,127,600 tons, while in 2018 the land area was 2,706,900 ha, with a total production of 5,737,300 tons.

The increase in the area of oil palm was also accompanied by an increase in palm oil mills to process oil palm fruit. According to the Directorate General of PPHP (2006), processing oil palm fruit in addition to producing high amounts of oil can also produce palm oil waste in the form of liquid waste and solid waste in the form of empty oil palm fruit bunches.

According to Rahmadi *et al*. (2014), 23% of the main waste from palm oil processing was solid waste in the form of palm oil empty fruit bunches. Processing every 1 tonne of fresh palm oil empty fruit bunches would produce accounting for 220-230 kg or 22-23% of empty oil palm oil empty fruit bunches. Yuwono (2006) stated that waste from palm oil mills could be used as fertilizer in the form of compost. Compost has enormous potential, one of which is to increase soil fertility. Palm oil empty fruit bunches (EFB) can also be used for soil improvement and as a source of nutrients for plants.

According to Darmosarkoro and Rahutomo (2007), empty fruit bunch (*EFB*) compost not only functions to add nutrients to the soil but also it can also improve soil physical properties, which in turn will increase nutrient absorption by plant roots. This was due to the increase in the organic matter content in the soil from the addition of compost. The increase in organic matter in the soil had a positive impact on the ability of the soil to hold water and soil structure.

The results study from Darmawati *et al*., (2014) showed that the best dose of palm oil solid waste on maize was at 3.4 kg per plot. The provision of palm oil solid waste had a significant effect on several parameters observed. This was due to the availability of sufficient nutrients needed for the growth of corn plants that came from the organic matter content of the solid waste of oil palm. Giving palm oil solid waste by increasing from 17 $tons.ha^{-1}$ to 30 $tons.ha^{-1}$ could significantly affect the growth and yield of corn plants that continue to increase.

The development of conventional rice cultivation technology is still being carried out. However, there is a technology that provides modifications to rice cultivation that can increase production while saving water, fertilizer, seeds, and other inputs known as the *System of Rice Intensification* (SRI). SRI aims to increase rice yields by improving plant growth conditions, especially in the plant roots. The soil around the plant roots is maintained therefore it remains moist and has a good area and is not flooded. The rice paddy inundation system that some farmers do is continuous inundation (continuous flow of irrigation water from one paddy field unit to another). The inundation system will use a lot of water in the paddy fields while with the SRI method the use of water is more saved. Therefore, excess water can be used for other plant needs (Barkelar, 2001).

The results of research conducted by Kasli and Arman (2012) in a puddle of 10 cm below the soil surface were the best treatment and provided an optimal effect on the growth of rice plants with the SRI method in polybags. And it produced the highest total number of tillers, reaching 64.16 tillers per clump, far more than the description of the Batang Piaman variety, accounting for 14-19 tillers per clump.

2. RESEARCH METHOD

This research was conducted from January 2019 to April 2019 at the UPT Experimental Garden, Faculty of Agriculture, University of Riau. The materials used include rice seeds of the Batang Piaman variety, paddy soil material, compost fertilizer, basic ingredients of oil palm empty fruit bunches, Urea fertilizer, KCl fertilizer, SP-36 fertilizer, water, *polybag* and insecticide Decis 250 ECN. The tools include hoes, machetes, soil sieves, rice envelopes, plastic, nets, large buckets measuring 30 cm x 50 cm, hoses, rulers, scissors, seed tanks, digital scales and others.

This research was carried out experimentally by using a completely randomized design (CRD) consisting of five treatment levels. They were 0 ton.ha^{-1}, 10 ton.ha^{-1}, 15 ton.ha-^{1}, 20 ton.ha^{-1} and 25 ton.ha.$^{-1}$. Each treatment level was repeated 3 replications. Therefore there were 15 treatment units, in each unit there were 6 plant samples so that the total sample plant was 90 plants. The treatments given were various doses of empty fruit bunch (*EFB*) compost with various levels of treatment.

Steps of Doing Research

The stages carried out in the implementation of this research are described as follows:

1. Preparation of the research site, namely the land used was cleaned by cleaning grass and garbage in the research location.
2. Preparation of planting media, namely the material used was paddy soil taken from Kampar Regency, Bangkinang District at a depth of 20 cm. For one week the soil was dried and then sieved by using a 25 mesh sieve. After that polybags with a diameter of 30 cm were filled with soil that had been sieved accounting for 10 kg.
3. Seed selection was done by soaking the seeds for 24 hours, then it was selected the submerged seeds to be used.
4. The nursery was carried out using a seedling tub by sowing the seeds on a seedling tub that already contained soil with a thickness of 13 cm. The length of the nursery was 12 days.
5. Giving compost treatment was given 1 week before planting by mixing it evenly with the planting medium according to the predetermined treatment level.
6. Planting was started by making a planting hole with a depth of two cm. Then each hole was planted one stem of rice seedlings that were 12 days old after that the planting hole was covered with soil.
7. Fertilization was done by inserting fertilizer in holes around the plant at a distance of 10 cm from the plant. The fertilizer used was Urea (N) fertilizer at a dose of one gram per polybag (200 kg.ha^{-1}), KCl (K2O) fertilizer at a dose 0.5 grams per polybag (100 kg.ha-1) and SP-36 (P2O5) fertilizer at a dose of 0.5 grams per *polybag* (100 kg.ha^{-1}). Urea fertilizer was applied 3 times with a dose of 1/3 the amount of fertilizer at the time of planting, at the age of 25 DAP and 42 DAP, while SP-36 and KCl were applied once at planting.
8. Maintenance included weeding which was done by cleaning the nuisance plants around the planting medium. Giving water 3 times a day by adding a lack of water to the bucket until the water level was 10 cm below the soil surface. Pest control was done by spraying insecticide Decis 25 EC with a concentration of 2 cc.l-1 water, to control bird pests by using trap nets.
9. Harvesting was done after the sample plants in one unit had met the harvest criteria.

3. RESULTS AND DISCUSSION

Number of productive tillers

Treatment of TKKS compost at various doses affected the number of productive tillers. After it was further tested with DNMRT (Duncan's) level 5% and presented in Table 1.

Table 1. The average number of productive tillers of the Batang Piaman variety of lowland rice by giving empty fruit bunch

(*EFB*) compost of modified SRI methods

Empty fruit bunch (*EFB*) compost (ton.ha^{-1})	Number of tillers
20	37,50a
25	31.85b
10	31.00 b
15	30.17 b
0	21.50 c

Table 1 showed that giving TKKS compost by SRI method at a dose of 20 tons.ha^{-1} resulted in a higher number of productive tillers than the other treatment levels, both at a dose of 25 tons.ha^{-1}, a dose of 10 tons.ha^{-1}, a dose of 15 ton.ha^{-1}, and without giving empty fruit bunch (*EFB*) compost. This was presumably due to differences in the phosphorus nutrient content contained in various treatments, where the phosphorus absorbed by plants could increase the productive tillers of rice plants. According to Hidayati (2010), the increase in the number of productive tillers in rice plants could be caused by the content of phosphorus nutrients absorbed by the roots plant. Iqbal (2008) also stated that phosphorus was needed by plants in sufficient and balanced amounts for plant growth and development.

Giving empty fruit bunch (*EFB*) compost at a dose of 20 ton.ha^{-1} resulted in the highest number of productive tillers compared to giving empty fruit bunch (*EFB*) compost at a dose of 25 ton.ha-1, at a dose of 15 ton.ha^{-1}, at a dose of 10 ton.ha^{-1}, and without giving empty fruit bunch (*EFB*) compost. This happened because the nutrients were absorbed optimally at a dose of 20 ton.ha^{-1} of empty fruit bunch (*EFB*) compost. Therefore, the plants absorbed all the nutrients needed to increase the productive tillers of rice plants at that dose. According to Munawar (2011), plant growth and development in order to be able to produce optimally was influenced by the availability of nutrients in sufficient and optimal quantities to meet plant nutrient needs.

Giving empty fruit bunch (*EFB*) compost at a dose of 25 ton.ha^{-1} resulted in lower productive tillers than giving EFB compost at a dose of 20 tons.ha^{-1}. This was due to the addition of too much TKKS compost which can cause the development of rice tillers to become productive tillers to be slower. Wahid *et al.* (2000) stated that, crop production would decrease if the nutrients provided were in excess of the plant's needs. This happened because the provision of nutrients that exceed the needs of the rice plant would result in plants that were relatively attacked by pests and easily fall down which ultimately caused the formation of productive tillers of rice plants is not optimal.

According to Lingga and Marsono (2005), growth and development will be optimal if the dose of fertilizer used is in accordance with the needs of the plant. The success of fertilization can be seen from the suitability of the dose of fertilizer used for plants. Giving empty fruit bunch (*EFB*) compost with a low dose of 20 ton.ha^{-1} resulted in fewer productive tillers. This is because the nutrient content produced at this level has not been able to meet the nutrient needs of plants. According to Dwidjoseputro (1990), the availability of nutrients in sufficient quantities and in accordance with plant needs will be able to cause plants to thrive.

Giving empty fruit bunch (*EFB*) compost using the SRI method formed the number of productive tillers ranging from 29-32 stems and more than the description of Batang Piaman variety rice, while using the conventional method only reached 14-19 stems. This happed because the modification of the SRI method with a puddle height of 10 cm below the soil surface was able to increase rice production. According to Laksono (2018), microclimate conditions would be created if there was sufficient water availability with an optimal planting system. Therefore, it would support plants in receiving large amounts of sunlight which can ultimately optimize the photosynthesis process and produce sufficient assimilate to increase the growth of rice tillers.

The productive tillers of rice plants were influenced by the number of tillers formed and the ability to maintain various physiological functions of the plant. Productive tillers would increase if the maximum tiller were formed in large quantities with the availability of nutrients in sufficient quantities and can be absorbed by plants. Yusuf (1998) stated that environmental factors and optimal nutrient uptake in the vegetative phase would affect the formation of productive tillers. Where environmental factors had a close relationship with the formation of productive tillers. If environmental conditions were suitable, the formation of productive tillers would run optimally.

Based on the observations that were made, the number of productive tillers from a dose of 0 ton.ha^{-1} to a dose of 25 ton.ha^{-1} decreased from the previous maximum number of tillers. This was caused by the occurrence of *photooxidative* stress which ultimately reduced the activity of the source and sink. It was caused by the lack of tolerance of flag leaves from late-emerging tillers and later tillers due to the higher photosynthetic capacity of early-emerging rice tillers (Sutoro et al. , 2015). It resulted in total tillers not being able to develop into productive tillers as a whole.

Age of Grain

Treatment of empty fruit bunch (*EFB*) compost at various doses did not affect grain age. After further testing with DNMRT (Duncan's) level at 5% and presented in Table 2.

Table 2. The average age of grain of paddy rice plant of Batang Pariaman variety by giving TKKS compost of modificated SRI method

Empty fruit bunch (*EFB*) compost (ton.ha^{-1})	Age of Grain (HST)
25	75.67 a
20	76.33a
15	77.42 a
0	78.42 a
10	78.92 a

Table 2 showed that giving empty fruit bunch (*EFB*) compost with modified SRI method at a dose of 25 tons.ha^{-1}, a dose of 20 tons.ha^{-1}, a dose of 15 tons.ha-1, a dose of 10 tons.ha^{-1} and without giving empty fruit bunch (*EFB*) compost has the same grain age. This was presumably because the panicle age of the Batang Piaman variety of rice plant was more influenced by the genetic nature of the plant than the effect of the treatment given. According to Warda (2011), the diversity of plant forms is more influenced by differences in genetic composition. One of which is the age at which the panicle emerges of rice plants which are influenced by the lines and varieties of plants used and have good adaptation to the environment. This statement is reinforced by Rahayu and Harjoso (2011) which stated that the variety used was very influential on plant growth compared to fertilizer application. This is because each plant variety has different physiological, morphological and genetic characteristics.

The results showed that grain age of rice plants was not influenced by fertilizer application but it was more influenced by the genetic nature of the plant. If the rice plant used had good genetic characteristics it would be able to accelerate the aging of the rice plant panicle or vice versa. Good conditions that can adapt to the environment well can also affect the age of the panicle exit of rice plants. According to Gultom and Mardaleni (2013), the flowering age of rice plants is strongly influenced by the rice variety used and environmental factors. This statement showed that the more dominant factor that affects the age at which the panicle emerges of rice plants. That is genetic characteristics rather than the treatment given.

Harvest Age

Treatment of empty fruit bunch (*EFB*) compost at various doses had no effect on harvest age. After it was tested with DNMRT (Duncan's) level at 5% ,it was presented in Table 3.

Table 3. The average of harvest age of the Batang Piaman variety rice plants by using the modified SRI method of empty fruit bunch (*EFB*) compost

Empty fruit bunch (*EFB*) compost (ton.ha^{-1})	Harvest Age (HST)
25	116.17a
15	116.33a
0	116.50 a
10	116.50a
20	117.50a

Table 3 shows that the application of SRI method of empty fruit bunch (*EFB*) compost with a dose of 10 tons.ha^{-1}, a dose of 15 tons.ha^{-1}, a dose of 20 tons.ha^{-1}, a dose of 25 tons.ha^{-1} and without giving empty fruit bunch (*EFB*) compost, the harvest ages tended to be the same and the harvest age of this rice plant is in accordance with the description of the Batang Piaman variety of rice. This can happen because the dominant factors that affect the harvest age of rice plants are environmental factors and plant genetic characteristics compared to the factor of treatment. According to Masdar et al. (2006), the maturity of the harvest that occurs in each plant varies, which is generally more influenced by the genetic nature of the plant. A plant will show maturity when the total energy produced has reached a certain dose limit (*growing degree day*).

Harvest age in rice plants could also be influenced by other factors. That was caused by the age of the panicle out of rice plants. The faster the panicle release on rice plants, the faster the harvest in rice plants will be. According to Maisura (2001), the age of harvest, it had a close relationship with the age of flowering, where in general if the plant bloomed quickly it would have a relatively short harvest period. This statement proved that the age of panicle exit could affect the age of harvest in rice plants. The results of the research on the age of the panicle out of rice plants (Table 2) showed that each level of treatment given did not affect the age of the panicle out of rice plants. Therefore, giving the same treatment also gave the same response to the parameters of harvesting age of rice plants.

Number of Pithy Grains per Panicle

Treatment of empty fruit bunch (*EFB*) compost at various doses affected the number of pithy grains per panicle. After further testing with DNMRT (Duncan's) level at 5% and presented in Table 4.

Table 4. The average numbers of pithy grains on the panicles of the Batang Piaman variety of rice plants by giving empty fruit bunch (*EFB*) compost of modified SRI method

Empty Fruit Bunch Compost (ton.ha^{-1})	Number of Pithy Grains per Panicle (Grain)
20	95.38a
25	77.32b
15	72.27b
0	68.24b
10	67.40 b

Table 4 showed that giving empty fruit bunch (*EFB*) compost of modified SRI method significantly increased the number of pithy grains per panicle of the Batang Piaman variety of rice plants. The highest number of pithy grain per panicle resulted from the treatment of empty fruit bunch (*EFB*) compost at a dose of 20 tons.ha^{-1} compared to other treatment levels, while the administration of empty fruit bunch (*EFB*) compost at a dose of 10 tons.ha^{-1}, a dose of 15 tons.ha^{-1}, a dose of 25 tons.ha $^{-1}$ and without giving empty fruit bunch (*EFB*) compost, the number of pithy grains per panicle of rice plants tended to be the same. This happened because the empty fruit bunch (*EFB*) compost was able to fulfill the nutrient content to increase the plant-based grain through the process of photosynthesis. The process of photosynthesis went well due to the fulfillment of nutrient content for plants would be able to increase the photosynthate yield which ultimately produced high amounts of pithy grain. Supardi (1992) stated that the availability of nutrients in the soil would increase if the content of organic matter available in the soil was sufficient. Therfore, it could help the solubility of nutrients in the soil to be absorbed by plants.

Giving empty fruit bunch (*EFB*) compost at a dose of 20 ton.ha^{-1} resulted in the highest number of pithy grains per panicle compared to the other treatment levels. This was because rice plants could take advantage of the nutrient content resulting from giving empty fruit bunch (*EFB*) compost, where a dose of 20 ton.ha^{-1} could provide optimal nutrients compared to other levels. According to Salisbury and Ross (1995), increasing the dose of fertilizer would not be able to increase plant growth and yield if the plant's needs were optimally fulfilled.

The least amount of pithy grain per panicle was produced by giving empty fruit bunch (*EFB*) compost at a dose of 25 tons.ha^{-1} compared to a dose of 20 tons.ha-1. This happened because the dose of 20 ton.ha^{-1} could provide optimal nutrients. Therefore, it could be utilized by rice plants to increase the amount of pithy grain per panicle. Suyani and Wahyono (2016) state that plant development and growth would be hampered if the dose used was too high and vice versa development and growth would not be optimal if the dose of fertilizer used was too small because the nutrient content needed by plants could not be fulfilled.

The treatment of empty fruit bunch (*EFB*) compost at a dose of 0 ton.ha^{-1}, a dose of 10 tons.ha^{-1}, a dose of 15 tons.ha^{-1} and a dose of 25 tons.ha^{-1} showed the results of the number of pithy grain per panicle which tended to be the same. This was caused by the time required for TKKS compost to meet the nutrient requirements of the rice plant compared to a dose of 0 ton.ha^{-1}. Therefore, the dose of TKKS compost is 10 tons.ha^{-1}, a dose of 15 tons.ha^{-1} and a dose of 25 tons. ha^{-1} tended to produce the same amount of pithy grain at a dose of 0 ton.ha^{-1}.
Sutedjo (2002) stated that, the number of doses and different times needed by plants to meet their nutrient needs.

The number of productive tillers had a close relationship with the number of pithy grains per panicle of rice plants. The number of pithy grain per plant panicle would increase if high numbers of productive tillers were produced, where each productive tiller produced would form a grain on each plant panicle. In order to obtain high yields, each grain in the plant panicle must be fully filled through the process of photosynthesis and a high rate of photosynthesis during the seed filling process. The amount of pithy grain is the most important yield component, because unfilled grains will become empty grains. According to Soemartono *et al*., (1984), the large number of productive tillers produced by rice plants will be able to increase the number of pithy grain, where productive tillers will be able to form panicles and fill them into pithy panicles.

The number of pithy grain per panicle was also influenced by growth components. One of which was root growth. Plant roots that grow well can absorb nutrients well which in turn can help the photosynthesis process to produce assimilate for seed filling. Assimilate produced by plants will be translocated to seeds. Therefore, it can help increase the pithy grain per panicle of rice plants. According to Nainggolan et al. (2017), nutrients will be well absorbed through root hairs if they have plant roots that grow well which will eventually be able to help the photosynthesis process to produce assimilate and it will be translocated to the grain of the rice plant.

Percentage of pithy grain per panicle

Treatment of empty fruit bunch (*EFB*) compost at various doses did not affect the percentage of pithy grain per panicle. After further testing with DNMRT (Duncan's) level at 5% and presented in Table 5.

Table 5. The average percentage of pithy grain on the panicle of the Batang Piaman variety of paddy rice field by giving empty fruit bunch (*EFB*) compost with modified SRI method

Empty fruit bunch (*EFB*) compost (ton.ha^{-1})	Percentage of pithy grain per panicle (%)
25	88.27 a
20	87.36 a
15	80.49 a
10	79.25 a
0	70.13 a

Table 5 showed that giving dose of empty fruit bunch (*EFB*) compost with the SRI method at a dose of 10 tons.ha^{-1}, a dose of 15 tons.ha^{-1}, a dose of 20 tons.ha^{-1}, a dose of 25 tons.ha^{-1} and without giving empty fruit bunch (*EFB*) compost resulted in the percentage of grain per panicle which tended to be the same. This could happen because the empty fruit bunch (*EFB*) compost content required for generative growth of plants that was equivalent, especially for filling grain. The photosynthetic results found in the leaves and stems of plants would be translocated and accumulated to the grain in order to increase the filling of the plant's pithy grain. According to Maintang *et al*. (2010), optimally filling plant seeds really needed plant leaves that were not old, erect, narrow, thick and dark green.

The results showed that the percentage of pithy grain ranged from 70.13% - 88.27%. The percentage results prove that rice plants can produce optimally by giving this treatment. The results that tended to be the same were shown from the percentage of pithy grain per panicle obtained. This was because the nutrients absorbed by plants from giving empty fruit bunch (*EFB*) compost were relatively the same. Therefore, the plants were not able to work optimally in the formation and filling of grain. According to Taufik *et al.* (2011), an increase in the formation of plant seeds will occur if the formation of carbohydrates, starch and protein is not inhibited. Thefeore, metabolic materials are highly accumulated for seed formation. This can happen if nutrient needs can be met and plants can absorb nutrients properly, which will eventually increase the percentage of pithy grain per panicle of rice plants.

Mahmud and Sulistyo (2014) stated that the availability of sufficient nutrients and the amount of grain per panicle greatly affected the percentage of pithy grain per panicle. The increase in the percentage of pithy grain per panicle also tends to be influenced by environmental conditions of the plant which can stimulate the panicle initiation process to be perfect. Therefore, there will be many fruit ovules formed which will eventually increase the percentage of pithy grain per panicle. Giving empty fruit bunch (*EFB*) compost can increase the availability of nutrients that will help the photosynthesis process of plants to produce photosynthate. According to Rauf *et al.* (2010), the formation of organic compounds in plant tissues can be assisted from photosynthesis produced by these plants, which have a role as raw materials and energy sources for each plant cell. Plant tissue would receive the results of photosynthate translocation including for the filling of plant seeds which ultimately increases the amount of pithy grain. Therefore, each treatment of TKKS compost produced a different percentage of pithy grain which was not significantly different.

1000 Grain Weight

Treatment of TKKS compost at various doses had no effect on the weight of 1000 pithy grains. After further testing with DNMRT (Duncan's) level of 5% and presented in Table 6.

Table 6. The average weight of 1000 grains of rice paddy of Batang Piaman varieties by giving empty fruit bunch (*EFB*) compost with modified SRI method

Empty Fruit Bunch compost (ton.ha^{-1})	1000 Grain Weight (g)
25	27.30 a
20	27.14 a
10	26.98 a
15	26.28 a
0	26.12 a

Table 6 showed that giving empty fruit bunch (*EFB*) compost with modified SRI method from a dose of 0 ton.ha^{-1} to a dose of 25 ton.ha^{-1} resulted in a weight of 1000 grains of pithy grain which tended to be the same at all treatment doses. This happened because the weight of 1000 grains of pithy grain was influenced by the size of the grains produced by the rice plant. The grain size produced by rice plants was influenced by the genetic nature of the plants used. Therefore, the same variety would produce 1000 seeds which tended to be the same weight. This statement could be proven from the weight yield of 1000 grains of rice paddy of the Batang Piaman varieties produced by giving various levels of treatment.

The treatment of empty fruit bunch (*EFB*) compost with the SRI method did not significantly affect the weight of 1000 grains. This is because the size and shape of the seeds produced by the Piaman stem variety rice plant are more influenced by genetic traits to produce a weight of 1000 grains. According to Masdar (2005), organic matter contained in the soil cannot affect the shape and size of plant seeds, but it is more influenced by the volume of *lemma* and *palea* from plant seeds which are determined by the genetic nature of the plant itself.

Another factor that affected the weight of 1000 grains of pithy grain was the ability of plants to absorb the availability of nutrients in the soil. The formation and filling of plant grains through the process of photosynthesis will be influenced by the adequacy of nutrients absorbed by the plant itself. Kamil (1986) stated that the amount of dry matter contained in plant seeds will affect the height and weight of plant seeds. The amount of dry matter contained in the seeds is produced from the photosynthetic results present in some parts of the plant and takes place in the vegetative phase of the plant, then the results are used for the formation and filling of plant seeds. The nutrient content absorbed from giving empty fruit bunch (*EFB*) compost using the SRI method had not been able to meet the nutrient needs of rice plants in increasing the weight of 1000 grains of pithy grain. Therefore, the parameter weight of 1000 grains of pithy grain showed results that tended to be the same when given several levels of treatment of empty fruit bunch (*EFB*) compost.

Weight of Dry Unhusked Grain per Clump

Treatment of empty fruit bunch (*EFB*) compost at various doses affected the weight of the grain per clump. After further testing with DNMRT (Duncan's) level of 5% and presented in Table 7.

Table 7. The average weight of milled dry rice in the Batang Piaman varieties by giving empty fruit bunch (*EFB*) compost with SRI modified method

Empty fruit bunch (*EFB*) compost (ton.ha^{-1})	Weight of dry unhusked grain (g)
20	94.72 a
25	76.75 b
15	71.08 b
10	70.64 b
0	43.11 c

Table 7 showed that giving empty fruit bunch (*EFB*) compost with modified SRI method at a dose of 20 tons.ha^{-1} affected the weight of milled dry grain parameters and resulted in the highest dry milled grain weight per clump compared to all other treatments. This was because the empty fruit bunch (*EFB*) compost given could improve soil absorption on the availability of soil nutrients and could also activate soil microorganisms. Therefore, it can increase soil fertility. According to Hakim *et al.* (1996), the application of compost can increase the activity of soil microorganisms, due to the content of organic matter contained in the compost. Soil microorganisms can increase micro and macro nutrients in the soil so that they become available for absorption by plants through the activity of breaking down organic matter.

The highest of milled dry grain weight per clump was found in the administration of empty fruit bunch (*EFB*) compost at a dose of 20 tons.ha^{-1} compared to the dose of 25 tons.ha-1, a dose of 15 tons.ha^{-1}, a dose of 10 tons.ha^{-1}, and without giving empty fruit bunch (*EFB*) compost. This was presumably due to the optimal availability of nutrients at a dose of 20 ton.ha^{-1} and maximum rice plants can absorb nutrients. Suyani and Wahyono (2016) stated that plant growth and development could not run optimally if fertilizers were given at low doses. Therefore, the nutrients needed by plants could not be met properly, while high doses of fertilizer would cause growth and development of plants disturbed.

The lowest weight of milled dry grain per clump was produced at a dose of 25 ton.ha^{-1} empty fruit bunch (*EFB*) compost compared to the administration of a dose of 20 ton.ha^{-1}. This happened because the 25 ton.ha^{-1} empty fruit bunch (*EFB*) compost required more time than the 20 ton.ha-1 dose in providing nutrients. Therefore, the plants cannot meet their nutrient needs. Nizar et al. (2017) stated that, nutrients can be gradually and slowly provided or released by organic matter, while the dose of empty fruit bunch (*EFB*) compost lower than the dose of 20 tons.ha^{-1} resulted in the weight of dry milled grain which decreased from a dose of 20 tons. ha^{-1}. This was caused by the need for nutrients that could not be fulfilled optimally to increase the weight of dry milled grain per clump of rice plants. According to Dwidjoseputro (1990), plants will be able to develop properly if the nutrient needs can be met properly and can be absorbed by plants.

Components of plant growth and yield can affect the increase in the weight of dry milled grain per clump. Root growth and plant height are one of the components of growth. The proportion of canopy or biomass as a source was indicated by plant height. Kartina *et al.* (2017) stated that, a lot of photosynthate produced by plants would have a major effect on increasing the weight of plant seeds, where the photosynthate yield was influenced by the plant crown which played a role in helping the photosynthesis process.

Root growth could affect the dry grain weight. Roots that grow well would be able to absorb the availability of nutrients well, which in the end the nutrients could be utilized by plants as a photosynthetic process that produced assimilate for filling grain. The increasing in pithy grain per plant panicle would occur if assimilate was produced in high quantities and translocated to plant grain. Nainggolan *et al.* (2017), stated that good roots can absorb nutrients through plant root hairs which will affect the photosynthesis process, which will ultimately affect assimilate yields to be translocated to plant grain.

Yield components such as the number of pithy grain per panicle and the number of productive tillers would affect the yield of dry milled grain weight per clump of rice plants. Other factors affecting the weight of milled dry grain per clump were the maximum number of tillers and the number of productive tillers. This means that the character of the number of tillers of rice plants produced in high numbers will be able to support the yield of rice plants with high numbers as well. According to Agustina et al. (2005), the maximum number of tillers and the number of productive tillers per clump were positively correlated with the weight of milled dry grain per clump of rice plants.

The high amount of grain produced was accompanied by an increase in the number of productive tillers that would produce panicles. The physiological process during the generative period of the plant would run smoothly if the plant was able to meet the availability of nutrients needed by rice plants. The highest yield on rice was found in the parameters of the number of productive tillers and the number of pithy grains per panicle by giving 20 ton.ha^{-1} of empty fruit bunch (*EFB*) compost. The results obtained were in line with the results of the weight of milled dry grain per clump of rice plants.

4. CONCLUSION

It can be concluded from the implementation of this research as follows:

1. Giving empty fruit bunch (*EFB*) compost using the SRI method can have an effect
2. On the parameters of the number of productive tillers, the number of pithy grain per panicle and the weight of milled dry grain per clump, but it did not affect the parameters of grain age, harvest age, percentage of pithy grain per panicle and weight of 1000 pithy grains.
3. Giving empty fruit bunch (*EFB*) compost using the SRI method at a dose of 20 ton.ha^{-1} is the best treatment dose to increase several components of lowland rice of Batang Piaman variety.

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