Trimming Test And Administering Manure Towards Growth And Production Of Paddy Salebu

Marahadi Siregar[1)], Julia Marisa[2)], Samrin[3)]
Faculty of Science and Technology, Pembangunan Panca Budi University
Jl. JendralGatot Subroto KM. 4,5 Sei Sikambing 20122 Medan - Sumatera Utara - Indonesia
E-mail: marahadisiregar@dosen.pancabudi.ac.id

Abstract

Rice is an important food crop in Indonesia. These conditions encourage the need to increase national rice production. Increase national paddy productivity also needed to reduce imported rice and achieve resilience and self-sufficiency. The effort to increase national Paddy production is Paddy cultivation Salebu. This research uses a split-split plot design within 1 m x 1 m area, whereas the main plot is the organic booster formula of organic Paddy from the Booster stem trimmed 10 cm (K) and stem trimmed 20 cm (N). Organic cow manure (P1), organic goat manure (P2), organic chicken manure (P3) and not given (NB) as subplots while three Paddy varieties Ciherang (V1) and Mekongga (V2), Inpara (V3) as subplots. The observed parameters of the potential of each variety of production in each plot all treatments (ton/ha) include the number and weight of grain and Paddy growth include higher plants, long panicles and number of saplings. From the initial research results that the production of grain weight of very real effect against per plotVeritasMikongga V2 (213.46). For VeritasImpara V3 very real effect against VeritasMikongga V2. Grain Weight Perplot parameter after the statistical tests shows that the treatment vareitasChiherang V1 (870.63 gr) have no effect against real VeritasImpara V3 (872.08 gr) but the very real effect against VeritasMikongga V2 (901.63 gr). For VeritasImpara V3 very real effect against VeritasMikongga V2.
Keywords: *manure. organic fertilizer, Paddy cultivation, salebu.*

A. INTRODUCTION

Rice is the staple food crop of Indonesia. These conditions encourage the need for increased national Paddy production. Increased National paddy productivity also needed to reduce imported rice and achieve food self-sufficiency and resilience. One of the efforts in improving national Paddy production was with Paddy cultivation salebu.

SalebuPaddy is a Paddy plant that shoots growing from the stumps of the rod that has been harvested and generate new saplings to be harvested. In General, the new shoots will emerge on the nearest segment of the former pieces, more or less three days after the Paddy stem cut. SalebuPaddyis Paddy planting did not move. In general, the growth and maturity of salebuPaddy speed are not uniform, and the results obtained are lower when compared to its main plant (transplanting). However, with better farming techniques, the production of salebupaddy could be improved and more profit can also be reached (Santoso, 2014).

Paddy genetically reported locally to have a kinship with the wild Paddy species have plantlets and salebu properties of the secondary. Salebu or in the language of the area is often referred to as the singgang or the turiangPaddy saplings are growing back after being harvested. Wild Paddy species Oryza perennisMoench was an ancestor of Oryza sativa l. That is widely found in Asia, especially in the swampland habitats. This species has a perennial type with potential ratun high and capable of producing a lot of vegetative growth (Oka 1974).

In resource constraints, this Ratun rice cultivation canbe used as an alternative to increasing cropping index per year, for example from 1 time to 2times or from 2 times to 3 times planting in one year. Some of the benefits of Salebu

paddy, among others, are: Without tillage, seeding, and planting again. Less labor needed, Timeto reach a short harvest, less need for irrigation water. Production costs are cheaper. Thetechnical requirements needed are in the area irrigation water is still available after the maincrop is harvested, and irrigation can be appropriately managed.

B. MATERIALS AND METHODS

Salebu technology is modified by utilizing the rice rootstock after harvest as a producer ofshoots or tillers that can be nurtured and cultivated. Observations in Tanah Datar Regency,West Sumatra, which has applied this technology with proper fertilization and maintenance,the productivity of Salebupaddy can reach 9.3 tons/ha, with an average of 6.5 to 8 tons/ha.

Regarding increasing the cropping index, it is possible because it does not require soiltreatment, nurseries, and planting so that it can save time, effort, and costs of operatingsignificantly. Salebupaddy cultivation is one of the technological innovations to

spur theproductivity of wet rice as a staple food for the community. Factors that influence thecultivation of Salebupaddy include cutting the remaining harvest stems, varieties, groundwaterconditions after harvest, and fertilization. Salebupaddy is a paddy plant that grows again afterthe remaining harvest stems are cut or trimmed, the shoots will emerge from books in thesoil. These shoots will release new roots so that the nutrient supply is no longer dependent onthe old stems; these shoots can divide or sprout again as paddy moves usually, this is whatmakes the growth and production the same or higher than the first plant (mother). Tillerpaddyis paddy that grows from the rest of the harvest without cutting the stems; the shoot will appearin the uppermost book; the nutrient supply remains from the old stem. This cultivation canalso indirectly overcome the limitations of superior varieties, because the next plant growthoccurs vegetatively, the quality of the variety remains the same as the first plant. The effort to increase the productivity of other rice plants is to fulfill their daily needs. Fertilization aims to increase the nutrients needed by plants because nutrients containedin the soil are not always sufficient to optimally promote plant growth. So far,farmers tend to use inorganic fertilizers continuously. The relatively high use of inorganicfertilizers can cause adverse impacts on the land. These conditions lead to the idea of re-using organicmaterial as a source of organic fertilizer. The use of organic fertilizer can maintain thebalance of land and increase land productivity and reduce the environmental impact of thesoil. Organic fertilizers are the result of decomposition of organic materials that aredecomposed (transformed) by microbes, the result of which can provide nutrients needed byplants for plant growth and development. Organic fertilizer is essential as a buffer for soilphysical, chemical and biological properties to improve fertilizer efficiency and landproductivity.

This research was carried out in Dusun VII Sukamaju Indah, Sukamaju Village, SunggalSubdistrict, Deli Serdang Regency, North Sumatra Province with an altitude of 20 m abovesea level and a distance from the beach 8 km and lasted from 2017

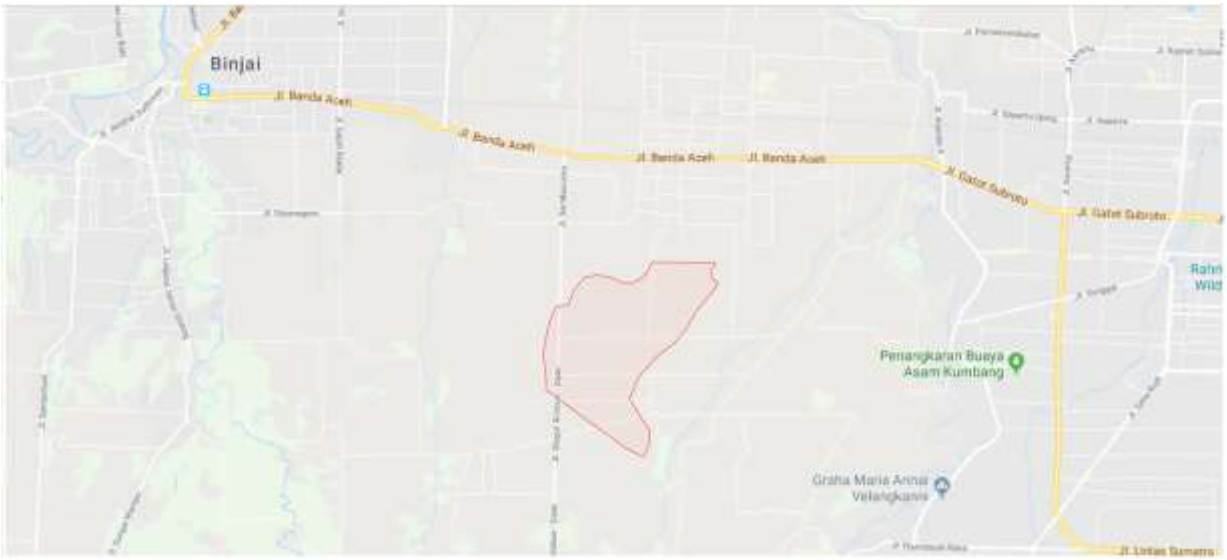


Figure1. Study area. Location of Dusun VII Sukamaju Indah, Sukamaju Village, Sunggal Subdistrict, Deli Serdang Regency, North Sumatra Province with an altitude of 20 m above sea level and a distance from the beach 8 km

The material used in thisstudy was paddy varieties with evaluation of potential yield such as Ciherang, Mekongga,Inpara, organic fertilizer namely animal waste. The tools used in this study are hoe, sprayer,stakes, electroconductivity, ph meters, meters, stationery, and other tools that support theresearch.

This study used a randomized block design group in which:

Factor I: 1. Trimming 10 cm (K). 2. Trimming 20 cm (N).

Factor II: 1. Cow manure (P1), 2. Goat Manure (P2) 3. Chicken Manure (P3)

Factor III: 1. Ciherang (V1) 2. Cavity (V2) 3. Inpara (V3).

The parameters observed are 1. The growth of rice plants includes the length of the plant,number of

tillers, panicle length 2. Rice production includes the number of grain crops andgrain weight.

C. RESEARCH METHODS

Time and place

Research was held in the village VII sukamaju, beautiful village of sukamajusubdisttrictsunggal, deli serdang district of North Sumatera with an altitude of 15 meters from sea level ang distance 25 km from the beach and lasted from 2018

Research design: Using Split Plot Design (SPD)

Factor I (A)

1. Trimming: 10 cm (K)
2. Trimming: 20 cm (N)

Factor II (B)

1. Cow Manure (P1)
2. Goat Manure (P2)
3. ChickenManure (P3)

Factor III (C)

1. VarietasCiherang (V1)
2. VarietasMakongga (V2)
3. VarietasInpara (V3)

Linier Model

$Y(i)\ jk1 = \mu_{ijk}1+A_j+\in(a)_{ij}+ B_k +(AB)_{jk} +\in(b)_{jkl}+C1+(AC)_{jl}+(BC)_{k}l+(ABC)_{jkl}+\in(c)_{ijkl}$

Which is:

Yij	=	observation value
μ_{ijk}**1**	=	average treatments
A_{ij}	=	treatment influent PU
$\in$**(a)**	=	random influent Aa
B_k	=	Treatment influent AP
$(AB)_{jk}$	=	interaction influent PU and AP
$\in(b)_{jk}$	=	random influent b
C_k	=	Treatment influent AAP
$(AC)_{jl}$	=	interaction influent PU and AAP
$(BC)_{jk}$	=	interaction influent AP and AAP
$(ABC)_{jkl}$	=	interaction influent PU, AP and AAP
$\in(c)_{ijkl}$	=	random influent C

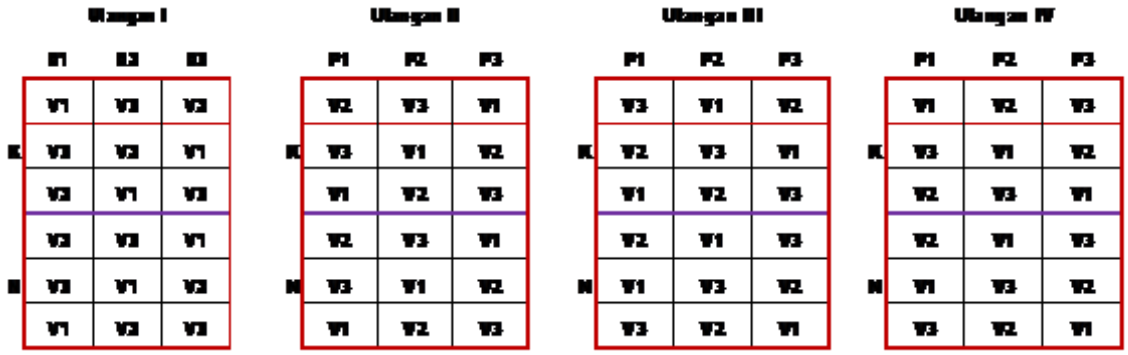
The number of the whole experiment plots needed is:

- 4 groups
- 2 main plots
- 3 sub plots
- 3 split plots
- r x A x B x C = 4 x 2 x 3 x 3 = 72 experiment plots

The observed parameters are:

1. The growth of rice crops includes the length of the plant, the number of saplings, the length of malai
2. Paddy production includes the amount of grain and weighs grain

Research Char.



DATA ANALYSIS

1.1. Variety Test

The average plant height and number of tillers after the Variety Test have no significant effect; this can be presented in the following table.

Table 3 Average Rice Variance Test after Pruning at 40 days

Treatment	Plant Height (cm)		Number of tillers (tillers)	
V1 = Chiherang	99.47	A	15.83	a
V2 = Mikongga	99.39	A	15.92	a

V3 = Inpara	99.40	A	15.92	a

Description: The number followed by the same letter in the same column shows no significant difference at 5% (lower case)

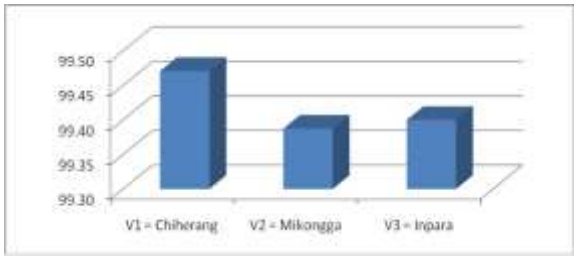


Figure 1. Pruning after harvet

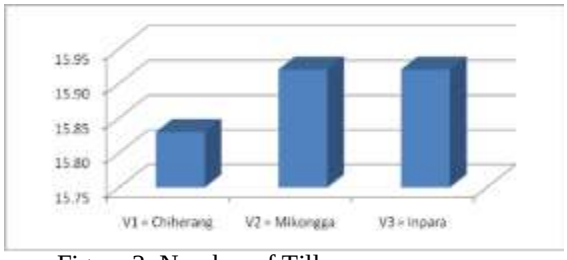


Figure 2. Number of Tillers

After statistical tests that the treatment of variance did not significantly affect plant height and number of tillers. The combination treatment of Salibu cultivation system with V1 (99.47 cm) varieties treatment gave the highest results among other treatments such as v (40.00 cm) and Fertilizer V3 (99.40 cm) and V2 (99.39 cm). As for the number of tillers of V2 and V3 varieties (15.92 tillers) in V1 treatment (15.83).

4.2. Pruning Test

As a result of Pruning Test there was no significant effect on panicle length, the number of grains of heavy grains of rice grains and the weight of plotted grain, this can be presented in the following table.

Table 4 Average of Padi stem Pruning Test at 90 days

Treatment	Tassel Length (cm)		Amount of Grain		Weight of GrainSamples (gr)	Grain Weight Perplot (gr)		
Pruning								
K = 10 cm	17.92	A	210.25	A	210.50	A	881.19	A
N = 20 cm	18.03	A	210.92	A	210.89	A	881.72	A

Description: The numbers followed by different letters in the same column show significant differences at the level of 5% (lower case) and differ very significantly at the level of 1% (big break)

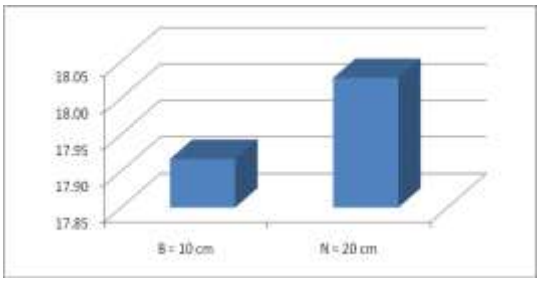


Figure 3. Plant Height after 90 days harvest

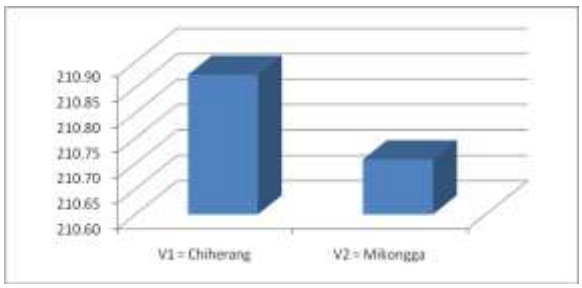


Figure 4. Number pf panicle after 90 days harvest

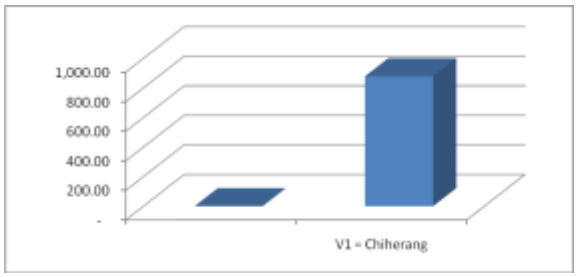


Figure 5. Weight grain per sample (gr)

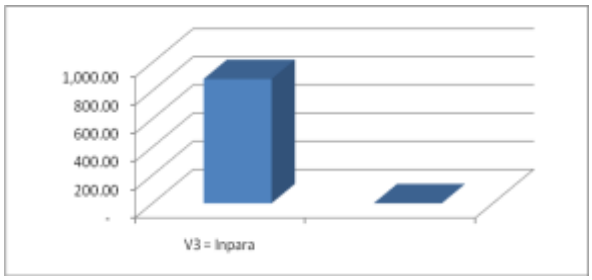


Figure 6, Weight grain per plot (gr)

After the statistical test, the difference in cutting height of the remaining crop stumps did not significantly affect the panicle length and amount of sliced grain, weight of paddy slabsand grain weight per plot. The combination of the treatment system of Salibu cultivation at Malai Length with a cutting height of 10 cm (17.92 cm) and cut 20 cm (18.03 cm). In the parameter of Amount of Salted Grain with a cutting height of 10 cm (210.25 grain) and cutting of 20 cm (210.92 grain). In parameter weight of Per Sample grain with cutting height 10 cm (210.50 gr) and cutting 20 cm (210.89 gr). On parameter of Grain Weight Per plot with cutting height 10 cm (881,19 gr) and cutting 20 cm (881,72).

4.3. Fertilization Test

Fertilization test had no significant effect on panicle length, the number of raw grains but very significantly different from the weight of paddy grains and the weight of plotted grain; this can be presented in the following table.

Table 5 Average Rice Fertilization Test after Pruning at 40 days

Treatment	Tassel Length (cm)		Amount of Grain		Weight of Grain Samples (gr)		Grain Weight Per plot (gr)	
Fertilizing								
P1 = Cattle Fertilizer	17.92	A	210.75	A	210.88	A	878.83	A
P2 = Goat Cage Fertilizer	17.92	A	210.29	A	210.71	A	881.08	A
P3 = Chicken Cage Fertilizer	17.96	A	210.42	A	210.50	A	882.46	A

Description: The numbers followed by different letters in the same column show significant differences at the level of 5% (lower case) and differ very significantly at the level of 1% (big break)

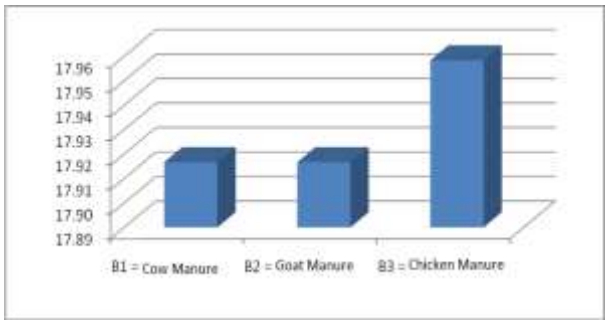


Figure 7. Panicles height after fertilization treatment

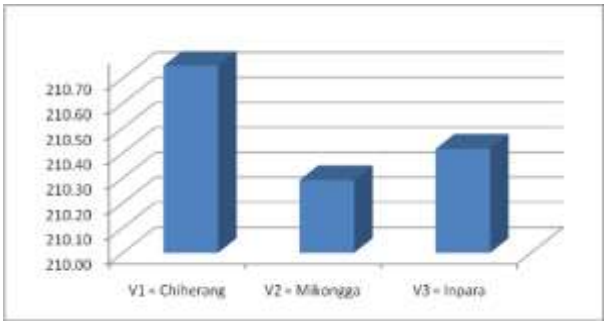


Figure 8. Panicles length after fertilization treatment

After statistical tests that fertilization treatment did not significantly affect the panicle length, the number of grain grains, the weight of rice paddy and the weight of grain plots. The combination of Salibu cultivation system parameters, panicle length treatment with the treatment of P1 cow manure (17.92 cm), goat manure P2 (17.92 cm), P3 chicken manure (17.96 cm). In the parameters of the number of grains with the treatment of giving P1 cow manure (210.75 grain), goat P2 manure (210.29 grain), P3 chicken manure (210.42 grain). For the parameters of the weight of the paddy sample with the treatment of giving cow manure P1 (210.88 g), goat manure P2 (210.71 g), P3 chicken manure (210.50 g) and the weight parameters of plots with treatment of manure P1 cow (878.83 gr), goat manure P2 (881.08 gr), P3 chicken manure (882.46 gr).

4.4. Variety Test

Average panicle length, number of permalai grain, grain weight of sample and weight of paddy plot due to pruning test had no significant effect on panicle length and number of unripe grain but very significantly different from the weight of paddy grain and weight of plotted grain, this can be presented in table 6 below

Table 6 Average Rice Variety Test after Pruning at 40 days.

Treatment	Tassel Length (cm)		Amount of Grain		Weight of Grain Samples (gr)	Grain Weight Per plot (gr)		
Variety								
V1 = Chiherang	17.92	A	210.75	A	209.21	C	870.63	C
V2 = Mikongga	17.92	A	210.29	A	213.46	A	901.67	A
V3 = Inpara	17.96	A	210.42	A	209.42	BC	872.08	BC

Description: The numbers followed by different letters in the same column show significant differences at the level of 5% (lower case) and differ very significantly at the level of 1% (big break)

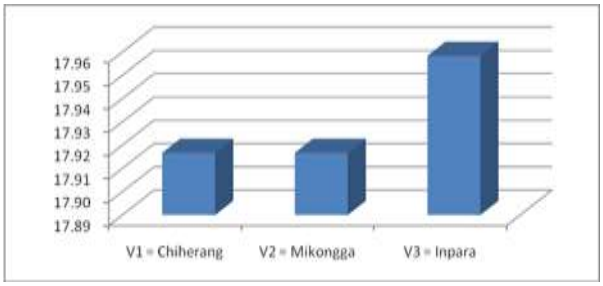


Figure 9. Panicles length

Figure 10. Grain weight

The panicle length parameters and the number of moth grain after statistical tests showed that the treatment of Chiherang V1 variety (17.92 cm) had no significant effect on the Void Cavity Variety (17.96 cm) and V3 (17.92 cm) For the parameter of the number of Chiherang V1 varieties (210.75 grains) of variety grain which has no significant effect on the V2 Vascularity Variety (210.29 grain) and Impara V3 210.42). On the parameter of Grain Weight Samples and weight of plotted grain after statistical tests showed that the treatment of Chiherang V1 variance (209.21 gr) had no significant effect on V3 (209.42 gr) but the very significant effect on V2 Vascularity (213.46). For V3, it has a genuine effect on V2 Vascularity. Parameters of Grain Weight Perplot after statistical tests showed that the treatment of Chiherang V1 variety (870.63 gr) had no significant effect on V3 (872.08 gr), but it was the very significant effect on Void Cavity V2 (901.63 g). For V3, it has a genuine effect on V2 Vascularity.

4.5. Plant height (cm) and number of tillers (tillers)

The results of the study after statistical analysis showed that the treatment of rice stem pruning did not show any effect on all observed parameters. However, from the results of higher growth, number of tillers, panicle length, number of barley grain, grain weight per sample and weight of plotted grain at 10 cm cutting are best, presumably because the part is closer to the root which is the source of nutrient supply throughout the body plant. It results in regrowth after cutting. Among photosynthetic devices that are directly related to cutting and the resulting metabolic function are leaves. The re-growth of Orchard grass depends both on the carbohydrate reserves in the plant stems and on the leaf, area remaining after pruning. The carbohydrates are needed to maintain metabolic activity during the initial stages of regrowth. Energy requirements for partial or complete regrowth can be supplied if there are enough stems or leaves left after pruning, to supply new leaves or tillers, which immediately become autotropic (self-generating energy) which will have an impact on production.

In the fertilization test in this study after the analysis was done in a statistic also did not show a real effect on all parameters observed. It is because the roots of plants have not appropriately utilized manure because it has not been completely decomposed. Giving manure in the water decomposes longer on the ground. The manure that is decayed is better than immature manure because more decayed manure contains high organic matter and the influence of nitrogen and microorganisms.

Plant height and number of tillers at 40 HST different varieties of rice are not real. This is thought to be variety V1 (varieties of ciherang), V2 (varieties of mekongga) and V2 (variants of inpara) where all three varieties have nearly the same genetic ability in

developing other factors such as water, CO2, light, nutrients, and space-grabbing so in growth that is theincrease in height size is not real. In the natural state of plant growth, it is largely determined by genetic factors of the plant itself, especially the condition of growth regulating substances (hormones). Ciherang variety data results showed higher plant growth because of genetically higher Ciherang varieties. In the weight parameters of paddy samples and the weight of grain, plots have a very significant effect on the variety planted. This is presumably, the difference in growth and yield of each variety in addition to genetic related to the plant itself, but also influenced by environmental factors. The internal factors of plant growth stimuli are in genetic control, but climatic, soil and biological elements such as pests, diseases, weeds and competition in obtaining nutrients that can affect growth and yield. Included in the availability of nutrients in the soil. It is suspected that plant growth is very much determined by the variety besides nutrients that are available in an optimum and balanced state. A plant will thrive if all the nutrients needed are sufficiently available for absorbing plants.

D. RESULTS AND DISCUSSION

The results of the study after statistical analysis showed that the treatment of paddy stem pruning showed no effect on all observed parameters. The best results of higher growth, number of tillers, panicle length, number of seed grains, weight of grain paddy and per plot grain weight were at 10 cm cutting, presumably because the part is closer to the root which is the source of supply of nutrients throughout the plant body. This resultcaused regrowth after cutting. Among photosynthetic devices that are directly related to the cutting and metabolic functions caused are leaves. The function of leaves after cutting for growth again in the family Gramina (grass) has been suggested by Gardner et al. (1991) that the regrowth of Orchard grass depends both on carbohydrate reserves in plant stems and on the leaf, area remaining after pruning. Gardner et al. (1991) state that carbohydrates are needed to maintain metabolic activity during the early stages of regrowth. Energy requirements for partial or full regrowth can be supplied if enough stems or leaves are left after pruning, to supply new leaves or tillers, which soon become autotropic (energy producers themselves) which will have an impact on production.

The fertilization test in this study after being analyzed was also statically also showed no significant effect on all parameters observed. This is because manure cannot be utilized properly by plant roots because it has not completely decomposed. Provision of manure in water is longer decomposed than on the ground. This is supported by Buckman and Brady (1994) who stated that fertilized manure is better than immature manure, because more weathered manure contains high organic matter and the influence of nitrogen and microorganisms.

Plant height and number of tillers at the age of 40 HST rice varieties differed not real. This is believed to be a variety of V1 (ciherang varieties), V2 (mekongga varieties) and V2 (vareitasinpara) where the three varieties have almost the same genetic ability in the ability to expect other factors such as water, CO2, light and nutrient growth so that in growth, the increase in height size is not significantly different. In the natural state of plant growth, it is determined by genetic factors of the plant itself, especially the condition of growth regulators (hormones). The results of the ciherang varieties showed higher plant growth because genetically the ciherang variety was higher.

The parameters of grain weight per grain and per plot grain weight have a very significant effect on planted varieties. This is suspected, the difference in growth and yield of each variety besides being related to the genetics of the plant itself, but also influenced by environmental factors, according to Gardner et al. (1991) states that internal factors stimulating plant growth are in genetic control, but the elements of climate, soil and biology such as pests, diseases, weeds and competition in obtaining nutrients can affect growth and yield. Included in the availability of nutrients in the soil. It is suspected that plant growth is very much determined by variety besides the available nutrients in an optimum and balanced state. According to the statement of Dwidjoseputro (1983) Namely a plant will thrive if all the nutrients needed are sufficient and, in a form, suitable to be absorbed by plants.

ACKNOWLEDGEMENT

This research was supported and financed by KEMENRISTEKDIKTI through Competing Grant in 2017/2018, Faculty of Science and Technology, University of Pembangunan Panca Budi.We thank LPPM from University of Pembangunan Panca Budi which provided guidance, insight and expertise that greatly assisted the research.

REFERENCES

Basyir, A., Punarto.S. dan Supriyatin. 1995. Padi gogo. Balai Penelitian Tanaman Pangan. Malang. Hal 45-46 hal.

Barkelaar, D. 2001 Sistem Intensifikasi Padi (The System of Rice Intensification-SRI). Sedikit dapat Memberi Lebih Banyak. Tejemahan bebas oleh Indro Surono, staf ELSPPAT dari bulletin ECHO Development Notes. Email :

echo@echonet.org.URl : http://www.echonet.org.

CIIFAD. 2002. A Scientists perspective on experience with SRI in China for raising the yield of super hybrid rice. Cornell International Institute for Food. Agriculture and Development, http//ciifat.cornell.edu/sri:ciifat@cornell.edu. 607-255-0831.

Defeng, Z., C. Shihua, Z. Yuping, and L. Xiaqing. 2002. Tillering patterns and the constribution of tillers to grain yield with hybrid rice and wide spacing. China National ice Research Institute, Hangzhou. CIIFAD, http://ciifad .cornell.edu/sri:ciifat@cornell.edu. 125-131 p.

Dinas Pertanian. 2003. Statistik tanaman pangan dan holtikultura Sumatera Barat. Padang Gadner, F.P,. R.B. Pearce dan .L. Mitchell. 1991. Fisiologi tanaman budidaya. Penerbit Universitas Indonesia. 428 hal.

Gardner, F.P., R. B. Pearce dan R. I. Mitchell. 1991. Fisiologi Tanaman Budidaya Universitas Indonesia press, Jakarta. 428 hlm.

IRRI, 1997.Informasi Ringkas Varietas Unggul Padi Sawah.1943-2007. http://www.knowledge.irri.org.Kerjasama Badan Litbang Pertanian-IRRI

Makarim A.K., U.S.Nugraha., dan U.G. Kartasasmita, 2000. Teknologi Produksi Padi Sawah. Pusat penelitian dan Pengembangan Tanaman Pangan, Bogor.

Prasad C.S., Maiti K,N., and Venugopal R, 2001. "Effect of rice husk ash in white ware compositions", Ceramic International.Samekto dan Riyo,2006. Pupuk Kandang. Citra Aji Parama.Yogyakarta.

Tisdale, S.L.& W.L. Nelson, 1965. Soil Fertility and Fertilizers. Millan, New York. Yulianto, 2007. Tanah Sawah di Daerah Sentra Beras.http: // www.republika. co.id.htm. Diakses 3 April 2014.

Erdiman. 2012. Teknologi Salibu Meningkatkan Produktivitas Lahan (3-6 Ton/Ha/Tahun) dan Pendapatan Petani (Rp.15-25 Juta/Tahun). Balai Pengkajian Teknologi Pertanian Sumatera Barat.

Gani, A. 2009. Potensi Arang Hayati (Biochar) sebagai Komponen Teknologi Perbaikan Produktivitas Lahan Pertanian. IPTEK Tanaman Pangan 4(1).

Harahap,A.2014. Tiga Cara Optimalisasi Lahan Sawah. Badan Penyuluhan dan Pengembangan Sumberdaya Manusia Pertanian, Kementerian Pertanian.Riau.

Halliday DJ, Trenkel ME. 1998. IFA World Fertilizer Use Manual. Paris: International Fertilizer Industry Association

Kartaatmadja, S., E. Suhartatik, I.G. Ismail, E. Jamal, Sunihardi, A. Kasno, A. Subaedi dan R. Buresh. 2009. Piranti Lunak Pemupukan Padi Sawah Spesifik Lokasi. Badan Penelitian dan Pengembangan Pertanian. Jakarta.

Salikin, K. A. 2003. Sistem Pertanian Berkelanjutan. Penerbit Kanisius. Yogyakarta

Sembiring H, A. Hippi, dan L. Wiraja swadi, 2001. "Jurnal" Pengaruh Umur dan Jumlah Bibit Terhadap Produksi Padi Sawah Pada Tanah Entisol Dan Inseptisol Di Nusa Tenggara Barat. Balaj Pengkajian Teknologi Pertanian Nusa Tenggara Barat, Lombok Barat.

Supartha, I. Wijana, G. Adnyana, G. 2012. Aplikasi Jenis Pupuk Organik pada Tanaman Padi Sistem Pertanian Organik. E-Jurnal Agroekoteknologi Tropika1(2).

Sari, N.Y., Ete, A. & Made, U. (2017). Growthresponse of rainfed lowland rice applied with

organic matter in the various condition of water availability. e-J. Agrotekbis, 5(1), 53-57.

Sarif, E. S. (1986). Kesuburan dan Pemupukan Tanah Pertanian. Pustaka Buana. Bandung.

Sarjana, D. G. R. & Utami. (2001). Analisis pertumbuhan tanaman bawang putih sebagai pengukur keefektifan EM-4 pada beberapa macam seresah. Agritrop,

20(1), 26-31.

Sumartono, Bahrinsamed & Harjono, R. (1983). Bercocok Tanam Padi. Yasaguna, Jakarta.

Sumardi. (2007). Peningkatan Produksi Sawah Melalui Perbaikan Lingkungan Tumbuh Dalam Meningkatkan Hubungan Source-sink Tanaman pada Metode SRI (The System Rice Intensification). Disertasi. Ilmu – Ilmu Pertanian. Program Pasca Sarjana. Universitas Andalas, Padang. (tidak dipublikasikan).

Supartha, I.N.Y., Wijana, G. & Andyana, G.M. (2012). Aplikasi jenis pupuk organik pada tanaman padi sistem pertanian organik. E Jurnal Agroekoteknologi Tropika, 1(2), 98-106

Wasito, M. Sarwani, dan E.E. Ananto. 2010. Persepsi dan adopsi petani terhadap teknologi pemupukan berimbang pada tanaman padi dengan indeks pertanaman 300. Penelitian Pertanian Tanaman Pangan 29(3)