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# Local Decomposer Increase Composting Rate and Produce Quality Rice Straw Compost



#### I Nengah Muliarta <sup>a</sup>, I Gusti Ayu Mas Sri Agung <sup>b</sup>, I Made Adnyana <sup>c</sup>, I Wayan Diara <sup>d</sup>

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Correspondence Author a



Keywords

compost quality; composting rate; enumeration; local decomposers; rice straw;

# Abstract

This study at aiming to examine the ability of Balinese local decomposers in composting rice straw. Another goal is to examine the composting rate and quality of compost in enumeration rice straw that is not enumerated. The study used 2 combinations of local decomposers and comparative decomposers. The local decomposer 1 combination consists of *Paenibacillus polimyxa*, Pseudomonas flourescens, and Trichoderma hazianum. The combination of local decomposers 2 consists of Pseudomonas flourescens, Trichoderma hazianum, and Aspergilus niger. Comparative decomposers are commercial decomposers consists of Azospirillum, Aspergillus, Actinomycetes, Lactobacillus, Pseudomonas, and yeast. The study was conducted in Tangkas Village, Klungkung on June 17 up to July 23, 2017. The study used a *Randomized Block Design (RBD)* with 3 (three) replications. Composting is conducted for 35 days and compost reversal is conducted every 7 days. The results showed that the addition of local decomposer 1 was able to provide a C/N ratio of up to 13.78, local decomposers 2 to 14.80 and this result was not significantly different from the comparison decomposition C/N ratio which reached 15.31.

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- <sup>a</sup> Doctorate Student Program of Agricultural Science, Faculty of Agriculture, Udayana University, Jl. PB. Sudirman, Denpasar, Bali, Indonesia
- <sup>b</sup> Lecturer in Doctorate Program of Agricultural Science, Faculty of Agriculture, Udayana University, Jl. PB. Sudirman, Denpasar, Bali, Indonesia
- <sup>c</sup> Lecturer in Doctorate Program of Agricultural Science, Faculty of Agriculture, Udayana University, Jl. PB. Sudirman, Denpasar, Bali, Indonesia
- <sup>d</sup> Lecturer in Doctorate Program of Agricultural Science, Faculty of Agriculture, Udayana University, Jl. PB. Sudirman, Denpasar, Bali, Indonesia

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#### 1. Introduction

The use of compost is part of an effort to reduce production costs due to the purchase of inorganic fertilizers. The use of compost is not only to reduce the need for inorganic fertilizers but also to reduce environmental pollution (Sarwar *et al.*, 2007). It can be used as an alternative to inorganic fertilizers to increase crop production (Wanatabe *et al.*, 2009; Palanivell *et al.*, 2013). The rice straw is a potential for local raw materials that can be processed into organic fertilizer. The amount at harvest is very abundant and has not been utilized optimally (Zhao *et al.*, 2014). In every 1 kg of grain produced 1-1.5 kg of rice straw (Binod *et al.*, 2010).

The results of various studies show that rice straw consists of nutrients included N, P, K and C-organic which is needed by the soil. Rice straw contains about 0.6% N, 1.5% K, 5% Si, 40% C, 0.10% P and S respectively (Ponnamperuma, 1984). Returning rice straw to paddy fields through a decomposition process can be an option for farmers to use agricultural waste with environmentally friendly technologies and efforts to reduce fertilizer costs (Gaind & Nain, 2011). Composting of the rice straw and its utilization on agricultural land serves to maintain the content of soil organic matter and soil microbiological properties (Goyal *et al.*, 2009). Erses *et al.*, (2008), argued that aerobic composting can be an option due to the decomposition process is faster than anaerobic and becomes an effort in reducing methane emissions.

In order to speed up the composting process can be conducted by adding a decomposer, the one is a combination of the local decomposers. The use of local decomposers in an effort to utilize local resources around farmers. The decomposers function is to stimulate the decomposition process due to they consist of bacteria and enzymes (Sadik *et al.*, 2010). The choice of decomposers must also pay attention to compost raw material in the form of rice straw included *lignocellulose* (*cellulose, hemicellulose,* and *lignin*). The content of *cellulose, hemicellulose,* and *lignin* in the material provides an opportunity to use *lignocellulotic microbes* to accelerate the decomposition process (Nur *et al.*, 2008; Sethi *et al.*, 2013; Saini *et al.*, 2015; Shruti *et al.*, 2015). The decomposition of lignocellulose material can be conducted by *lignocellulose microbes* consisting of *fungi, bacteria,* and *actinomycetes.* Several groups of microorganisms such as *clostridium, cellulomonas, trichoderma, penicillium, neurospora, fusarium, aspergillus,* etc, have high *cellulolytic* and *hemicellulolytic* activity (Chandel *et al.,* 2007).

Reducing the size of compost material at enumerating compost material is expressed as a means of accelerating the composting process (Bending & Turner, 1999). The enumeration of lignocellulose material will make it easier for microbes to decompose lignocellulose material (Nazhad *et al.*, 1995). Atalia *et al.*, (2015), argued that compost material for composting with natural aeration can be cut into pieces about 1-5 cm.

The studies on composting of the rice straw with the addition of decomposers have been conducted, other researchers. Yaacob *et al.*, (2017), composting rice straw using fungi of *Trichoderma harzianum*. Goyal & Sindhu (2011), composted rice straw using a consortium of three fungi (*Aspergillus awamorii, Paecilomyces fusisporous* and *Trichoderma viride*). Sitepu *et al.*, (2017), conducted composting of rice straw by adding *Aspergillus niger* LD 137 and *Trichoderma viride* LD 140. Research on composting rice straw by utilizing local decomposers, especially Balinese local decomposers, had not been done. Therefore, this research needed to be completed.

The stability and maturity of compost have become an important parameter for evaluating the quality of compost in the United States (Brewer & Sullivan, 2001). The C/N ratio can be used as a reference for estimating compost maturity (Harada *et al.*, 1981). The chemical indicators commonly used to assess the stability and maturity of compost included the content of organic matter, dissolved organic carbon, the ratio of

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C/N, ammonia and nitrate, pH and electrical conductivity (Wichuk & McCartney, 2010). The parameters measured in this study is temperature, water content, C/N, N, P, K, organic C, pH, composting rate and percentage decrease mass.

#### 2. Materials and Methods

Composting of the rice straw (Ciherang variety) was conducted using 3 types of decomposers (Local 1, Local 2 and comparative decomposers). Local decomposers 1 are a combination of *Paenibacillus polimyxa, Pseudomonas flourescens,* and *Trichoderma hazianum*. Local Decomposer 2 is a combination of *Pseudomonas flourescens, Trichoderma hazianum,* and *Aspergillus niger. Paenibacillus polimyxa* decomposer (isolated from *rhizosphere* plant), *Pseudomonas flourescens* (isolated from *rhizosphere* onion), and *Trichoderma hazianum* (isolated from the dung of cow) is a collection of Laboratory of Plant Diseases, Faculty of Agriculture, Universitas Udayana. *Aspergillus niger* decomposer (isolated from Bali chicken manure) is a collection of the Bali Institute of Agricultural Technology (BPTP). Comparative decomposers (positive controls) use commercial decomposers produced by PT Indo Acidatama Tbk. which consists of *Azospirillum, Aspergillus, Actinomycetes, Lactobacillus, Pseudomonas,* and *yeast.* The decomposer dose used was 20 ml for 20 kg of the rice straw.

In this study, *Randomized Block Design (RBD)* is used with 3 (three) replications. The treatments that were tried were types of decomposers (local decomposer 1, local 2 and comparison) and straw enumeration (non-enumerated and enumerated) which were arranged factorially (Table 1). The composting tank uses a gunny sack with a diameter of 75 cm and a height of 110 cm, 35 days of composting and compost reversal every 7 days.

Table 1 Treatment was tried in this study

Treatment	Non	Local docomposor 1	Local	Comparative
Treatment	decomposer	Local decomposer 1	decomposer 2	decomposer
Not enumerated	NDUC	D1UC	D2UC	CDUC
Enumerated	NDCC	D1CC	D2CC	CDCC

The variables observed included compost temperature, decomposition rate, moisture content, C/N, pH, organic C, N, P, and K compost, compost weight, and weight loss of compost during composting. The speed of composting or the rate of decomposition during composting is calculated using equations (Olson, 1963; Sari *et al.*, 2016).

Reference:

- R = Decomposition rate (g/day)
- T = Composting time (days)
- W<sub>0</sub> = Initial material weight

Wt = Weight after composting process at T-time

The weight of the compost and the weight loss of the compost are obtained at weighing the final weight and then looking for the difference between the initial weight and the final weight. The percentage of weight loss during the composting process is calculated according to the equation (Olson, 1963; Sari *et al.*, 2016):

W = Decomposition percentage (%)

W<sub>0</sub> = Initial material weight

Wt = Weight after composting process at T-time

Analysis

Data obtained were analyzed by variance (ANOVA) followed the *smallest real difference (SRD)* test at the level of 5% with *COSTAT* and *MSTAT* Computer software.

# 3. Results and Discussions

The comparison of the results of the composting process with the addition of decomposers and enumeration shows the rate of composting and decrease in compost mass, it is presented in Table 2.

The effect of decomposers and enumeration of materials on composting rates and percentage loss of compost mass

Treatment	Composting rate (kg/day-1)	Percentage of mass loss (%)	Water content (%)	Total of compost microbes (cfu/ml)	pH compost
Decomposer					
Non decomposer	0,067 <sup>b</sup>	12,83 <sup>b</sup>	43,17ª	1,43 x10 <sup>8 b</sup>	7,50ª
Local decomposer 1	<b>0,088</b> ª	15,833ª	43,33ª	1,36 x10 <sup>8 b</sup>	7,63ª
Local decomposer 2	0,083ª	15,833ª	43,17ª	2,24 x10 <sup>8 a</sup>	<b>7,43</b> ª
Comparative	<b>0,088</b> ª	15,667ª	43,00 <sup>a</sup>	2,19 x10 <sup>8 a</sup>	<b>7,81</b> ª
Decomposer					
SRD 5%	0,0133	2,1399	-	0,190	-
Enumeration					
Without enumerated	0,074 <sup>b</sup>	12,917 <sup>b</sup>	43,17ª	1,49 x10 <sup>8 b</sup>	7,65ª
Enumerated	<b>0,089</b> ª	17,177ª	43,17ª	2,12 x10 <sup>8 a</sup>	7,54 <sup>a</sup>
SRD 5%	0,0094	1,5132	-	0,134	-

Reference: The numbers followed by the same letters in the treatment, in the same column, are not significantly different from the SRD 5% test

Based on the results of the study showed that the composting rate in composting rice straw ranged from 0.067-0.089 kg/day. The lower results were obtained by Adawiyah *et al.*, (2017), who obtained decomposition rates ranging from 11.2-16.2 gr/day when composting waste with the addition of bacterial isolates from the landfill and with composting time for 30 days. The composting rate in the control was recorded at 0.067 kg/day, the composting rate was thought to occur due to the role of the decomposers already contained in the rice straw. This allegation is in line accordance viewing of Strom & Finsstein (1994), stated that decomposer microbes found in nature have the ability to compost. Statistically, the composting rate in the control (composting without decomposers) was lower or significantly different compared to the addition of decomposer treatment (p<0.05). This is thought to occur due to the combination of added decomposers can work synergistically with the decomposer contained in the material. It is to guess is in accordance with a viewing of Tsigarida *et al.*, (2003) and viewing of Mitri & Foster (2013), who argued that the addition of a microbial association or a single microorganism can have a positive, negative, or neutral response with other microorganisms present in the same material. While the composting rate in the treatment of the addition of local decomposers does not look different compared to the comparison. It indicates that the local decomposer combination used has the same decomposition rate as the comparative decomposer.

The addition of local decomposers and comparators also gave a higher decrease in mass compared to controls. This is presumably due to the addition of decomposers accelerates the decomposition process, therefore, the compost mass decreases. This result is in accordance with the opinion that composting is substantially part of efforts to reduce waste mass (Larney *et al.*, 2000; Tiquia *et al.*, 2002; Breitenbeck &

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# Table 2

Schellinger, 2004). However, according to Michel *et al.*, (2004), the reduction in the mass of material during composting is strongly influenced by the moisture. The moisture (moisture content) of compost at the end of composting obtained in the study generally is still in accordance with *standard national Indonesia (SNI)* 19-7030-2004 standards, it is recommended a maximum humidity of 50%. The moisture of compost decreases during the composting period due to the degradation of waste by microbial activity that produces heat. Therefore, the temperature becomes high (Kadir *et al.*, 2016). The moisture percentage will also decrease by adding time intervals and is a positive sign to evaluate the stability of compost. Decreasing the percentage of moisture provides a more stable and mature compost (Ameen *et al.*, 2016).

The compost turns out to also provide a faster composting rate and a higher decrease in mass compared to without enumeration. This condition occurs due to the microbial activity is related to particle size, wherein, the smaller particle sizes make it easier for microbes to access the substrate (Atalia *et al.*, 2015; Roman *et al.*, 2015). The enumeration of lignocellulose material will make it easier for microbes to decompose lignocellulose material (Nazhad *et al.*, 1995). Theoretically, it is true that the smaller particle size is better the biological degradation (Bertoldi *et al.*, 1983).

In this study, the total microbial compost of rice straw obtained ranged from 1.36 x 10<sup>8</sup> cfu/ml to 2.19 x 10<sup>8</sup> cfu/ml. The total microbial results obtained are in accordance with the statement of Chandna *et al.*, (2013), stated that the microbial population of compost ranged from 10<sup>5</sup> to 10<sup>9</sup> cfu g<sup>-1</sup> compost. The results of analysis of variance showed that the total microbes in the control were the same as the treatment of the addition of local decomposers 1, however, the different from the total microbes in the treatment of addition of local decomposers 2 and comparators. The enumeration treatments have made microbes easier to decompose (Atalia *et al.*, 2015). The presence of microbes both bacteria and fungi utilize organic matter as an energy source for growth (Streminska & Raviv, 2016). The microbial diversity will increase when the decomposition process takes place and the quality of the substrate decreases (Dilly *et al.*, 2004). According to Streminska & Raviv (2016), the microbial activity is regulated by the heat produced and the quality of organic matter. These factors also affect the number and diversity of microbes at each stage of composting.

During the composting process, the highest temperature was recorded at 57.40° C occurred in the D1CC treatment on the 4<sup>th</sup> day. The optimal temperature for composting not enumerated occurred on the 11<sup>th</sup> day, with a maximum temperature of 45.57° C and occurred in the D2UC treatment. In the study, Dhal *et al.*, (2012), obtained a maximum composting temperature of 57.3° C. In another experiment, Makan *et al.*, (2013), obtained a maximum composting temperature of 47° C. The increased temperatures during composting were due to the activity of microorganisms in degrading agricultural waste. The increased temperature is influenced by the availability of the amount of oxygen in the compost pile in aerobic composting (Abdel-Aziz, 2014). Composting with an optimal temperature range of 45-65° C will produce mature compost in 4-6 weeks (Sondang *et al.*, 2014). The description of temperature changes during the composting process, it is presented in Figure 1.



Figure 1. The change in temperature during the composting process

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According to Tuomela *et al.*, (2000), when the temperatures exceed 55 to 60° C, microbial activity down drastic. While the optimum temperature for thermophilic mushrooms is 40-50° C, it is also the optimum temperature for lignin degradation in compost. The combination of temperatures above 40° C and pH below 6 is a combination of conditions that greatly inhibit the composting process (Sundberg, 2005). The condition of acid pH affects inhibiting the composting process, due to it inhibits microbial respiration rate and decreases the rate of degradation (Wang *et al.*, 2015; Ameen *et al.*, 2016). During the composting process, the lowest pH was recorded in all enumerated straw treatments reached a value of 5, it occurs on the 3<sup>rd</sup> and 4<sup>th</sup> days. Lowering pH value about 5.0 or less due to the formation of organic acids (Atalia *et al.*, 2015; Roman *et al.*, 2015). The initial stage of composting, pH is acidified by the formation of organic acids. In the thermophilic phase, due to the conversion of ammonium to ammonia, pH rises until finally stabilizes at near neutral values (Roman *et al.*, 2015). The description of changes in pH during the composting process is presented in Figure 2.



Figure 2. The change of pH during the composting process

The acidity (pH) of rice straw compost obtained in this study ranged from 7.5-7.81. If it is compared with the SNI standard, pH value of rice straw compost is seen above the SNI standard, it requires a pH of 6.80-7.49. This result is in accordance with a viewing of Fuchs *et al.*, (2016), that the pH value of compost is usually relatively high around 7.2-8.5. Based on the technical requirements of organic solid fertilizer listed in the Minister of Agriculture Regulation No. 70/Permentan/SR.140/10/2011 concerning Organic Fertilizers, Biofertilizers, and Soil Improvement. It is stated that pH of solid organic fertilizers ranges from 4-9.

The results of the analysis of straw compost an average water content of 11.36 found the characteristics of rice straw compost is presented in Table 3.

Table 3 The effect of decomposers and enumeration of materials on the characteristics of compost produced

Treatment	C /N matio	C- organic	N-total	Р	К
Treatment	C/N ratio	(%)	(%)	(%)	(%)
Decomposer					
Non composer	<b>20,08</b> ª	29,70ª	1,49 <sup>b</sup>	0,192 <sup>b</sup>	4,01 <sup>b</sup>
Local decomposer 1	13,78 <sup>b</sup>	26,16 <sup>b</sup>	1,90ª	<b>0,270</b> ª	<b>4,77</b> ª
Local decomposer 2	14,80 <sup>b</sup>	26,36 <sup>b</sup>	1,80ª	0,252ª	<b>4,87</b> ª
Comparative decomposer	15,31 <sup>b</sup>	24,67 <sup>b</sup>	1,77ª	<b>0,2</b> 48ª	<b>4,68</b> ª
SRD 5%	2,148	3,288	-	0,0478	0,3653
Enumeration					
Without enumerated	15,28ª	26,36 <sup>a</sup>	1,74 <sup>a</sup>	<b>0,224</b> ª	<b>4,64</b> <sup>a</sup>
Enumerated	16,71ª	27,08 <sup>a</sup>	1,74 <sup>a</sup>	0,257ª	<b>4,53</b> ª

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SRD 5%			-		-		-		-	-		
Reference:	The numbers	followed	by the	same	letters	in the	treatment,	in the	e same	column,	are	not

The highest content of C compost was in the control (without additional decomposers) reached 29.70%. The results of statistical analysis showed that the C compost in the control was significantly different (p<0.05) with C compost in the addition of decomposer treatment. Higher C content in the control showed a slower degradation process compared to the treatment with the addition of decomposers. The change in C content reflect degradation of organic matter due to the microbial activity, wherein, C decreases due to oxidation to CO2 (Wu *et al.*, 2010; Tiquia *et al.*, 2002). The carbon is an energy source for microbes and nitrogen is needed for the synthesis of protoplasm (Kalatzi *et al.*, 2016; Kadir *et al.*, 2016). During the early stages of composting, the use of metabolic carbon is much higher than nitrogen, which causes a decrease in the C/N ratio (Wu *et al.*, 2010).

The highest ratio of C/N compost was found in the control treatment with values reaching 20.08. Based on the technical requirements of organic solid fertilizers listed in the Minister of Agriculture Regulation No. 70/Permentan/SR.140/10/2011 concerning Organic Fertilizers, Biofertilizers, and Soil Improvement. It is stated that the ratio of C/N to solid organic fertilizer can range from 15-25. The ratio of C/N compost in the control can reach the required standard, presumably due to the rice straw and water used when composting already contains decomposer microbes. This assumption is in accordance with Lee (2016), viewed that microorganisms naturally occur in all organic matter, water, air, and soil so that the diversity of microorganisms is high. Microorganisms unlike bacteria, fungi, and Actinomycetes act as decomposers. According to Rishell (2013), naturally, microbes found on the surface of the material can degrade compost material. Streminska & Raviv (2016), revealed that it is difficult to generalize the presence of microbes in composting raw materials. Due to it is controlled by a number of factors, *i.e.*, the type of organic matter, water content, and temperature. In the study, Stella & Emmyrafedziawati (2015), found a microbial consortium consisting of 30 types of bacteria have the ability to degrade cellulose, hemicellulose, and lignin found in the soil. The microbial consortium is believed to be able to accelerate and increase the degradation of the rice straw in the composting process. Sirisena & Manamendra (1995), identified two strains of cellulolytic bacteria from rice straw *i.e.*, Listeria sp. & Enterobacter sp. has an important role during the early stages of composting. In addition, about 85-99% of bacteria cannot be cultivated with known culture techniques in the laboratory (Hongoh & Toyoda, 2011; Stewart, 2012; Lok, 2015). Bacteria do not grow in laboratory standard media tend to play an important role in the cycle of carbon, nitrogen, and other elements, and have an impact on the organism and the surrounding environment (Stewart, 2012).

Statistically, the ratio of C/N control was significantly different (p<0.05) if it is compared to the addition of decomposer treatment. This means that the combination of decomposers added can accelerate the process of decomposition of organic matter, thus, providing a lower ratio of C/N than controls. This result is in accordance with the viewed of Nuraini (2009) and Sadik *et al.*, (2010), stated that the decomposers function to stimulate the decomposition process due to they consist of bacteria and enzymes. This is due to the decomposers are microbial isolates have the special ability to digest organic matter, therefore, they decompose quickly (Chheda *et al.*, 2016).

The other studies also found that the addition of decomposers was able to provide better compost maturity. Sadik *et al.*, (2010), stated that the addition of decomposers to composting agricultural wastes (leftover vegetables, fruit, and animal waste) gave a lower ratio of C/N than controls (without decomposers) in the composting time of 35 days. Wherein, the ratio of C/N compost with the addition of a decomposer is 15 and without additional decomposers of 19. However the results of the C / N ratio obtained are not accompanied by statistical analysis, so that, the differences can be found to be significantly different or not. Nuraini (2009), claimed to get different results when composting rice straw using M-Dec decomposers (*Trichoderma sp., Aspergillus sp.,* and *Trametes sp.*) with reversals every 7 days. The compost with the M-Dec decomposer produces C/N 15 and controls (without M-Dec) 21, but the composting time is 2 months. Yaacob *et al.*, (2017), when composting rice straw using fungi of *Trichoderma harzianum*. The treatment with additional decomposers *Trichoderma harzianum* produces compost with a ratio of C/N 17.5 and control of 28.7. However, composting was conducted within 90 days and rice straw was soaked in water for 24 hours before composting.

significantly different from the SRD 5% test

The N content obtained in this study is still in accordance with SNI which gives a minimum limit of N content of 0.40%. This result is also in accordance with a viewing of Herity (2003), stated that the N total range in compost is 1-3%. Statistically, the N content in controlling was significantly different compared to the addition of decomposer treatment (p<0.05). The N content of compost with the addition of decomposer treatment seems to have a higher N content than control. This is happened due to the role of decomposers added, specifically the role of N binding bacteria. The activity of nitrogen-fixing bacteria is common at the end of composting (Bishop & Godfrey, 1983). *Paenibacillus polymyxa* is not only one of the phosphorus solvent bacteria but also has the ability to perform N fixation (Lal & Tabacchioni, 2009).

In general, the P content in all treatments is very in accordance with the SNI which gives a minimum limit of 0.1%. The results of the statistical analysis, the P content in the control was significantly different if it is compared with the addition of decomposer treatment (p<0.05). The P content of compost with the addition of decomposer treatment (p<0.05). The P content of the decomposer added. *Pseudomonas fluorescens* is one of the bacteria that has the ability to dissolve phosphate (Soesanto *et al.*, 2011; Alemu, 2013) and is also ideal as a biofertilizer (Oteino *et al.*, 2015). There are also *Paenibacillus polymyxa* bacteria which in addition have the ability to degrade lignocellulose also have the ability to dissolve phosphate and nitrogen fixation (Weselowski *et al.*, 2016). *Aspergillus niger* is one of the fungi have the ability to provide phosphorus for plants (Salih *et al.*, 1989). There is also a fungus from the genus *Trichoderma sp.* which in addition to being a solvent P is also a biological controlling agent (Kapri & Tewari, 2010). One of them is *Trichoderma harzianum* which has the ability as a potential phosphorus solvent (Tallapragada & Gudimi, 2011).

In composting rice was obtained compost with K content in accordance with SNI requires a minimum limit of 0.20%. Statistically, the K content in the control was significantly different from the addition of decomposer treatment (p<0.05). In addition to the effects of the mineralization process, the presence of microbial K solvents in the decomposer combination added was thought due to the K content in the decomposer addition treatment to be higher than control. Aspergillus is one of the fungi that has the ability as a solvent K (Assad *et al.,* 2010). Increased levels of K are also thought to be caused by the presence of K solvent bacteria, namely bacteria from the genus Pseudomonas sp. (Parmar *et al.,* 2016) and K solvent bacteria from the genus *Paenibacillus sp.* (Liu *et al.,* 2012).

Generally, the addition of a combination of local decomposers 1 and 2 gives a higher ratio of C/N, higher content of C-organic, N, P, and K. It means that the combination of decomposers 1 and 2 can provide better compost quality. However, the combination of local decomposers 1 and 2 gives results that are not significantly different compared to commercial decomposers. The results indicate that the combination of local decomposers 1 and 2 have the same degradation capability.

The treatment of rice straw enumeration in composting for 35 days did not provide different compost maturity. Composting with enumerated compost, with a size of 2-5 cm shows a rapid decomposition process at the beginning of composting. This result is in accordance with a viewing of Cooperband (2000) and Atalia *et al.*, (2015), stated that the smaller raw material size provides more access for microbes to decompose in the early stages of composting. However, the particle size of compost material that is too low also limits the entrance space for oxygen. If it is based on the ratio of C/N, C-organic, N, O, and K obtained, it can be concluded that composting of rice straw does not require enumeration. The results of the same compost quality also mean that the material with a size of 50-55 cm is still an ideal size for composting with natural aeration.

#### 4. Conclusion

The conclusions that can be drawn from this study are.

- The use of local decomposers is able to provide good compost quality, in accordance with SNI 19-7030-2004 standard. Composting of the rice straw with the addition of a local decomposer 1 was able to provide a C/N ratio up to 13.78 and local decomposers 2 up to 14.80. Local decomposition also has the same ability as commercial decomposers in decomposing rice straw.
- 2) The use of local decomposers gives the composting rate and the percentage of the compost mass reduction is higher than the control.

3) Enumeration of rice straw does not provide different compost maturity and quality if it is compared to the treatment without being enumerated.

Based on the results of the study, composting of the rice straw should use a local decomposer. The research is needed to obtain local decomposers in a practical and easy way.

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# **Biography of Authors**

I Nengah Muliarta, S.Si. M.Si was born January 21 <sup>st</sup> , 1979 in Klungkung. He curremtly lives at Perumahan Griya Bentulu Jl. Bedahulu V/A1 Denpasar. His Phone number is Ph. 6281338576547/+6287861499449. He is now a doctorate student at Universitas Udayana, interested in the studies program of agricultural science. <i>Email: nengahmuliarta@gmail.com</i>
I Gusti Ayu Mas Sri Agung is a professor in the Faculty of Agriculture, Universitas Udayana, Indonesia. The office address is in Jalan P.B. Sudirman Denpasar, Bali, Indonesia 80114, Ph./Fax: +62361223797. <i>Email: sri_agung@ymail.com</i>
I Made Adnyana is a professor in the Faculty of Agriculture, Universitas Udayana, Indonesia. The office address is in Jalan P.B. Sudirman Denpasar, Bali, Indonesia 80114, Ph./Fax: +62361223797. <i>Email: adnyanamd@unud.ac.id</i>
I Wayan Diara is a lecturer in the Faculty of Agriculture, Universitas Udayana, Indonesia. The office address is in Jalan P.B. Sudirman Denpasar, Bali, Indonesia, 80114, Ph./Fax: +62361223797. <i>Email: wayandiara@unud.ac.id</i>