APPLICATION OF INTEGRATED BOKASHI PLUS FERTILIZER ON THE GROWTH AND YIELDS OF INTERCROPPED MAIZE AND PEANUT UNDER EARLY GROWTH OF TEAK PLANTATION IN NAPABALANO DISTRICT, MUNA REGENCY, INDONESIA

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ABSTRACT

Agroforestry practices has been recognized by the farmers as the integration of various plant species derived from annual and perennial crops at the same time and place that plays an important ecosystem function in maintaining sufficient agricultural production for human needs and conserving biological diversity in simile forestry ecosystem in Napabalano district, Muna regency. Muna regency is the place where this activity was conducted, located in eastern part of Indonesia that teak trees with high unique quality wood are found. The yields of agroforestry system had been achieved where annual crops were planted integrated with forestry crops, however, the productivity has not yet been fulfilled. The main objective of this paper was to overview and to analyze the response of bokashi plus fertilizer application in sustainable creative agroforestry system on the growth and yields of intercropped maize and peanut under early growth of teak trees in improving agriculture production and maintaining biological diversity set up in Lambiku and Pentiro villages. New technology offered in sustainable creative agroforestry technology was the application of various doses of bokashi plus fertilizer using high adapted crops of maize and peanut, planted between the rows of teak trees. The selected method of activity was phisical through demonstration plot and non-physical approach via FGD, TT, PRA and ECB. The results of research showed that most of the respondents were agreed with the improvement of sustainable creative agroforestry system offered integrated with the use of bokashi plus feetilizer since this activity might increase up to doubled yields of intercropped maize and peanut compared to conventional one and sustain biological diversity. The application of proper doses of organic fertilizer derived from bokashi plus was significantly improve soil quality (p=0.05) and increase maize and peanut production without interfering the early growth of teak trees. The growth of teak trees were also observed and during the young age of teak plantation, agriculture crops could be planted along the rows of teak and other forestry trees. The results also recomended the adoption of sustainable creative agroforestry system significantly contributed to overcome land degradation, to conserve plant diversity and to maintain sustainable crop production.

Keywords: agroforestry, intercropping, maize, peanut, teak tree

I. INTRODUCTION

Agroforestry practices has been recognized by the farmers as the integration of various plant species derived from annual and perennial crops at the same time and place that plays an important ecosystem function in maintaining sufficient agricultural production for human needs and conserving biological diversity in simile forestry ecosystem in Napabalano district, Muna regency. Napabalano district is the place where the oldest teak tree found in Muna Regency is grown with the diameter of about 8.5 m and its surrounding areas, agroforestry systems were practiced with various agricultural crops cultuvated. Karimuna, *et al*., (2018) reported that agroforestry system is a sort of future integration of various plant species derived from annual and perennial crops which play a significant ecosystem function in sustaining biological diversity and improvement of agriculture production for the smallholding farmers of the region. Integration of agricultural crops between the rows of tree crops has been practiced for a long time by the farmers with various patterns. There are such several annual crops as paddy, maize, peanut and various types of food crops that can be cultivated include rice, corn, peanut and cassava among teak, mahogany, sengon, rambutan and mango before reaching the age of 7 years. Rice, corn and peanut crops are food crops that can be cultivated among forestry crops, which are widely consumed by communities.

Muna regency is the place where this activity was conducted, located in eastern part of Indonesia that teak trees with high unique quality wood are found. The yields of agroforestry system had been achieved where annual crops were planted integrated with forestry crops, however, the productivity has not yet been fulfilled. Farmers of the region are still practicing agroforestry system where annual crops were planted integrated with forestry crops. Statistical Central Bureau data of Muna

Regency 2015, harvested area and production of maize and peanut in Muna Regency since 2010 until 2014 decreased from year to year where since 2010 the area of maize and peanut crops reached 19,532 ha and 4.477 ha with production 49.253 ton and 3.106 ton and continues to decline until 2014 to 14.355 ha and 3.702 ha with production of 35.786 ton and 3.163 ton, respectively, while other crops for example soybean, most of cultvated areas were failed to produce seed due to low cultivation techniques, low soil fertility and low soil organic matter.

The fact of low soil fertility resulted in low production of agricultural crops cultivated, either on monoculture or agroforestry cropping patterns such as less optimal soil drainage and poor soil structure, less optimal crop maintenance, pest and disease attacks, and poor seed quality as reported by Suprapto (2003). Other problems were the lack of organic fertilizer applicaton and planting low yield varieties Studies on the efforts organic fertilizer bokashi plus using EM4 on the intercropping maize and peanut (Karimuna *et al*., 2014). Similar study conducted by Haverkort *et al*. (1992) suggested that bokashi fertilizer functions as a nutrient storage which would slowly be released into the soil solution and could be utilized by plants, organic materials in or above the soil surface would also protect and help regulate the temperature and soil moisture. Under controlled agroforestry system might sustain the growth and yields of annual crops planted between the rows of teak trees up to 3 years of age as confirmed by Karimuna, *et al*., 2018. Proper arrangement in space and time of annual crops between the rows of plantation crops might use nutrient, water, light and soil efficiently in agricutural ecosystem to achieve good production

Marginal land found in the study region is compulsory to be improved with the application of organic fertilizer using local organic substances derived from the biomass of secondary vegetation, dominated by *Chromolaena odorata* L integrated with organic waste from chichen dung and micorhyza to form organic fertilizer which can be applied to increase soil fertility. The main objective of this paper was to overview and to analyze the response of bokashi plus fertilizer application in sustainable creative agroforestry system on the growth and yields of intercropped maize and peanut under early growth of teak trees in improving agriculture production and maintaining biological diversity in Lambiku and Pentiro villages.

II. MATERIALS AND METHODOLOGY

New technology offered in sustainable creative agroforestry technology was the application of various doses of bokashi plus fertilizer using high adapted crops of maize and peanut, planted between the rows of teak trees. The selected method of activity was phisical through demonstration plot and non-physical approach via FGD, TT, PRA and ECB through training and workshop. Plants used in this controlled agroforestry technology was the use of selected and high adapted agricultural crops. Maize and peanut were planted in intercropping system, while forest tree planted was teak plantation crop. Annual crops were planted between the rows of early growth of teak trees.

2.1. Place and Time

This activity was carried out in two farmers land of Lambiku dan Pentiro villages, Napabalanao district, Muna regency. Soil samples and bokashi plus fertilizer were taken and analyzed for nutrient contents in the analytical laboratory of the Faculty of Agriculture, University of Halu Oleo, Kendari, Southeast Sulawesi Province, Indonesia. This activity was held from December 2018 to April 2019.

2.2. Materials and Equipment

Intercropping system in agroforestry system was designed in the cultivation of annual crops of maize and peanut between the rows of teak trees. The materials used in this activity were local maize and local peanut ecotype, bokashi plus fertilizer, pouches of plastic and newsprint, while equipment used in this activity were soil processing tool, sieve the soil, analytic scales, meter, water pump, watering tools, ropes, plastic pouches, scissors, digital camera, stationery writing, waring net, electric oven, leaf area meter, measurement of moisture content and tools for laboratory analysis of soil and bokashi plus fertilizer.

Other materials used in the agroforestry experimental field for annual crops were biomass of secondary vegetation dominated by *Chromolaena odorata* L., EM4, water, sugar, rice bran, label, poles and rope. The instruments used in the field test were hoe, knife, balance, sprayer, oven, camera, measurement, and soil thermometer. In addition, hand tractor was used for land preparation in two farmers areas of Lambiku dan Pentiro villages.

2.3. Methods

Physical and non physical methods were applied for data collection. Phisical method was arranged into experimental design with two annual crops cultivated of local maize seed var. Bisi 2 and local peanut variety, cultivated in two villages of Lambiku and Pentiro with the same pattern. Each location was designed using factorial pattern within a Randomized Block Design. The first factor was variety of local agricultural crop (V), consisting of two levels, i.e. local maize seed (V1)and local peanut variety (V2). The second factor was dose of bokashi plus fertilizer (B), consisting of four levels, i.e. without bokashi plus fertilizer (B0), 6 t ha^{-1} bokashi plus fertilizer (B1), 12 t ha^{-1} bokashi plus fertilizer (B2) and 18 t ha^{-1} bokashi plus fertilizer (B3) From the two factors tested above, there were eight combinations. Each combination was repeated three times, so in all there were 24 experimental units. While, non physical method was applied for the perception of the respondents selected using 15-listed questionnaire. 30 selected respondents were asked on the perception of controlled agroforestry system through training and workshop. All data were tabulated using excell program and were analyzed using descriptive analyses. .

2.4. Research Implementation and Data Analyses

Physical method was carried out in the form of demonstration plot in farmer's land of Lambiku and Pentiro villages, Napabalano district. The preparation of the land and the procurement of annual and pirennial crops was implemented. Annual crops cultivated, especially local paddy, maize and peanuts had tested the adaptation of those crops, including the yields stability in the first stage. The provision of bokashi plus fertilizer was made using komba-komba (*Chromolaena odorata* L.),

chichen dung and inoculated with mycorrhiza. Application of biotechnology bokasi plus was done a week before planting depends on the appropriate treatment dose. Before planted, the seeds were soaked into the water to accelerate the process of germination. Planting was done manually using wood stick, and each hole planted two seeds. During maintenance of growth, when there was no rain for six days, then watering is done evenly in accordance with cropping condition. Two weeks after planting, abnormal plants are cut so that there is only one plant per hole and maintained until the time of harvest. Pest and disease that attacks were controlled with insecticides, pesticides or fungicides. Plant maintenance included the activity of making fence, watering, weeding, pest and disease control.

Observation on peanut growth components, such as plant height, number of leaves and leaf areas were collected at the age of 2, 4, 6 and 8 weeks after planting (WAP), whereas the dry weight biomass observations were carried out for plant sample at the age of harvesting time. Growth and yield components of annual and pirennial crops planted in intercropping systems were recorded for the variables of plant height, number of leaves, leaf areas, 100 seeds dry weight, yield per plant and yield of crop per ha. All data were were recorded using excell program and analyzed using analyses of variances (ANOVA). If significant difference, followed by Honestly Significant Difference (HSD) with 95 confidence level.

III. RESULTS AND DISCUSSION

3.1 Results

The results of research showed that most of the respondents were agreed with the improvement of sustainable creative agroforestry system offered integrated with the use of bokashi plus feetilizer since this activity might increase up to doubled yields of intercropped maize and peanut compared to conventional one and might sustain biological diversity. The application of proper doses of organic fertilizer derived from bokashi plus was significantly improve soil quality (p=0.05) and increase maize and peanut production without interfering the early growth of teak trees.

3.1.1 Farmer Perception

When site visit was carried out to investigate the possibility of financial support for the program of extension services, the farmer were asked regarding the application of bokashi plus fertilizer as organic fertilizer as well as the importance of agroforestry practices and the potential improvement. The results of research showed that the selected farmers as respondents were agreed with the application of bokashi plus fertilizer in controlled agroforestry system offered since the output of activities might increase agricultural production of crops planted and sustain biological diversity that simile forestry ecosystem and might help facilitate and realize the achievement of improved the community welfare since agriculture crops between the rows of forestry trees were found grown well. The perception of farmer as respondents on the application of bokashi plus fertilizer in intecropping system under the controlled agroforestry system was accepted as a sustainable creative system. As described before, that Napabalano district is the place where the oldest teak tress are grown and the farmers with the government support try to conserve this place and teak trees are protected from any other activities to destroy its habitat. Therefore, the introduction of improved agroforestry system proposed is suggested by the farmers and local government especially the head of village. The local government was also totally agreed on the application of controlled agroforestry system in order to improve farmer income and community welfare, and to the provision of high yield of annual crops without adverse effects on the growth tree crops. This result was relevant to finding on the respondents perception reported by Karimuna, *et al*., (2018). The farmers believed that this improved methods in intercropping system under controlled agroforestry pattern was the right option to come out from the poverty since this practice has been known by the farmers for a long time on the management of land through the application of agroforestry that might increase human welfare, as explained by Karimuna, *et al*., 2016.

3.1.2 The application of Bokashi Plus Fertilizer on Plant Growth

The shortage of soil fertility might overcome by the application of fertilizer. The use of organic fertilizer derived from bokashi plus was recommended to maintain soil health, inclusing the use of local natural resources as a source of organic matter was beneficial to improve soil quality significantly. Bokashi plus fertilizer applied was made of the composition of *Chromolaena odorata* L, chichen dung and micorhyza. Intercropping maize and penut were planted along the rows of teak and other forestry trees. Growth components of maize and peanut crops observed in this agroforestry research were limited to plant height, leaf number and leaf areas, as shown in Table 1, 2 and Table 3, respectively. The results of recorded variables on intercropped maize and peanut for plant height at 2, 4, 6, and 8 weeks after planting (WAP) between the rows of teak crop in Lambiku and Pentiro villages, Napabalano district was shown in Table 1.

Table 1 showed that for local maize at 2 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 48.37 cm and 49.96 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 2 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 18.72 cm and 18.78 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05). Table 3 also showed that for local maize at 4 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 81.99 cm and 85.74 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 4 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 36.76 cm and 37.64 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05). For local maize at 6 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 198.62 cm and 193.73 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 6 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 48.94 cm and 47.63 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05). Table 1 also showd that for local maize at 8 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 215.82 cm and 217.24

cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 8 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 58.55 cm and 59.93 cm, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05).

Table 1. The application of bokashi plus fertilizer on the averages of plant height (cm) of local maize and local peanut in intercropping system planted at 2, 4, 6, and 8 (WAP) between the rows of early growth of teak trees in Lambiku and Pentiro villages.

Doses of bokashi plus fertiizer	Local Maize		Local Peanut		Local Maize		Local Peanut	
	LBK	PTR	LBK	PTR	LBK	PTR	LBK	PTR
	2 weeks after planting (WAP)				**4 weeks after planting (WAP)**			
0 t ha^{-1}	40.21a	41.76a	15.91a	15.58a	72.68a	75.23a	26.94a	25.65a
6 t ha^{-1}	41.82ab	43.65ab	16.45ab	15.78a	76.75bc	79.83ab	33.23ab	32.06ab
12 t ha^{-1}	45.76ab	47.26ab	17.66ab	16.24a	79.56c	82.46b	34.42ab	36.56b
18 t ha^{-1}	48.37b	49.96b	18.72b	18.78a	81.99c	85.74b	36.76b	37.64b
HSD 0.05	**7.91**	**6.27**	**2.43**	**Ns**	**6.05**	**7.46**	**8.43**	**10.28**
	6 weeks after planting (WAP)				**8 weeks after planting (WAP)**			
0 t ha^{-1}	168.24a	164.21a	35.24a	37.95a	193.73a	195.94a	48.36a	49.33a
6 t ha^{-1}	185.03ab	179.26a	38.02ab	42.34ab	199.52ab	199.36ab	51.28ab	50.82ab
12 t ha^{-1}	193.72bc	188.71ab	42.94bc	45.21bc	213.36bc	211.85bc	55.39ab	56.32ab
18 t ha^{-1}	198.62c	193.73b	48.94c	47.63c	215.82c	217.24c	58.55b	59.93b
HSD 0.05	**15.48**	**16.25**	**9.46**	**7.02**	**16.74**	**14.84**	**9.52**	**8.65**

Notes: 1. LBK = Lambiku village, PTR = Pentiro village
2.The figures in column followed by the difference letters were significant difference using Honestly Significant Difference (HSD) at 95 confidence level.

Table 2 showed that for local maize at 2 WAP, the highest leaf number for Lambiku (LBK) and Pentiro (PTR) was 9.98 leaves and 9.94 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 2 WAP, the highest leaf number for was 17.35 leaves and 16.74 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05). Table 2 also showed that for local maize at 4 WAP, the highest leaf number for Lambiku (LBK) and Pentiro (PTR) was 14.86 leaves and 15.16 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 4 WAP, the highest leaf number for Lambiku (LBK) and Pentiro (PTR) was 38.72 leaves and 37.26 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05). For local maize at 6 WAP, the highest leaf number for Lambiku (LBK) and Pentiro (PTR) was 18.98 leaves and 18.64 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 6 WAP, the highest laef number for Lambiku (LBK) and Pentiro (PTR) was 41.73 leaves and 44.05 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05).

Table 2. The application of bokashi plus fertilizer on the averages of leaf number (blades) of local maize and local peanut in intercropping system planted at 2, 4, 6, and 8 (WAP) between the rows of early growth of teak trees in Lambiku and Pentiro villages.

Doses of bokashi plus fertiizer	Local Maize		Local Peanut		Local Maize		Local Peanut	
	LBK	PTR	LBK	PTR	LBK	PTR	LBK	PTR
	2 weeks after planting (WAP)				**4 weeks after planting (WAP)**			
0 t ha^{-1}	9.12a	9.15a	11.24a	11.21a	12.43a	12.16a	32.48a	31.26a
6 t ha^{-1}	9.44ab	9.47ab	11.73a	12.67ab	13.49ab	13.42ab	34.65ab	34.82ab
12 t ha^{-1}	9.75ab	9.65ab	14.64ab	15.25bc	14.51bc	14.74bc	36.62bc	35.54ab
18 t ha^{-1}	9.98b	9.94b	17.364b	16.74c	14.86c	15.16c	38.72c	37.26b
HSD 0.05	**0.73**	**0.65**	**4.35**	**2.73**	**1.32**	**1.45**	**2.98**	**4.96**
	6 weeks after planting (WAP)				**8 weeks after planting (WAP)**			
0 t ha^{-1}	17.42a	16.43a	36.83a	34.82a	18.21a	17.67a	51.82a	50.54a
6 t ha^{-1}	17.90ab	16.85ab	37.33ab	40.26ab	19.36ab	18.42ab	53.36ab	54.62ab
12 t ha^{-1}	18.22ab	17.75bcb	39.67ab	43.41b	19.58bc	19.64bc	56.81bc	57.64bc
18 t ha^{-1}	18.98b	18.64d	41.73b	44.05b	20.12c	19.85c	58.43c	59.05c
HSD 0.05	**1.12**	**1.26**	**2.80**	**8.48**	**1.62**	**1.41**	**4.65**	**7.27**

Notes: 1. LBK = Lambiku village, PTR = Pentiro village
2.The figures in column followed by the difference letters were significant difference using Honestly Significant Difference (HSD) at 95 confidence level.

Table 2 also showd that for local maize at 8 WAP, the highest leaf number for Lambiku (LBK) and Pentiro (PTR) was 20.12 leaves and 19.85 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 8 WAP, the highest leaf number for Lambiku (LBK) and Pentiro (PTR) was 58.63 leaves and 59.05 leaves, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05).

Table 3 showed that for local maize at 2 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 49.42 cm^2 48.56 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 2 WAP, the highest plant height for Lambiku (LBK) and Pentiro (PTR) was 31.56 cm^2 and 32.49 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant difference (p=0.05). Table 3 also showed that for local maize at 4 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 194.46 cm^2 and 198.05 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 4 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 65.52 cm^2 and 64.79 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations were not significant difference (p=0.05). For local maize at 6 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 354.67 cm^2 and 347.21 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 6 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 95.82 cm^2 and 102.06 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05). Table 3 also showed that for local maize at 8 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 565.82 cm^2 and 543.12 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively. For local peanut at 8 WAP, the highest leaf areas for Lambiku (LBK) and Pentiro (PTR) was 199.65 cm^2 and 197.84 cm^2, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05).

Table 3. The application of bokashi plus fertilizer on the averages of leaf areas (cm^2) of local maize and local peanut in intercropping system planted at 2, 4, 6, and 8 (WAP) between the rows of early growth of teak trees in Lambiku and Pentiro villages.

Doses of bokashi plus fertiizer	Local Maize		Local Peanut		Local Maize		Local Peanut	
	LBK	PTR	LBK	PTR	LBK	PTR	LBK	PTR
	2 weeks after planting (WAP)				**4 weeks after planting (WAP)**			
0 t ha^{-1}	30.52a	31.17a	27.61a	27.75a	141.75a	145.24a	59.33a	58.83a
6 t ha^{-1}	37.83ab	38.74ab	28.15ab	29.53ab	168.20bc	177.46ab	60.63ab	59.57ab
12 t ha^{-1}	46.25bc	47.70bc	30.23ab	30.74ab	188.34c	197.65b	62.48ab	61.84bc
18 t ha^{-1}	49.42c	48.56c	31.56b	32.49b	194.46c	199.05b	65.52b	64.79c
HSD 0.05	**11.42**	**10.77**	**2.88**	**3.36**	**20.83**	**28.24**	**5.07**	**4.25**
	6 weeks after planting (WAP)				**8 weeks after planting (WAP)**			
0 t ha^{-1}	247.25a	254.76a	82.88a	87.24a	399.54a	387.65a	138.25a	136.14a
6 t ha^{-1}	272.66ab	286.52ab	85.46ab	91.87ab	428.05ab	426.61ab	152.43ab	148.32ab
12 t ha^{-1}	334.86c	316.24bc	89.87ab	93.62ab	529.72c	502.45c	176.76c	167.76bc
18 t ha^{-1}	354.67c	347.21c	95.82b	102.02b	565.82c	543.12c	199.65c	197.84c
HSD 0.05	**36.46**	**45.26**	**9.39**	**11.76**	**43.81**	**53.42**	**28.82**	**32.05**

Notes: 1. LBK = Lambiku village, PTR = Pentiro village

2.The figures in column followed by the difference letters were significant difference using Honestly Significant Difference (HSD) at 95 confidence level.

3.1.3 The Application of bokashi plus fertilizer on Plant yields

Maize and peanut yield components observed in this intercropping system were flowering time, 100 seed dry weight, yield per plant and yield (t ha^{-1}) as shown in Table 4.

Table 4 showed that for local maize, the fastest averages of flowering time for Lambiku (LBK) and Pentiro (PTR) was 54.73 days and 54.87 days, obtained at without bokashi plus fertilizer giving significant different compared to 18 t ha^{-1} bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05). For local peanut, the fastest averages of flowering time for Lambiku (LBK) and Pentiro (PTR) was 27.86 days and 27.98 days, obtained at 18 t ha^{-1} bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05). Table 4 also showed that for local maize, the highest averages of 100 seed dry weight for Lambiku (LBK) and Pentiro (PTR) was 27.45 g and 27.48 g, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant. For local peanut, the highest averages of 100 seed dry weight for Lambiku (LBK) and Pentiro (PTR) was 18.78 g and 17.98 g, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05). Finally, Table 6 also showed that for local maize, the highest averages of yields per plant (g $plant^{-1}$) for Lambiku (LBK) and Pentiro (PTR) was 76.67 g $plant^{-1}$and 74.25 g $plant^{-1}$, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05). for local peanut, the highest averages of yields per plant (g $plant^{-1}$) for Lambiku (LBK) and Pentiro (PTR) was 51.43 g $plant^{-1}$ and 50.02 g $plant^{-1}$, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer,

respectively, while among locations and other treatments were not significant (p=0.05). For local maize, the highest averages of crop yields (t ha^{-1}) for Lambiku (LBK) and Pentiro (PTR) was 9.43 t ha^{-1} and 9.36 t ha^{-1}, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05). For local peanut, the highest averages of crop yields (t ha^{-1}) for Lambiku (LBK) and Pentiro (PTR) was 2.38 t ha^{-1} and 2.39 t ha^{-1}, obtained at 18 t ha^{-1} of bokashi plus fertilizer giving significant different compared to without bokashi plus fertilizer, respectively, while among locations and other treatments were not significant (p=0.05).

Table 4. The application of bokashi plus fertilizer on the averages of flowering time (days), 100 seed dry weight (g), yield per plant (g plant^{-1}) and yield of crop (t ha^{-1}) of local maize and local peanut in intercropping system planted between the rows of early growth of teak trees in Lambiku and Pentiro villages.

Doses of bokashi plus fertiizer	Local Maize		Local Peanut		Local Maize		Local Peanut	
	LBK	PTR	LBK	PTR	LBK	PTR	LBK	PTR
	Flowering time (days)				**100 seed dry weight (g)**			
0 t ha^{-1}	65.24b	66.76c	31.31a	32.34a	22.24a	21.56a	14.31a	14.76a
6 t ha^{-1}	59.32ab	60.24bc	29.54a	30.65a	23.75a	23.51b	15.05a	15.53a
12 t ha^{-1}	57.55a	58.61ab	28.05a	29.78a	25.53bc	25.02c	16.95ab	16.86ab
18 t ha^{-1}	54.73a	54.87a	27.86a	27.98a	27.45c	27.44d	18.78b	17.98b
HSD 0.05	**8.82**	**9.26**	**3.43**	**3.61**	**3.46**	**3.85**	**2.76**	**2.36**
	Yield per plant (g plant^{-1})				**Yield of crop (t ha^{-1})**			
0 t ha^{-1}	56.25a	54.76a	39.86a	43.24a	5.32a	5.16a	1.42a	1.43a
6 t ha^{-1}	61.63a	61.42bc	42.47a	45.64a	6.38ab	6.27ab	2.13abc	2.23abc
12 t ha^{-1}	68.54bc	68.43cd	49.26a	48.96a	8.26bc	8.19bc	2.32bc	2.35bc
18 t ha^{-1}	76.67c	74.25d	51.43b	50.02b	9.43c	9.36c	2.38c	2.39c
HSD 0.05	**16.45**	**15.26**	**9.26**	**6.72**	**2.54**	**2.38**	**0.28**	**0.34**

Notes: 1. LBK = Lambiku village, PTR = Pentiro village
2.The figures in column followed by the difference letters were significant difference using Honestly Significant Difference (HSD) at 95 confidence level.

The result of growth dynamic of teak trees on teak tree height and leaf number were revealed to indicate a rapid development during the young age of teak plantation. Eventhough agriculture crops could be planted between the rows of teak and other forestry trees, the competition of plant growth could not be prevented. However, intercropping maize and peanut planted between the rows of teak trees could grow well due to sufficient nutrient content from the application of bokashi plus fertilizer and solar radiation are efficiently used by intercropped maize and peanut so that the growth and yeilds of agricultural crops might optimally produce.

3.2. Discussion

.The results of study on the perception of respondents confirmed the importance of using organic fertilizer derived from bokashi plus to increase soil fertility of the study region on the growth and yield of maize and peanut intercropping as reported by Karimuna, *et al*. (2018). Sarman (2001) explained that the cultivation of corn with peanut in intercropping system could increase the land use efficiency as one of cultivating systems where there are two or more different plants which are planted in the same or different time with regular spacing on an area. Similar finding had also been reported by Garrity (2004), the importance of agroforestry system has been studied and it was proved that agroforestry trees provide important ecosystem services including: soil, spring, stream and watershed protection; animal and plant biodiversity conservation; and carbon sequestration and storage, all of which ultimately affect food and nutritional security.

A proper space arrangement of maize and peanut intercropping under early growth of teak trees in sustainable creative agroforestry system might increase the efficiency use of available natural resources like nutrient content through the application of organic fertilizer, water use, light transmition and growth space. This phenomenon lead to the increasing trend of growth and yield components of maize and peanut intercropping by the increase doses of bokashi plus fertilizer applied and through the management and cultivation of good ways, dry land have the potential of very marginal potential for regional development of peanuts and other crops (Fachruddin, 2000; Sopandie, 2006; Karimuna *et al.*, 2001). Table 1, 2, 3 and Table 4 showed clear results that the higher the doses of bokashi plus fertilizer applied, the higher the growth components for plant height, leaf number and leaf area at 2, 4, 6 and 8 WAP and the yields components for flowering time, 100 seed dry weight, yield per plant and yield of crop per ha. It was also revealed that there was no significant different among location (p=0.05), indicating high adaptability of maize and peanut crops planted between the rows of early growth of teak trees. Buhaira (2007) said that peanut cultivation between two rows of corn on 100 cm space yielded 2,93 ton/ ha dry pod. The intercropping of peanut and corn could increase the efficiency of fertilizer and land use under appropriate planting space and time. Sarman and Ardiyaningsih (2000) cit. Buhaira (2007) said that double row of corn with 140 cm plant spacing between double rows x 40 cm significantly affected yield of corn, leaf area of soybean and dry weight of corn plant.

Based on the resuts of research as shown in Table 1, 2, 3 and Table 4 confirmed the suitability of maize and peanut had as a good potential to be cultivated between the rows of early growth of teak trees in the form of agroforestry pattern. It was cleared that the growth of annual crops was sufficient and not influenced by the presence of teak trees in its surroundings since the soil media provide enough quantity of nutrient, water and other elements as explained by Karimuna, *et al.*, 2017, and others. This finding was relevant to findings reported by Pasaribu, *et al.*, (2014), Andila, *et al.*, (2016), Rahayu, *et al.*, (2006) and Ekowati and Nasir, 2011). Karimuna, *et al*. (2009) suggested that bokashi fertilizer can improve the physical, chemical and biological properties of the soil, improve yields and maintain the stability of crop production, and be able to produce quality and quantity of agricultural products in a sustainable manner.

Interestingly was that the application of bokashi plus fertilizer for the sake of increased efficiency and effectiveness of the utilization of marginal lands was to answer the shortage of soil limting factors that was the main problem of low production of local maize and local peanut under agroforestry practices. Karimuna, *et al*., 2017 reported that some local peanut ecotype of maize and peanut that have been released to the community did not yet have the level of adaptation to local conditions and is susceptible to various types of plant disease. This is caused by the dry climatic conditions with marginal lands which include a shortage of nutrient elements, sensitive to erosion and very little organic material content (Karimuna *et al.*, 2009; Kasno *et al*., 2006; Karimuna, 2000).

The results of research showed that the growth and the yield of intercropping maize and peanut under sustainable creative agroforestry system were better significantly affected by the application of bokashi plus fertilizer in marginal soils. This was occurred due to the shortage of nutrient content, low CEC content, low organic matter content could be overcome by the nutrient availability of bokashi plus fertlizer application. It could be concluded that a sustainable creative agroforestry system on maize and peanut intercropping between the rows of early growth of teak trees through the application of bokashi plus fertilizer might guarantee and sustain the growth and yield performances. The acceptance of the farmers on their perception to go into agroforestry practices strengthens the potential adoption of this system to improve community welfare and to achieve the stability of global environmental fluctuation of Indonesian region. This finding was also concided with the government policy in the growing interest to intensively use organic fertilizer in increasing agriculture production. The use of bokashi plus as sort of organic fertilizer derived from local natural resources has been encouraged by the government to improve agriculture productivity as a whole.

In the midtermn planning of Muna regency 2015-2020, one of the main program in agriculture sector was the development of sustainable agriculture productivity through the use of organic farming. The stable increase of intercropping maize and peanut planted between the rows of early growth of teak plantation through the application of integrated bokashi plus fertilizer was the positive effects of organic fertilizer practices to improve community welfare. Therefore, the government policy was necessary to support mutual collaboration among parties such as local government, private, mass media and scientist. Since this activity was highly supported by the government up the lowest level of village, this finding of the positive effects of bokashi plus fertilizer on increasing yields of intercropping maize and peanut has been widely used to other such agricuktural crops as tomatoes, chili, mungbean, lowland rice, upland rice and cassava.

Lastly, I would like to express my sincere thanks to the Government of Indonesia, via Ministry of Research, Technology and Higher Education for the financial support to carry out this research in 2019, I do like to frankly speaking that this activity was highly needed by local community of the study region and benefited to the improvement of community welfare. The results also recomended the adoption of sustainable creative agroforestry system significantly contributed to overcome land degradation, to conserve plant diversity and to maintain sustainable crop production.

4. CONCLUSION AND RECOMMENDATION

Based on the results and discussion of research, it could be summarized that as follows

1. The higher the doses of bokashi plus fertilizer applied, the higher the growth and the yield of intercropping maize and peanut produced and the interaction among local varieties of annual crops planted between the rows of early tree crops in sustainable creative agroforestry system.
2. The application of bokashi plus fertilizer gave a significant different and better effects on the plant height, number of leaves, leaf areas, flowering time, 100 seed dry weight, yield per plant and yield per ha of intercropping local maize and peanut.
3. The best yields of local maize and peanut applied by various doses of bokashi plus fertilizer might achieve to 9.43 and 2.39 t ha^{-1}, respectively with the best treatment of bokashi plus fertilizer amounted to 18 t ha^{-1}.
4. The increasing production trend of intercropping maize and peanut under early growth of teak trees through the increasing doses of bokashi plus fertilizer, it was recommended for further study on the space and time arrangement to obtain the optimum and best growth and yields integration of annual and pirennual crops.

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