THE EFFECTS OF SUSTAINABLE CREATIVE AGROFORESTRY SYSTEM ON THE GROWTH AND YIELDS OF AGRICULTURE CROPS IN NAPABALANO DISTRICT, MUNA REGENCY, INDONESIA

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ABSTRACT

Sustainable creative agroforestry system has been introduced to the farmers of the study region through the integration of food crops with forestry crops, with the objective of achieving ecological, economic, social, cultural and environmental functions. The main purposes of this paper were to evaluate the conditions of sustainable creative agroforestry application on the growth and yields of agricultural crops recently and to analyze the prospects of its development on the quality of human resources in Lambiku and Pentiro Villages, Napabalano District. This research was carried out in Napabalano District where the oldest teak trees was planted since Dutch colonial time in Muna Regency. The interviewing method was applied to 40 respondents who had practiced improved agroforestry system using a listed questionnaire. The demonstration plot of improved agroforestry system was set up to compile data on the growth and yields of agriculture food crops planted between the rows of teak trees treated by bokashi plus fertilizer. The results of research showed that the application of sustainable creative agroforestry system had proved to improve the growth and yields of agriculture crops cultivated by the farmers. There were three types identified of agroforestry systems implemented in Lambiku and Pentiro Villages, Napabalano District, namely (1) integration of food crops and teak with relatively dense teak spacing, (2) mixed cropping of food crops, horticulture between cashew, banana and teak, without space arrangement and (3) integration of food crops, horticulture between forestry crops. The introduction of sustainable creative agroforestry system through the application of bokashi plus fertilizer under proper crops arangement of food crops between the wider rows of young teak trees up to 6-7 years were preferred and selected by 100% respondents. In the demonstration plot, it proved the increasing growth and yields of agriculture crops such as maize, peanut, cassava, and rice under sustainable creative agroforestry system compared with conventional one. The results of research also showed the high prospects of community development to improve agriculture food yields treated by bokashi plus fertilizer technology in the cultivation of rice, maize, cassava, peanut, mungbean and horticultural crops both single, intercropped and mixed between early growth of teak trees, as well as the development of food processing technologies for cashew nuts, cocoa. coconut and other agricultural commodities in order to achieve added values.

Keywords: agroforestry, bokashi plus, harvest, food processing, sustainable

INTRODUCTION

It was recognized that agroforestry system had been known and practiced by the farmers in tropical region including in the study region of Muna regency, Southeast Sulawesi Province, Indonesia. In the conventional one, traditional agroforestry systems practices of using no chemical inputs and maintain a diverse canopy with native trees. Many studies have shown that traditional agroforestry practices will be more sustainable than sun-grown agriculture, yet they tend to produce lower yields and can require long fallow periods (Tscharntke, et al., (2005); Reyes, et al., (2006). This, of course, will be suitable to a lower population density and huge areas of agricultural practices in which those conditions are rare to be found. Therefore, an effort to increase agriculture production to meet human needs and to conserve environmental degradation is compulsory.

The improvement of agroforestry practices was taken into account not only to solve the problems on achievement of sufficient food crops needed, but also to maintain environmental stability. Many research findings on agroforestry studies reported by Garity, (2004); Karimuna, *et al*., (2016), Karimuna, *et al*., (2018), Karimuna, *et al*., (2019) and Karimuna, *et al*., (2020) revealed that the farmers obtained significant benefits on economic, social, cultural and environmental functions through proper management of agroforestry system in Kotawo, Lambale and La Uki villages, West Kulisusu district, North Buton regency and relevant findings recorded in Lambiku dan Pentiro villages, Napabalano distrit, Muna regency. However, most of the farmers practiced agrofrestry system were established under sub optimal soil conditions which lead to low agricultural productivity and low revenues gained. In oder to overcome the shortages of nutrients deficiency, many approaches had been introduced like the use of chemical fertilizer, new variety of agricultural crops, conventional pest and diseases control, and common crop maintenance and local poor seed quality as reported by Suwarjono (2004).

There are various types of agroforestry practices found in the farmers land but agroforestry system has a lot in common with intercropping (the practice of planting two or more crops on the same plot) with both practices placing an emphasis on interaction between different plant species (Garity, 2004). Similar findings described by Karimuna, *et al*., (2018), 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. Moreover, Bishop and Landell-Mills (2002); Perfecto, et al., (2003); and Turner, et al., (2007) explained that agroforestry is the practice of growing trees with agricultural crops that has been identified as an important strategy for conservation and development because it can generate additional sources of income, diversify food crops, and protect soils. The potential environmental services and livelihood benefits of agroforests in the tropics have attracted the attention of the conservation community and their donors as a possible method to enhance biodiversity and ecosystem services, especially the sequestering of carbon, while benefiting local livelihoods (Schroth, et al., 2004; Steffan-Dewenter, et al., 2007). One of the promising inovative approach to meet the people needs of agriculture crops production and to protect adverse effect of enviromental degradation suitable to local condition is sustainable creative agroforestry system.

Sustainable creative agroforestry system has been introduced to the farmers of the study region through the integration of food crops and forestry crops with proper space arrangement, the application of bokashi plus fertilizer to increase agriculture yields and the development of food processing technologies, with the main objective of achieving ecological, economic, social, cultural and environmental functions (Karimuna, *et al*., 2019), but how the effects of sustainable creative agroforestry system on the possible changes of farmers profiles and the growth and yields of agricultural commodities has been unknown and need to be studied. The main purposes of this paper were to evaluate the conditions of sustainable creative agroforestry application on the growth and yields of agricultural crops recently and to analyze the prospects of its development on the quality of human resources in Lambiku and Pentiro Villages, Napabalano District.

MATERIALS AND METHODOLOGY

Place and Time

This research was carried out in Lambiku and Pentiro villages, Napabalano District where agroforestry system had been practiced and the place where oldest teak trees was planted since Dutch colonial time in Muna Regency.Southeast Sulawesi Province, Indonesia. This research was held from January 2020 to May 2020 during rainy season. Four pieces of agricultural land were used as the place for demonstration plots of planting maize and peanut or soybean in intercropping system applied by bokashi plus fertilizer under financial support of the Government of Indonesia, Ministry of Education and Culture, Research and Technology, Republic of Indonesia for the third years 2021.

Materials and Equipment

Materials used in this research were two types of maize such as local maize and Bisi-2, local peanut ecotype, soybean var. Dering, upland rice, bokashi plus fertilizer derived from biomass of *Chromolaena odorata* L., chicken manure, EM4, water, sugar, rice bran, label, poles, rope, plastic pouches and newsprint, while equipment used in this research were hand tractor, chopper machine, hoe, knife, electic balance, sprayer, oven, soil sieve, analytic scales, meter, tower, watering tools, ropes, scissors, digital camera, stationery writing, waring net, electric oven, measurement tools for laboratory analysis of soil.

Methods

There were two methods in this research applied for data collection, such as qualititative and quantitative methods. Qualitative method was initially used to compile data on the respondents characteristics of age, income, land owned and number of teak trees planted, including their perception of agroforestry system implemented in the study region. The interviewing method was applied to 40 selected respondents who had practiced improved agroforestry system using a 15-listed questionnaire in each village. The respondents were also asked about the knowledge of sustainable creative agroforestry system introduced to the farmers and its effect on the growth and yields of agricultural crops as well as the impacts to the economical development of the region. The types of exsisting agroforestry system were also recorded. All qualitative data collected were analyzed using descriptive analysis. Then, quantitative method was applied to collect data of the effects of improved agroforestry system on the agricultral crops growth and yields, using field test in the demonstration plots. The demonstration plot of sustainable creative agroforestry system was set up to compile data on the growth and yields of agriculture food crops planted between the rows of teak trees treated by bokashi plus fertilizer.

Agricultural crops selected to be planted were maize, peanut, upland rice and cassava either cultivated in intercroppng or monoculture planted between the rows of 1-2 years of teak trees. There were two demonstration plots were set up in each village and thus, there were four sites in all with different agricultural crops, two sites in Lambiku village and two sites in Pentiro village. In each demonstration plot, the research was initiated by the preparation of land for planting where huge amount of herbs and shrubs grew. All pieces of logs were moved to the edge of land. All herbs and shrubs in the selected plots were cleared-cut, while young growing teak trees of one or two years of age in the demonstration plots of four sites were maintained. Surprisingly was that biomass of *Chromolaena odorata* L. as a source of organic materials used in this research were cut, collected and mixed with chichen manure, EM4 and inoculated with mycorrhiza to make bokashi plus fertilizer. Four demonstration plots of sustainable creative agroforestry system with the area of 40 m x 50 m was ploughed twice using hand tractor. The cultivation of maize and peanut in intercropping system between the rows of teak trees was carried out according to the experiment designed. The demonstration plot was set up in the same plot used in 2019, therefore the age of teak trees was one and two years with 6 m x 6 m space arrangement. The growth of two years teak trees had many branches and leaves. This might influence light penetration to the soil surface where agricultural crops were planted. Therefore, some of the teak trees branches and leaves were prunned and compilled to the edge of land.

In order to protect a demonstration plot from hog pests, a strong fence was constructed. After bokashi plus fertilizer being made, the application of bokashi plus into the soil was carried out a week before planting depends on the appropriate dose treated. The agricultural crop seeds were soaked into the water to accelerate the seed germination process. Planting seeds were manually done using wood stick with about 5 cm depth, and two seeds were planted into each hole. While for cassava, the ends of cuttings were inserted into the soil with 1 m x 1 m space arrangement, laid down between the rows of maize and 50 cm apart from the rows of teak trees. For the maintenance of each plot, watering was applied evenly in accordance with cropping condition, when there was no rain for five to six days in order to prevent withered temporarily. Two weeks after planting, abnormal plants were cut so that there was only one plant per hole and maintained until the time of harvest. For peanut itself, peanut root stocking was done to make gynophores easy getting into the soil. Pest and disease attacked were intensively controlled with insecticides, pesticides or fungicides as well as weed control treatment.

At four demonstration plots in Lambiku and Pentiro villages, each research work was arranged in randomized block design (RBD) with one factor of the application of bokashi plus fertilizer with four level of treatments namely without bokashi plus fertilizer (P0), bokashi fertilizer plus 3 t ha^{-1} (P1), bokashi fertilizer plus 6 t ha^{-1} (P2) and bokashi fertilizer plus 9 t ha^{-1} (P3). Each treatment was repeated four times so that there were 16 experimental units. The growth of plant height and number leaves at six weeks after planting (WAP) for upland rice. local maize, peanut, and cassava were recorded and yield components of agricultural crops for 100 seed dry weight and yield per ha were also collected. All variables were analyzed using analyses of variances (ANOVA), and if significant, then followed by Honestly Significant Difference (HSD) test with 95 percent confidence level.

RESULTS AND DISCUSSION

The Characteristics of Respondents

Eighty selected respondents from Lambiku and Pentiro villages who practiced agroforestry system were surveyed to collect data on the age, income, land area owned and the number of teak trees planted as the characteristics of the farmers of the study region. The characteristics of the respondents was figured out in Table 1.

Table 1. The characteristics of respondents based on their age, income, land owned and the quantity of teak trees that were planted in Lambiku and Pentiro villages

Variables	Lambiku (n=40)			Pentiro (n=40)		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Age (years)	32	46	56	29	47	68
Income (Rp/week)	150.000	860.000	1.400.000	160.000	850.000	1.800.000
Land Area (ha)	1.0	2.0	4.5	1.2	1.8	4.0
Trees quantity (poles)	200	600	1.200	250	560	1.300

Source : Primary Data, 2021

Table 1 showed that in terms of age for both villages, the age range varied from a minimum of 29 to a maximum of 68 with mean value of 46.5, indicating the active human resources in the practice of agroforestry in the study area. This agrees with according to FAO (1999) which affirm that this group of people are the economically active population. Income per week was also categorized from Rp. 150.000,- to Rp. 1.800.000,- with mean value of Rp. 855.000,- and the land owned varied from 1 ha to 4.5 ha with mean value of 1.9 ha. In terms of the number of teak trees planted in both villages varied from 200 poles to 1.300 poles with mean value of 580 poles.

The respondents were also interviewed on their knowledge regarding the objectives of the development of teak trees based sustainable creative agroforestry system as hown in Table 2.

Table 2. Respondents knowledge related to the objectives of the development of teak trees base sustainable creative agroforestry system in Lambiku and Pentiro villages.

Variables	Strongly agree (%)	Agree (%)	Doubt (%)	Disagree (%)	Totally disagree (%)
	Lambiku Village (n=40)				
Provides future savings	65.0	30.0	5.0	2.5	0
Uses for further study	40,0	45,0	10,0	5,0	0
Makes wood price more expensive	20.0	70.0	7.5	2.5	0
Has long harvest time	27.5	47.5	17.5	7.5	0
Protects flora and fauna	22.5	52.5	12.5	10.0	2.5
Sustains environmental protection	35.0	60.0	2.5	2.5	0
Prevents global warming	30.0	45.0	20.0	2.5	2.5
	Pentiro Village (n=40)				
Provides future savings	67.5	25.0	2.5	5.0	0
Uses for further study	35,0	50,0	12,5	2,5	0
Makes wood price more expensive	25.0	60.0	5.0	5.0	0
Has long harvest time	22.5	45.0	20.0	10.0	2.5
Protects flora and fauna	27.5	55.0	7.5	7.5	2.5
Sustains environmental protection	42.5	52.5	0	5.0	0
Prevents global warming	32.5	47.5	17.5	5.0	0

Source : Primary Data, 2021

Table 2 showed that in Lambiku village, 95% and 85% of the respondents were agreed and strongly agreed to the objectives of the development of agroforestry system for providing future savings and using for their children to study since teak wood price getting more expensive was confirmed by 90% of the respondents agree and strongly agree, eventhough planting teak trees based agroforestry system needed long time at least 10 years to be harvested, confirmed by 75% respondents agree and strongly agree, whilst the rest were doubt and disagree, responded by 25% respondents. The respondents were asked concerning about the objective of agroforestry practices to sustain environmental protection responded by 95% agreed and strongly agreed. Prevention of global warming and protection of flora and fauna were similarly responded by 75% of the respondents agree and strongly agree (Table 2). Moreover, in Pentiro village, 92.5% and 85% of the respondents were agreed and strongly agreed to the objectives of the development of agroforestry system for providing future savings and using for their childreen to study since all knew that teak wood price was getting more expensive, confirmed by 85% of the respondents agree and strongly agree, eventhough planting teak trees based agroforestry system needed long time to harvest, confirmed by 67.5% respondents agree and strongly agree, whilst the rest were doubt and disagree, responded by 32.5% respondents. Sustaining environmental protection was the highest precentage (95%) of the respondents answered agreed and strongly agreed. 82.5% and 80% of the respondents were agreed and stongly agreed with the objectives of protection of flora and fauna and pevention of global warming, respectively as shown in Table 2.

The respondents were asked related their opinion of knowledge and perception regarding the importance of sustainable creative agroforestry system offered. The results showed that in Lambiku village, eight items of the importance of sustainable creative agroforestry system proved to have high contribution ranged from 92.5% to 100% to the improvement soil fertility by using secondary vegetation as a source of biomass and fertilizer (97.5%), provision better yields of annual crops (100%), prevention direct precipitation into the soil (95%), reduction soil compaction and erosion (97.5%), maintenance biological diversity simile forestry ecosystem (92.5%), increasing knowledge and understanding (95%) and help facilitate and realize the achievement of improved the community welfare (97.5%) since agriculture crops between the rows of forestry trees were found grown well, as figured out in Table 3. Similar trends was also shown in Pentiro village where from eight components asked to the respondents, they answered high persentage ranged from 90% - 100%. The results of survey also showed that the adoption of sustainable creative agroforestry system contributed to guarantee better soil fertility, to increase agriculture yields, to prevent direct precipitation to the soil and to overcome land degradation, to conserve plant diversity, to improve income and community welfare. This was reasonable due to the increasing basic knowledge and skills of the farmers in the aspects of innovation and new technologies applied in various agroforestry patterns. One of the promising inovation on the adoption of sustainable creative agroforestry system was the integration of organic fertilizer application that can be used as an effort to improve the community welfare through additional alternative income from increased crop productivity. This was relevant to the finding reported by Karimuna, *et al*., 2016, improved methods of agroforestry pattern had been practiced by the farmers for along time so that they had familiar to the management of land through the application of agroforestry that might increase human welfare.

Table 3. Opinions on the knowledge and perception of the respondents (percentage) regarding the importance of sustainable creative agroforestry system in Lambiku and Pentiro villages Napabalano district, Muna Regency.

No.	The importance of sustainable creative agroforestry system	Lambiku village	Pentiro village
1.	Uses secondary vegetation as a source of biomass and fertilizer	97.5%	100%
2.	Increases soil fertility	97.5%	97.5%
3.	Provides better yield of annual crops	100%	97.5%
4.	Prevents direct precipitaion into the soil	95%	95%
5.	Reduces soil compaction and erosion	97,5%	95%
6.	Maintains biological diversity simile forestry ecosystem	92.5%	90%

7.	Increases knowledge and understanding	95%	100%
8.	Improves income and community welfare	97.5%	95%

Source : Primary Data, 2021

The respondents from two villages were also asked about the types of existing agroforestry system practiced in which all agroforestry system practiced by the respondents were classified into three types, such as (1) integration of food crops and teak with relatively dense teak spacing, (2) mixed cropping of food crops, horticulture between cashew, banana and teak, without space arrangement and (3) integration of food crops, horticulture between forestry crops. The existing agroforesry types praciced by the respondents in the study region was shown in Table 4.

Table 4. The distribution of agroforestry types practiced by the respondents in the study region

No.	Agroforestry types	Lambiku village (%)	Pentiro village (%)
1.	Integration of food crops and teak with relatively dense teak spacing	45,0	47,5
2.	Mixed cropping of food crops, horticulture between cashew, banana and teak, without space arrangement	35,0	30,0
3.	Integration of food crops, horticulture between forestry crops	20,0	22,5

Source : Primary Data, 2021

Table 4 showed that in Lambiku and Pentiro villages, 45% and 47,5% of respondents had practiced agroforestry type one the integration of food crops and teak with relatively dense teak spacing, respectively. Type two mixed cropping of food crops, horticulture between cashew, banana and teak, without space arrangement was responded by 35% and 30% of respondents in Lambiku and Pentiro villages, respectively, while the rest for type three was answered by 20% and 22,5% respondents on the integration of food crops, horticulture between forestry crops. Interestingly was that in most of farmers land, teak trees were planted since they believe in this activity for supporting future generation.

Therefore, the introduction of sustainable creative agroforestry system through the application of bokashi plus fertilizer under proper crops arangement of food crops between the wider rows of young teak trees up to 6-7 years were preferred and selected by 100% respondents.

Growth and Yields of agriculture crops

a. Plant Height

Data were collected on the plant height averages (cm) of upland rice, local maize, local peanut and cassava at six weeks after planting (WAP) under one and two years of teak trees in Lambiku and Pentiro villages, it clearly showed that the higher the bokashi plus fetilizer applied the higher the plant height obtained both in one years old teak trees stands and in two years old teak trees stands. The averages of plant height (cm) of agricultural crops planted between the rows of one and two years old teak trees applied by bokashi plus fertilizer at six weeks after planting (WAP) in Lambiku and Pentiro villages was figured out in Table 5.

Table 5. Plant height averages (cm) of upland rice, local maize, local peanut and cassava in intercropping system applied by bokashi plus fertilizer under one and two years teak trees at six weeks after planting (WAP) in Lambiku (LBK) and Pentiro (PTR) villages.

Bokashi plus fertilizer	One year of teak trees stands				Two years of teak trees stands			
	LBK1	LBK2	PTR1	PTR2	LBK1	LBK2	PTR1	PTR2
	Upland rice							
0 t ha^{-1} (B0)	52.34a	53.67a	52.92a	53.95a	54.43a	53.73a	55.44a	51.98a
3 t ha^{-1} (B1)	59.54ab	58.72ab	61.67ab	60.77ab	57.45ab	58.84ab	59.87ab	57.46ab
6 t ha^{-1} (B2)	61.59ab	60.21ab	64.78ab	63.46ab	61.67ab	62.22ab	62.65ab	60.38ab
9 t ha^{-1} (B3)	64.76b	63.54b	66.23b	64.45b	65.75b	65.35b	64.24b	64.51b
HSD 0,05	**7.21**	**6.65**	**7,43**	**7,38**	**7.29**	**6.54**	**7,56**	**7,46**
	Local maize							
0 t ha^{-1} (B0)	142.70a	150.30a	149.27a	151.34a	146.72a	152.34a	148.47a	151.45a
3 t ha^{-1} (B1)	168.11b	170.34a	172.35bcd	163.63a	169.26b	170.60a	171.32bcd	168.60a
6 t ha^{-1} (B2)	182.04cd	185.73bc	175.44cd	175.58bc	174.99cd	173.65bc	182.34cd	172.74bc
9 t ha^{-1} (B3)	190.32d	188.53c	191.53d	187.06c	186.43d	182.65c	189.55d	183.50c
HSD 0,05	**12.39**	**16.05**	**18.25**	**16.38**	**12.08**	**16.35**	**18.26**	**16.32**
	Local peanut							
0 t ha^{-1} (B0)	22,31c	23,76b	22,17b	23,34b	24,40c	23,21b	24,46c	22,77c
3 t ha^{-1} (B1)	26,26b	25,30b	26,65ab	25,54ab	26,15c	27,75ab	28,55b	27,43b
6 t ha^{-1} (B2)	28,53a	29,43a	29,24ab	28,50ab	29,35b	30,62ab	30,76ab	29,78a
9 t ha^{-1} (B3)	30,49a	31,06a	31,47a	30,72a	31,05a	31,15a	31,70a	31,50a
HSD 0,05	**2,20**	**2,19**	**2,31**	**2,42**	**2,36**	**2,39**	**2,50**	**2,65**
	Soybean Var. Dering 1							

0 t ha^{-1} (B0)	42,78b	41,50b	41,68b	39,76	37,34c	40,57b	40,13b	38,71b
3 t ha^{-1} (B1)	46,62b	43,42b	43,57b	46,42	46,68b	43,49b	44,55b	42,50ab
6 t ha^{-1} (B2)	54,60a	51,82a	51,40a	48,10	54,64a	52,46a	51,47a	45,23a
9 t ha^{-1} (B3)	57,94a	54,46a	53,70a	52,14	56,45a	54,87a	53,68a	51,52a
HSD 0,05	**7,06**	**6,93**	**5,62**	**ns**	**6,43**	**7,56**	**6,91**	**7,04**
	Cassava							
0 t ha^{-1} (B0)	36,23	34,60b	35,37b	32,35b	34,68	33,26b	32,65b	33,54c
3 t ha^{-1} (B1)	39,81	38,78ab	38,60ab	37,56ab	36,69	35,70ab	37,52ab	36,87bc
6 t ha^{-1} (B2)	40,92	41,25a	40,65a	42,43a	41,24	40,25a	42,58a	40,29ab
9 t ha^{-1} (B3)	42,57	43,49a	41,08a	42,84a	43,28	42,46a	43,40a	42,57a
HSD 0,05	**ns**	**6,45**	**6,09**	**7,43**	**ns**	**7,84**	**7,05**	**6,19**

Notes : - LBK1 = Lambiku 1, LBK2 = Lambiku 2, PTR1 = Pentiro 1 and PTR2 = Pentiro 2
- Values followed by different letter were significant different in Honestly Significant Difference (HSD) at 95% confidence level. Ns = not significant different.

Table 5 showed that the higher the doses of bokashi plus fertilizer applied, the higher the average plant height gained both in one year of teak trees and in two years teak trees stands in Lambiku and Pentiro villages. In one year of teak trees stands for upland rice, the highest plant height was 66,23 cm performed by the application of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. Moreover, in two years of teak trees stands, the highest average of plant height was 65,75 cm obtained in the treatment of 9 t ha^{-1} (B3) significant different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) obtained in both Lambiku (LBK1 and LBK2) and in Pentiro (PTR1 and PTR2). In one year of teak trees stands for local maize, the highest plant height was 191,53 cm performed by the application of 9 t ha^{-1} (B3) significantly different found in PTR1 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. In addition, in two years of teak trees stands, the highest average of plant height was 189,55 cm obtained in the treatment of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, LBK2 and PTR2. In one year of teak trees stands for local peanut, the highest plant height was 31,47 cm performed by the application of 9 t ha^{-1} (B3) significantly different found in PTR1 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. In addition, in two years of teak trees stands, the highest average of plant height was 31,70 cm obtained in the treatment of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, LBK2 and PTR2. In one year of teak trees stands for soybean var. Dering 1, the highest plant height was 57,94 cm performed by the application of 9 t ha^{-1} (B3) significantly different found in LBK1 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK2, PTR1 and PTR2. In addition, in two years of teak trees stands, the highest average of plant height was 56,45 cm obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK2, PTR1 and PTR2. In one year of teak trees stands for cassava, the highest plant height was 43,49 cm performed by the application of 9 t ha^{-1} (B3) significantly different found in LBK2 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, PTR1 and PTR2. In addition, in two years of teak trees stands, the highest average of plant height was 43,40 cm obtained in the treatment of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, LBK2 and PTR2.

b. Number of leaves

Data were collected on the number of leaves (strands) of upland rice, local maize, local peanut and cassava at six weeks after planting (WAP) under one and two years of teak trees in Lambiku and Pentiro villages, it clearly showed that the higher the bokashi plus fetilizer applied the higher the number of leaves obtained both in one years old teak trees stands and in two years old teak trees stands. The number of leaves averages (strands) of agricultural crops planted between the rows of one and two years old teak trees applied by bokashi plus fertilizer at six weeks after planting (WAP) in Lambiku and Pentiro villages was figured out in Table 6.

Table 6 showed that the higher the doses of bokashi plus fertilizer applied, the higher the average number of plant leaves gained both in one year of teak trees and in two years teak trees stands in Lambiku and Pentiro villages. In one year of teak trees stands for upland rice, the number of plant leaves was 13,30 strands gained by the application of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1) and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. Moreover, in two years of teak trees stands, the highest average of number of plant leaves was 13,42 strands obtained in the treatment of 9 t ha^{-1} (B3) significant different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) obtained in both Lambiku (LBK1 and LBK2) and in Pentiro (PTR1 and PTR2).

Table 6. Averages number of leaves (strands) of upland rice, local maize, local peanut and cassava in intercropping system applied by bokashi plus fertilizer under one and two years teak trees at six weeks after planting (WAP) in Lambiku (LBK) and Pentiro (PTR) villages.

Bokashi plus fertilizer	One year of teak trees stands				Two years of teak trees stands			
	LBK1	LBK2	PTR1	PTR2	LBK1	LBK2	PTR1	PTR2
	Upland rice							
0 t ha^{-1} (B0)	10.62c	10.41b	11.52b	10.86b	10.04	10.35b	11.21b	10.46c
3 t ha^{-1} (B1)	11.07bc	11.25ab	12.04b	11.82ab	11.12	11.84b	11.72b	11.25bc
6 t ha^{-1} (B2)	12.14ab	12.08a	12.51ab	12.15ab	12.31	12.26ab	12.35ab	11.89ab
9 t ha^{-1} (B3)	13.26a	12.84a	13.30a	12.76a	12.49	13.22a	13.42a	12.53a
HSD 0,05	**1.32**	**1.18**	**1.26**	**1.37**	**ns**	**1.29**	**1.22**	**1.24**
	Local maize							
0 t ha^{-1} (B0)	15.63b	15.46b	15.57b	15.22	15.74b	15.58b	15.56a	15.04c
3 t ha^{-1} (B1)	16.41ab	16.55ab	16.02ab	15.63	16.36ab	16.16ab	16.34ab	16.37bc
6 t ha^{-1} (B2)	16.58a	16.72a	16.32ab	16.43	16.58a	17.08a	16.85ab	16.82ab
9 t ha^{-1} (B3)	16.87a	17.25a	16.71a	16.65	16.67a	17.53a	17.05b	17.20a
HSD 0,05	**0.74**	**1.12**	**0.83**	**ns**	**0.76**	**1.17**	**0.86**	**0.77**
	Local peanut							
0 t ha^{-1} (B0)	91,46b	92,88b	92,65b	95,92c	91,26b	93,73b	92,84b	91,25b
3 t ha^{-1} (B1)	97,27b	96,85b	94,21ab	98,28bc	98,15ab	94,03b	95,03b	96,23b
6 t ha^{-1} (B2)	110,96a	107,56a	110,56a	106,44ab	103,75a	108,94a	106,94a	110,71a
9 t ha^{-1} (B3)	109,55a	115,43a	112,52a	110,61a	102,94a	113,21a	111,78a	112,45a
HSD 0,05	**8,38**	**9,43**	**8,72**	**8,26**	**9,18**	**9,83**	**8,72**	**9,65**
	Soybean Var. Dering 1							
0 t ha^{-1} (B0)	22,46c	21,68b	23,14c	20,32b	22,14c	21,63b	20,76b	22,43b
3 t ha^{-1} (B1)	24,38bc	22,25ab	24,50bc	25,84b	24,27bc	24,28b	23,54b	28,82ab
6 t ha^{-1} (B2)	31,57ab	30,83a	32,65ab	34,76a	32,19ab	30,52ab	33.67a	32,45a
9 t ha^{-1} (B3)	37,63a	34,12a	38,16a	37,42a	38,65a	37,54a	40,15a	36,70a
HSD 0,05	**7,34**	**8,95**	**7,83**	**8,67**	**8,89**	**9,03**	**8,16**	**9,62**
	Cassava							
0 t ha^{-1} (B0)	26,45b	25,48c	26,74	26,61b	25,05b	26,06b	24,98b	26,44
3 t ha^{-1} (B1)	27,27ab	26,34bc	27,62	26,94b	26,99ab	27,40ab	26,32ab	27,76
6 t ha^{-1} (B2)	27,92a	28,12ab	27,08	27,70ab	27,15a	28,54a	27,66a	28,12
9 t ha^{-1} (B3)	28,56a	28,74a	27,85	28,92a	28,37a	29,15a	28,78a	29,04
HSD 0,05	**1,36**	**2,41**	**ns**	**1,22**	**2,08**	**2,14**	**2,76**	**ns**

Notes : - LBK1 = Lambiku 1, LBK2 = Lambiku 2, PTR1 = Pentiro 1 and PTR2 = Pentiro 2
- Values followed by different letter were significant different in Honestly Significant Difference (HSD) at 95% confidence level. Ns = not significant different.

Table 6 also showed that in one year of teak trees stands for local maize, the highest number of plant leaves was 17,25 strands gained by the application of 9 t ha^{-1} (B3) significantly different found in LBK2 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, PTR1 and PTR2. In addition, in two years of teak trees stands, the highest average of number of plant leaves was 17,53 strands obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK2 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, PTR1 and PTR2. In one year of teak trees stands for local peanut, the highest number of plant leaves was 115,43 strands obtained by the application of 9 t ha^{-1} (B3) significantly different found in LBK2 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, PTR1 and PTR2. In addition, in two years of teak trees stands, the highest average of number of plant leaves was 113,21 strands obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK2 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, PTR1 and PTR2. In one year of teak trees stands for soybean var. Dering 1, the highest number of plant leaves was 38,16 strands performed by the application of 9 t ha^{-1} (B3) significantly different found in PTR1 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. In addition, in two years of teak trees stands, the highest average of number of plant leaves was 40,15 strands obtained in the treatment of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, LBK2 and PTR2. In one year of teak trees stands for cassava, the highest number of plant leaves was 28,92 strands performed by the application of 9 t ha^{-1} (B3) significantly different found in PTR2 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR1. In addition, in two years of teak trees stands, the highest average of number of plant leaves was 29,15 strands obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK2 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, PTR1 and PTR2.

c. Leaf Area

Data on the leaf areas (cm^2) of upland rice, local maize, local peanut and cassava at six weeks after planting (WAP) under one and two years of teak trees stands were collected in Lambiku and Pentiro villages, it clearly showed that the higher the bokashi plus fertilizer applied, the higher the leaf area obtained both in one years old teak trees and in two years old teak trees stands. The leaf areas averages (cm^2) of agricultural crops planted between the rows of one and two years old teak trees applied by bokashi plus fertilizer at six weeks after planting (WAP) in Lambiku and Pentiro villages was figured out in Table 7.

Table 7 showed that the higher the doses of bokashi plus fertilizer applied in the cultivation of agricultural crops, the higher the average plant leaves area gained in one year of teak trees and two year of teak trees stands in Lambiku and Pentiro villages. In one year of teak trees stands for upland rice, the highest plant leaves area was 535,06 cm^2 performed by the application of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. Moreover, in two years of teak trees stands, the highest average of plant leaves area was 539,89 cm^2 obtained in the treatment of 9 t ha^{-1} (B3) recorded in PTR1 significant different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) obtained in LBK1, LBK2 and PTR2. In one year of teak trees stands for local maize, the highest plant leaves area was 655,35 cm^2 performed by the application of 9 t ha^{-1} (B3) recorded in PTR2 not significantly different compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was dissimilar trend to the results recorded in LBK1, LBK2 and PTR2 in which they were signficant different. In two years of teak trees stands, the highest average of plant leaves area was 654,79 cm^2 obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK2, PTR1 and PTR2.

Table 7. Averages leaf areas (cm^2) of upland rice, local maize, local peanut and cassava in intercropping system applied by bokashi plus fertilizer under one and two years teak trees at six weeks after planting (WAP) in Lambiku (LBK) and Pentiro (PTR) villages.

Bokashi plus fertilizer	One year of teak trees stands				Two years of teak trees stands			
	LBK1	LBK2	PTR1	PTR2	LBK1	LBK2	PTR1	PTR2
	Upland rice							
0 t ha^{-1} (B0)	427,24c	418,79c	463,45b	436,90c	403,91b	416,38c	450,98b	420,81c
3 t ha^{-1} (B1)	445,35bc	452,59b	484,37b	475,52bc	447,36b	476,32b	471,50b	452,59bc
6 t ha^{-1} (B2)	488,39b	485,98b	503,28ab	488,79ab	495,23a	493,22ab	496,84ab	478,33ab
9 t ha^{-1} (B3)	533,45a	516,55a	535,06a	513,33a	502,47a	531,84a	539,89a	504,08a
HSD 0,05	**45,26**	**39,57**	**41,32**	**46,24**	**47,85**	**44,57**	**51,04**	**50,12**
	Local maize							
0 t ha^{-1} (B0)	566,67b	574,44b	573,82c	582,55	581,99b	564,46b	565,48b	571,75b
3 t ha^{-1} (B1)	606,71ab	614,48ab	613,86bc	615,31	614,75ab	604,50ab	605,52ab	611,79ab
6 t ha^{-1} (B2)	610,35ab	618,12ab	617,50ab	618,95	618,39ab	608,14ab	609,16ab	615,43ab
9 t ha^{-1} (B3)	646,75a	650,88a	650,26a	655,35	654,79a	644,54a	645,56a	648,19a
HSD 0,05	**51,24**	**49,35**	**43,12**	**ns**	**50,43**	**48,32**	**52,76**	**49,64**
	Local peanut							
0 t ha^{-1} (B0)	280,11c	294,02c	287,25c	305,51c	335,43b	259,69b	267,05b	293,51c
3 t ha^{-1} (B1)	301,62bc	307,97c	307,86bc	336,33bc	356,28ab	275,96b	277,27b	315,52bc
6 t ha^{-1} (B2)	317,16b	342,39b	327,34ab	360,98ab	367,59ab	295,19ab	301,01ab	331,73ab
9 t ha^{-1} (B3)	344,39a	375,28a	348,67a	370,67a	378,70a	326,94a	343,96a	348,03a
HSD 0,05	**25,17**	**28,43**	**27,98**	**32,56**	**36,57**	**39,45**	**42,58**	**38,44**
	Soybean Var. Dering 1							
0 t ha^{-1} (B0)	278,95c	269,27b	287,40c	252,37c	274,98c	268,64c	257,84c	278,58b
3 t ha^{-1} (B1)	302,80c	276,35b	304,29c	320,93b	301,43c	301,56c	292,37c	357,94b
6 t ha^{-1} (B2)	392,10b	382,91a	405,51b	431,72a	399,80b	379,06b	418,18b	403,03a
9 t ha^{-1} (B3)	467,36a	423,77a	473,95a	464,76a	480,03a	466,25a	498,66a	455,81a
HSD 0,05	**65,70**	**59,72**	**62,56**	**58.92**	**54,75**	**55,90**	**61,46**	**59,05**
	Cassava							
0 t ha^{-1} (B0)	664,95b	640,57b	672,24	668,98b	629,76b	655,15c	628,00c	664,70b
3 t ha^{-1} (B1)	685,57ab	662,19b	694,37	677,27b	678,53ab	688,84bc	661,68bc	697,89ab
6 t ha^{-1} (B2)	701,91ab	706,94ab	680,79	696,38ab	682,55a	717,50ab	695,37ab	706,94ab
9 t ha^{-1} (B3)	718,00a	722,52a	700,15	727,05a	713,22a	732,83a	723,53a	730,07a
HSD 0,05	**48,06**	**44,95**	**Ns**	**46,30**	**40,01**	**42,93**	**49,24**	**45,18**

Notes : - LBK1 = Lambiku 1, LBK2 = Lambiku 2, PTR1 = Pentiro 1 and PTR2 = Pentiro 2
- Values followed by different letter were significant different in Honestly Significant Difference (HSD) at 95% confidence level. Ns = not significant different.

Table 7 also showed that in one year of teak trees stands for local peanut, the highest plant leaves area was 375,28 cm^2 performed by the application of 9 t ha^{-1} (B3) recorded in LBK2 significantly different compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, PTR1 and PTR2. In addition, in two years of teak trees stands, the highest average of plant leaves area was 378,70 cm^2 obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK2, PTR1 and PTR2. In one year of teak trees stands for soybean var. Dering 1, the highest plant leaves area was 473,95 cm^2 performed by the application of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. In addition, in two years of teak trees stands, the highest average of plant leaves area was 498,66 cm^2 obtained in the treatment of 9 t ha^{-1} (B3) recorded in PTR1 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, LBK2 and PTR2. In one year of teak trees stands for cassava, the highest plant leaves area was 727,05 cm^2 performed by the application of 9 t ha^{-1} (B3) significantly different found in PTR2 compared to lower doses of bokashi plus fertilizer 0 t ha^{-1}(B0), 3 t ha^{-1}(B1),and 6 t ha^{-1}(B2). This was similar trend to the results recorded in LBK1, LBK2 and PTR2. In addition, in two years of teak trees stands, the highest average of plant leaves area was 732,83 cm^2 obtained in the treatment of 9 t ha^{-1} (B3) recorded in LBK2 significantly different compared without fertilizer (B0), 3 t ha^{-1} (B1) and 6 t ha^{-1} (B2) found in LBK1, PTR1 and PTR2.

Yield Components of Agricultural Crops

There were many generative components of agricultural crops recorded, but in this paper, 100 dry seed weight (g) and yield crops (t ha^{-1}) of upland rice, local maize, local peanut and soybean var. Dering 1 was presented.

a. Dry Seed Weight

Data on 100 dry seed weight were collected of upland rice, local maize, local peanut and soybean var. Dering 1 applied by bokashi plus fertilizer either planted in intercropping and monoculture between the rows of one and two years old of teak trees stands of Lambiku and Pentiro, Napabalano district, Muna regency as shown in Table 8.

Table 8. The averages of 100 dry seed weight (g) of upland rice, local maize, local peanut and soybean var. Dering 1 under one and two years teak trees stands based sustainable creative agroforestry system in Lambiku and Pentiro villages

Bokashi plus fertilizer	Lambiku village				Pentiro village			
	Upland rice (g)	Local maize (g)	Local peanut (g)	Soybean var. Dering 1 (g)	Upland rice (g)	Local maize (g)	Local peanut (g)	Soybean var. Dering 1 (g)
	One year teak trees stands							
0 t ha^{-1} (B0)	10.79b	31,33b	20.13	8,21c	10.29c	28,63b	22.43	7,84c
3 t ha^{-1} (B1)	11.94b	35,69ab	22.26	8,86bc	11.48bc	33,91b	24.28	8,63bc
6 t ha^{-1} (B2)	12.42ab	39,95a	24.42	9,37b	12,96ab	36,03ab	25.36	9,21b
9 t ha^{-1} (B3)	13.56a	41,46a	26.51	11,85a	13.04a	42,56a	27.42	10,42a
HSD 0,05	**2,13**	**7,94**	**Ns**	**1,15**	**1.63**	**8,55**	**Ns**	**1,12**
	Two years teak trees stands							
0 t ha^{-1} (B0)	8.34b	29,20c	18.55c	7,08c	8.26	25,42b	18.12b	7,32b
3 t ha^{-1} (B1)	9.61ab	32,31bc	18.72bc	8,24bc	8.38	29,49ab	18.73b	7,98b
6 t ha^{-1} (B2)	9.73ab	37,46ab	19.54ab	8,57ab	9.17	30,68ab	19.32ab	8,24ab
9 t ha^{-1} (B3)	10.30a	38,95a	20.43a	9,48a	10,25	32,94a	20.39a	8,77a
HSD 0,05	2,02	6.31	0.61	1.20	ns	6.45	1,23	1.24

Notes : Values followed by different letter were significant different in Honestly Significant Difference (HSD) at 95% confidence level.

Table 8 showed that the higher the doses of bokashi plus fertilizer applied, the higher the 100 seed dry weight of upland rice, local maize, local peanut and soybean var. Dering 1 obtained both in one and two years of teak trees stands in Lambiku and Pentiro villages. In one year of teak trees stands for upland rice in Lambiku village, the highest average 100 seed dry weight was 13,56 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 10,79 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 13,04 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 10,29 g obtained in the treatment 0 t ha^{-1} (B0). For local maize in Lambiku village, the highest average 100 seed dry weight was 41,46 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 31,33 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 42,56 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 28,63 g obtained in the treatment 0 t ha^{-1} (B0). For local peanut in Lambiku village, the highest average 100 seed dry weight was 26,51 g gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments, whilst the lowest was 20,13 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 27,42 g gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments, whilst the lowest was 22,43 g obtained in the treatment 0 t ha^{-1} (B0). For soybean var. Dering 1 in Lambiku village, the highest average 100 seed dry weight was 11,85 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 8,21 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 10,42 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 7,84 g obtained in the treatment 0 t ha^{-1} (B0). Table 8 also sehowed that in two year of teak trees stands for upland rice in Lambiku village, the highest average 100 seed dry weight was 10,30 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 8,34 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 10,25 g gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments. For local maize in Lambiku village, the highest average 100 seed dry weight was 38,95 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 29,20 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 32,94 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 25,42 g obtained in the treatment 0 t ha^{-1} (B0). For local peanut in Lambiku village, the highest average 100 seed dry weight was 20,43 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to other treatments, whilst the lowest was 18,55 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 20,39 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to other treatments, whilst the lowest was 18,12 g obtained in the treatment 0 t ha^{-1} (B0). For soybean var. Dering 1 in Lambiku village, the highest average 100 seed dry weight was 9,48 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 7,08 g obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average 100 seed dry weight was 8,77 g gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1), whilst the lowest was 7,32 g obtained in the treatment 0 t ha^{-1} (B0).

b. Yield of Crops

The results of data collection on the yield of upland rice, local maize, local peanut and soybean var. Dering applied by bokashi plus fertilizer were recorded either planted in intercropping and monoculture between the rows of one and two years old of teak trees stands of Lambiku and Pentiro villages, Napabalano district, Muna regency as shown in Table 9.

Table 9. The averages yields (t ha^{-1}) of upland rice, local maize, local peanut and soybean var. Dering 1 under one- and two-years teak trees based sustainable creative agroforestry practices in Lambiku and Pentiro villages

Bokashi plus fertilizer	Lambiku village				Pentiro village			
	Upland rice (t ha^{-1})	Local maize (t ha^{-1})	Local peanut (t ha^{-1})	Soybean var. Dering (t ha^{-1})	Upland rice (t ha^{-1})	Local maize (t ha^{-1})	Local peanut (t ha^{-1})	Soybean var. Dering (t ha^{-1})
	One year teak trees stands							
0 t ha^{-1} (B0)	1.79b	4.15b	2.13	1,20b	1.29c	4.05b	2.12	1,06b
3 t ha^{-1} (B1)	1.94ab	4.54ab	2.26	1,23ab	1.48bc	4.22ab	2.28	1,24ab
6 t ha^{-1} (B2)	2.42ab	4.76a	2.42	1,31ab	1,96ab	4.67ab	2.39	1,29a
9 t ha^{-1} (B3)	2.56a	4.90a	2.51	1,35a	2.23a	4.84a	2.40	1,31a
HSD 0,05	0.64	0.58	ns	0,14	0.62	0.74	ns	0,18
	Two years teak trees stands							
0 t ha^{-1} (B0)	1.34b	4.02b	1.57c	1,02	1.27	3.82b	2.12b	1,02b
3 t ha^{-1} (B1)	1.61ab	4.28ab	2.02bc	1,22	1.38	4.03ab	2.24ab	1,15ab
6 t ha^{-1} (B2)	2.03ab	4.46ab	2.24ab	1,27	1.87	4.47ab	2.35ab	1,22ab
9 t ha^{-1} (B3)	2.30a	4.65a	2.28a	1,32	1,97	4.58a	2.39a	1,28a
HSD 0,05	0.89	0.51	0.61	ns	ns	0.72	0,23	0,20

Notes : Values followed by different letter were significant different in Honestly Significant Difference (HSD) at 95% confidence level.

Table 9 showed that the higher the doses of bokashi plus fertilizer applied, the higher the yields of crops for upland rice, local maize, local peanut and soybean var. Dering 1 obtained both in one and two years of teak trees stands in Lambiku and Pentiro villages. In one year of teak trees stands for upland rice in Lambiku village, the highest average yield of crops was 2,56 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0) and 3 t ha^{-1} (B1). In Pentiro village, the highest average yield of crop was 2,23 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), 3 t ha^{-1} (B1), whilst the lowest was 1,29 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). For local maize in Lambiku village, the highest average yield of crop was 4,90 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 4,15 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 4,84 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 4,03 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). For local peanut in Lambiku village, the highest average yield of crop was 2,51 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments, whilst the lowest was 2,13 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 2,40 t ha-1 gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments, whilst the lowest was 2,12 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). For soybean var. Dering 1 in Lambiku village, the highest average yield of crop was 1,35 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 1,20 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 1,31 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 1,06 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). Table 8 also showed that in two year of teak trees stands for upland rice in Lambiku village, the highest average yield of crop was 2,30 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 1,34 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 1,97 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments. For local maize in Lambiku village, the highest average yield of crop was 4,65 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 4,02 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 4,58 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 3,82 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). For local peanut in Lambiku village, the highest average yield of crop was 2,28 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to other treatments, whilst the lowest was 1,57 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 2,39 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) significantly different compared to other treatments, whilst the lowest was 1,12 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0). For soybean var. Dering 1 in Lambiku village, the highest average yield of crop was 1,32 t ha^{-1} gained in the treatment of 9 t ha^{-1} (B3) not significantly different compared to other treatments, whilst the lowest was 1,27 t ha^{-1} gained in the treatment 0 t ha^{-1} (B0). In Pentiro village, the highest average yield of crop was 1,28 t ha^{-1} obtained in the treatment of 9 t ha^{-1} (B3) significantly different compared to without bokashi plus fertilizer (B0), whilst the lowest was 1,02 t ha^{-1} obtained in the treatment 0 t ha^{-1} (B0).

The Prospects of Sustainable Creative Agroforestry System

The results of research also showed the high prospects of community development to improve agriculture food yields treated by bokashi plus fertilizer technology in the cultivation of rice, maize, cassava, peanut, mungbean and horticultural crops both single, intercropped and mixed between early growth of teak trees, as well as the development of food processing technologies for cashew nuts, cocoa. coconut and other agricultural commodities in order to achieve added values. The increasing knowledge and skills of the farmers on the effective use of natural resources as well as the integration of agricultural crops in agroforestry stands especially at the early growth development of teak trees might escalate the achievement of farmers welfare.

Discussion

The results of research revealed that in terms of age, income, land area owned and the number of poles belonging as shown in Table 1, the recent status of farmers had a promising trend and no constraints in the development of sustainable creative agroforestry system in order to improve community welfare. This was supported by high precentage of agree and strongly agree to the objectives of the development of agroforestry system for providing future savings and using for their childreen to study, teak wood price getting more expensive, sustain environmental protection eventhough planting teak trees based agroforestry system needed long time at least 10 years to be harvested, prevention of global warming and protection of flora and fauna were similarly responded by a bit lower of the respondents agree and strongly agree (Table 2). Moreover, the increasing knowledge and skills of the farmers on the objective measures of agroforestry practices might support the acceleration of farmers better change. This was confirmed by the results of survey as shown in Table 3 revealed that the adoption of sustainable creative agroforestry system contributed to guarantee better soil fertility, to increase agriculture yields, to prevent direct precipitation to the soil and to overcome land degradation, to conserve plant diversity, to improve income and community welfare. This was reasonable due to the creation of innovation and new technologies applied in various agroforestry patterns with both practices placing an emphasis on interaction between different plant species (Garity, 2004). One of the promising inovation was the integration of organic fertilizer application that can be used as an effort to increase soil fertility and to maintain environmental stability, so as to improve agricultural crops productivity and achieve the community welfare. This was relevant to the previous research findings reported by Gilbert, *et al*., 2008; Karimuna, *et al*., 2016, Karimuna, et al., 2019; Karimuna, et al., 2020. Similar study had been 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. Over the past two decades, a number of studies have been carried out analysing the viability of agroforestry.

The integration of food crops and teak with relatively dense teak spacing and mixed cropping of food crops, horticulture between cashew, banana and teak without crop spacement were the dominant agroforestry types practiced by the respondents in Lambiku and Pentiro villages (Table 4). This result was similar to the previous finding reported Karimuna, *et al*., 2018 that the combination of crops cultivated for more than one plants in one place, has the function and importance of maintaning biological diversity and protection of soil degradation since all plants canopy might close soil surfaces that lead to stability of ecosystem landscape. In contrast to the requirement of agricultural crops in the lower canopy, they needed sufficient light to provide the photosyntheses processing. Interestingly was that the stands of teak trees with older ages might close canopies due to huge number of teak branches. Therefore, in order to maintain enough light to penetrate into the soil surface, prunning of teak branches with high caution was needed. The arrangement of this condition was carried out in a proper management to achieve environmental stability 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 (Garity, 2004; Roshetko, *et al*., 2007; Karimuna, *et al*., 2016).

The response of bokashi plus fertilizer on the growth components on plant height, number of leaves and leaves area of upland rice, local maize, local peanut, soybean var. Dering 1 and cassava were significant (Table 5, 6 and 7) and lined with the increase of yields components for 100 dry seed weight and yield of crop as figured out in Table 8 and Table 9. It was shown that the farmers in the two villages were intensively participated in the research work to adapt the sustainable creative agroforestry system since it provided better growth and sufficient yield of upland rice, local maize, local peanut and soybean var. Dering 1, had the role and function to increase agricultural crops cultivated under early teak growth of one to two years of age and to increase other agricultural productivity. This was relevant to the previous finding as reported by Silitonga, *et al*., (2018); Karimuna, *et al*., 2018 and Ma'sumah (2002), even though these results were mostly higher compared to growth and yields components of peanut in interropping system stated by Pasaribu, *et al*., (2014). The growth of plant height, number of leaves and leaf area might affect metabolisme process especially photosynthesis. This was relevant to the finding reported by Mahmood, *et al*., (2002) that good plant height growth and the number of leaves that affect the photosynthesis process an increase in the photosynthesis process will also increase the results of photosynthesis in the form of organic compounds that will be translocated throughout the plant organs and affect the dry weight of the plant. Moreover, the leaf area of a plant depends on the number of leaves, there was a tendency if the number of leaves the more the greater the leaf area. According Ma'sumah (2002) and Silitonga, *et al*. (2018), reported that leaves play a very important role for productivity a plant. The number and size of leaves was influenced by genotypes and environmental factors, such as soil, water, light and nutrients.

The application of organic fertilizer derived from bokashi plus and other sources of organic matter was very important to increase soil fertility significantly and might affect the increasing yield of upland rice, local maize, local peanut and soybean var. Dering (Table 8 and 9). This was confirmed that sustainable creative agroforestry system had proved to improve the growth and yields of agriculture crops cultivated by the farmers. In the demonstration plot, it proved the increasing growth and yields of agriculture crops such as maize, peanut, cassava, and rice under sustainable creative agroforestry system compared with conventional one. In this research, the early growth of one and two years teak trees, agriculture crops were planted between the rows of teak and other plantation trees. The increasing age of young teak tree up to two years did not significantly affect plant height, leaf number and leaf area of agriculture crops planted. However, there was a trend decreasing tissue compaction of leaves and stem under older teak trees canopy. Application of bokashi plus fertilizer that contains sufficient nutrients is necessary to increase soil fertility and to maintain better growth development in order to overcome the shortage of nutrient contents. However, during the early stages of development, the nutrient quantity of soil should be sufficient to sustain the plant life cycle (Wilson *et al*. 2001) and can be periodically increased with doses of organic fertilizers and chemical fertilizers-NPK (Beaulah *et al*. 2001). Factors required for better crop yield are adequate soil fertilization and proper feld management with organic amendments of plant or animal origin. According to Stofella *et al*. (1997), compost and other organic fertilizers have been reported to improve soil nutrient levels, as fertilizers provide a ready source of carbon and nitrogen for soil microorganisms, improve soil structure, reduce erosion, lower soil temperatures, facilitate seed germination and increase soil water retention capacity. Fertilizers stabilize soil pH, increase soil organic matter, and ultimately improve the growth and yields of plants (Roe *et al*. 1997) and organic fertilizer derived from cow dung was needed applied in Ultisols to increase nutrient contents for better growth and yield of watermelon (Safuan, 2012).

The higher the doses of bokashi plus fertilizer given to the soil under agroforestry condition, the higher the average 100 dry seed weight and yield of crop in Lambiku and Pentiro villages, indicating high adaptability of agricultural crops cultivated between the rows of early growth and teak trees. This trend was a good potential to be cultivated in the form of agroforestry pattern without interfering the normal growth of teak trees and still give a positive effect on the growth and yields of upland rice, local maize, local peanut, soybean var. Dering 1 either in intercropping system or monoculture. It was caused by the availability of sufficient nutrient contents and enough space to grow, so the competition among plants was minimized by the proper space arrangement of maize and peanut between the rows of teak trees and the soil media provide enough quantity of nutrient, water and other elements that might affect to development of well growing generative components as explained by Karimuna, *et al*., (2017) and Pasaribu, *et al.* (2014).

CONCLUSION

The conclusions of the research work were as follows (1) sustainable creative agroforestry system had significantly affect the improvement of growth and yields of agricultural crops under one and two years of teak trees plantation either planted in intercropping system or monoculture in Lambiku and Pentiro villages, (2) the increasing knowledge and skills of the farmers on sustainable creative agroforestry system might affect and support the improvement of social and economic condition of community in the study region as well as synchronizing the objectives of agroforestry development in providing future savings, using for their children to further study, having teak wood price getting more expensive and sustaining environmental protection, (3) the higher the doses of bokashi plus fertilizer applied into the soil, the higher the growth and yields of upland rice, local maize, local peanut, soybean var. Dering 1 and cassava cultivated under one and two years of teak trees plantation. (4) the application of various doses of bokashi plus fertilizer in the village of Lambiku and Pentiro under sustainable creative agroforestry system had significant different and better effects on the growth and yields components of peanut agricultural crops and had a promising prospect for further development.

REFERENCES

Beaulah AE, Vadivelu U, Rajadural KR, 2001. Growth analysis of Moringa CVPKM-l under organic and inorganic systems of culture. PKM Thesis, HC and RI. PKM. Doctor of Philosophy in Horticulture, Tamil Nadu Agricultural University, Coimbatore, Inde-641 003. https://doi.org/10.5897/AJB2014.14359

Bishop J, Landell-Mills N., 2002. Forest Environmental Services: An Overview. In: Pagiola S, Bishop J, Landell-Mills N (eds) Selling Forest Environmental Services. Earthscan, London, p 299

FAO, 1999. States of the World's Forest, FAO, Rome, Italy.

Garrity D P 2004 Agroforestry and the achievement of the Millennium Development Goals. Agroforestry Systems **61: 5–17**

Gilber RA, Morris DR, Rambelt CR, McCrey JM, Perdomo RE, Eiland B, Powel G, Montes G. 2008. Sugarcane response to mill mud, fertilizer, and soybean nutrient source on sandy soil. Agron. J. 100 : 845 – 854

Haverkort, B., A. W. Bayer and C. Reitatjes. 1992. Agriculture of the future. Kanisius. Jakarta

Karimuna L, Halim, Resman. Rufendi L M, Marfi W E, and Akri S 2017 Agroforestry in West Kulisusu, North Buton Regency, Final Report of Ipteks For Regional, Research and Higher Education, Institution of Research and Community Services, University of Halu Oleo, Kendari, Southeast Sulawesi Province

Karimuna L, Halim, Resman, Rufendi L M, Marfi W E, and Akri S 2018 Growth and Yields Performances of Agricultural Crops Under Controlled Agroforestry System on Maintaining Biological Diversity and Improvement of Community Welfare in Indonesia, *Proc. on the 6th Kuala Lumpur Int. Agriculture, Forestry and Plantation Conf., Agriculture, Forestry and Plantations: Challenges in the 4th Industrial Revolution*, 24-25 April 2018.

Maesarah, M.M. 2016. Effect of Chicken and Cow Manure Doses on the Growth Peanut Weeds and Products (*Arachis hipogaea L.*) on the sand beach *http:// repository.upy.ac.id/12/1/ArtikelMeirina20%Maesarah.pdf.*

Mahmood, M., K. Farroq, A. Hussain, R. Sher. 2002. Effeck Of Mulching On Growth and Yield Of Potato Crop. Asian J. Of Plan Sci. 1(2):122-133

Ma'sumah. 2002. Effect of various planting media and concentrations of liquid organic fertilizers on the growth and yield of Tomato (Lycopersicum esculentum Mill.) by hydroponics. Thesis. Faculty of Agriculture, UNS Surakarta

Pasaribu P K,. Barus A, and Mariati 2014 Growth and Production of Peanuts (Arachis hypogaea L.) with Cow Manure and Phosphate Fertilizer Application, Agrotechnology Department, Faculty of Agriculture, USU, Medan, 2015. *Online J. of Agrotechnology*, ISSN No. 2337-6597, **Vol 2 (4):1391-1395**

Perfecto I, Armbrecht I, 2003. Technological change and biodiversity in the coffee agroecosystem of Northern Latin America. In: Vandermeer J (ed) Tropical agroecosystems. CRC Press LLC, Boca Raton, pp 159–194

Rahayu M, Prajitno D, and Syukur A 2006 Vegetation Growth of Upland Rice and Some Pineaple Varieties in Interropping at Dryland Gunung Kidul, Yogyakarta, Department of Agronomy, Faculty of Agriculture, University of Eleven March (UNS), Surakarta, Biodiversitas, ISSN: 1412-033X, **Vol 7 (1):73-76**,

Reyes T, Luukkanen O, Quiroz R., 2006. Small cardamom—precious for people, harmful for mountain forests. Mountain Research and Development 26:131–137

Roe NE, Stofella PJ, Graetz DA., 1997. Compost from various municipal waste feedstocks afects vegetable crops II growth, yield and fruit quality. J Am Soc Hortic Sci 122:433–437. https://doi. org/10.21273/JASHS.122.3.433

Roshetko J M, Lasco R D, Delos Angeles M S 2007 Smallholder agroforestry systems for carbon storage. Mitigation and Adaptation Strategies for Global Change **12:219–242**

Safuan L. 2012. Effect of organic matter and potassium fertilizer on melon plant growth and production (*Cucumis melo* L.). Agroteknol. J. (2) 2: 70-76.

Silitonga, L., E Turmudi, Widodo, 2018. Growth and Yield Response of Peanut (*Arachis hypogaea* L.) to Cow Manure Dosage and Phosphorus Fertilizer on Ultisol, Department of Crop Production, Faculty of Agriculture, University of Bengkulu WR Supratman St, Kandang Limun, Bengkulu 38371, Indonesia, Akta Agrosia. 2018. 21(1):11-18.

Stofella PJ, Li YC, Roe NE, Ozores-Hampton M, Graetz DA, 1997. Utilization of organic waste composts in vegetable crop production systems. In: Morris RA (ed) Managing soil fertility for intensive vegetable production systems in Asia. Asian Vegetable Research and Development Center, Shanhua, p 12

Suwardjono. 2004. Pengaruh Beberapa Jenis Pupuk Kandang terhadap Pertumbuhan dan Produksi Kacang Tanah. *http//www.ut.ac.id/jurnal/suwardjono/pengaruh.htm.* Di akses 12 September 2004.

Schroth G, da Fonseca GAB, Harvey CA, Gascon C, Vasconcelos HL, Izac AMN., 2004. Agroforestry and biodiversity conservation in tropical landscapes. Island Press, Washington.

Steffan-Dewenter I, Kessler M, Barkmann J, Bos M, Buchori D, Erasmi S, Faust H, Gerold G, Glenk K, Gradstein RS, Guhardja E, Harteveld M, Hertel D, Ho ̈hn P, Kappas M, Ko ̈hler S, Leuschner C, Maertens M, Marggraf R, Migge-Kleian S, Mogea J, Pitopang R, Schaefer M, Schwarze S, Sporn GS, Steingrebe A, Tjitrosoedirdjo SS, Tjitrosoemito S, Twele A, Weber R, Woltmann L, Zeller M, Tscharntke T., 2007. Tradeoffs between income, biodiversity, and ecosystem functioning during tropical rainforest conversion and agroforestry intensification. Proceedings of the National Academy of Sciences 104:4973–4978

Tscharntke T, Kelin AM, Kruess A, Steffan-Dewenter I, Thies C., 2005. Landscape perspectives on agricultural intensification and biodiversity-ecosystem servicemanagement. Ecology Letters 8:857–874

Turner WR, Brandon K, Brooks TM, Costanza R, da Fonseca GAB, Portela R., 2007. Global conservation of biodiversity and ecosystem services. BioScience 57:868–873

Wilson SB, Stofella PJ, Graetz DA., 2001. Use of compost as a mediaamendment for containerized production of two subtropical perennials. J Environ Hortic 19(1):37–42