Examination of advantage potential Carrying Capacity Based on Dry Matter Yield of monoculture land and Intercropping land of *Indigofera* and *Brachiaria* underneath mature coconuts

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Abstract-Intercropping can increment crop development and yield because of assets use effectively. The reason for this exploration was decides the correlation of expected dry matter yield and conveying limit of monoculture land and intercropping place that is known for tree legume Indigofera (Li) and tropical grass Brachiaria (Bg). This experiment was conducted using Completely Randomized Design (CRD) with four treatment mix of establishing space as follows: Li, with planting areas of 1.00 m by 1.50 m and 1.00 m by 1.50 m, and Bg, with planting areas of 0.25 m by 0.25 m and 0.25 m by 0.50 m. Data were analyzed using analysis of variance and HSD test. The variables measured were comparison potential dry matter yield, carrying capacity and advantage for monculture and intercropping. The results showed that treatment were significant different ($P<0.01$) on potential yield, potential carrying capacity and advantage based on carrying capacity. The HSD test showed that intercropping *Li* with planting space at 1.00 m x 1.00 m and *Bg* with planting space at 0.25 m x 0.25 m have highest potential yield and carrying capacity, but Li with planting space at 1.00 m x 1.50 m and *Bg* with planting space at 0.25 m x 0.50 m have highest advantage based on carrying capacity. It conclusion that intercropping Li with planting space at 1.00 m x 1.50 m and *Bg* with planting space at 0.25 m x 0.50 m have most suitable for advantage based on carrying capacity.
Key Words : advantage, carrying capacity, dry matter, planting space

I. INTRODUCTION

One of the integrated soil fertility management practices that involves cultivating two or more crops simultaneously in the same area is known as intercropping. This practice has been used for decades and has helped agriculture achieve its objectives. Likewise, intercropping frameworks are helpful to the smallholder ranchers in the low-input as well as high-risk climate of the jungles, where intercropping of oats and vegetables is far reaching among smallholder ranchers because of the capacity of the vegetable to add to resolving the issue of declining levels of soil richness (Matusso et al 2012). Tropical grasses as the principal fountain-head of feed is never adequate to accomodate nutritious qualification at littlest 8% of crude protein (Fujisaka et al 2000). Legumes grows up extravagantly and available on the year, where those corner legumes bring out foliage and could build the superiority of low-quality grasses. The positive effects of tree legume leaves can be ascribed to their high levels of protein and has condensed tannins content, which is known to form complexes with dietary protein helping their escape from the rumen and efficient digestion in the intestines (Preston and Leng 1987).

The fundamental reason for intercropping is to deliver a more prominent yield on a land by improving assets that can't be used in a monocropping framework productively (Moradi et al 2014). The primary benefit of intercropping is helps in using the accessible assets proficiently and builds the efficiency of the harvests. Intercropping can ration soil water by giving shade, diminishing breeze speed, expanding penetration with mulch layers, and further developing soil structure (Mobasser et al 2014). The progress of intercropping frameworks and execution of part crops are administered basically by the accessibility of and the opposition between the parts for the natural assets (Telleng et al 2016). Notwithstanding, a few mixes adversely affect the yield of the parts under intercropping framework (Matusso et al 2012).

A significant device for the review and assessment of intercropping frameworks is advantage gotten by growing at least two yields or assortments as an intercrop contrasted with developing similar harvests or assortments as an assortment of independent monocultures (Yancey and Cecil 1994). Cultivating frameworks applied in North Sulawesi region of Indonesia was still in type of coordinated land with modern agrarian estates including coconut that can be utilized for the improvement of rummage crops (Anis et al 2015). However, this kind of agricultural integration system is facing the competition for nutrients, water and sunlight. Therefore, it is essential to examine and compare the advantages of the intercropping system between brachiaria grass and indigofera legumes in coconut plantation areas with the development of comparable plants or varieties if they were planted in monoculture.

II. MATERIALS AND METHODS

A. Experimental Site

The review was directed in the exploratory station of Asassement Institute of Agriculture Technology (AIAT) of North Sulawesi, located 12 km from Manado City. Trial site got a typical precipitation of 500 mm, and genuinely conveyed even around area, with the exception of the time of lower precipitation of 50-100 mm month to month, happened from July to September. The pH of the fruitful, sandy topsoil soil was around 6. Light transmission at 10.00 a.m on a bright day as Standard under mature tall coconuts was averaging of 73 percents. The soil color was dark brown clay. Precipitation tops occurred in January, with high precipitation power This condition caused high relative mugginess of 86 percents. Air temperature ranged from 23 ^{0}C to 32 ^{0}C.

B. Experimental Design

Grass of *Brachiaria* (Gb) were obtained from Asassement Institute of Agriculture Technology (AIAT) of North Sulawesi. Legume seeds of *Indigofera* (Li) were obtained from the Nutrition and Feed Technology Laboratory of the Faculty of Animal Science, Sam Ratulangi University. *Indigofera* seeds sown on land had been processed as a nursery. Plant seeds that had grown well were then moved into the 2.5 kg plastic bag already filled with soil (one plant/plastic bag). After growing of two months in a medium plastic bag, the plant was then transferred in to experimental site in a plot size of 3 m x 4 m that had been processed with 4 treatments of planting spacing (PS) with row spacing of 1 m apart. Two planting space Li : (i) 1.00 m x 1.00 m, and (ii) 1.00 m x 1.50 m. After two months Li grown in experimental plots, Gb was planted. Two Planting space Gb : (i) 0.25 m x 0.25 m, and (ii) 0.25 m x 0.50 m. Intercropping having four combination and each was planted in five plot. The plot combination were: C_1= 1.00 m x 1.00 m *Lg* & 0.25 m x 0.25 m Gb*;* C_2= 1.00 m x 1.00 m Lg & 0.25 m x 0.50 m Gb*;* C_3= 1.00 m x 1.50 m Lg & 0.25 m x 0.25 m Gb*;* C_4= 1.00 m x 1.50 m Li & 0.25 m x 0.50 m Gb.

Data were then statistically analyzed by using analysis of variance (ANOVA) by means of MINITAB (Version 16). Honestly Significance Difference (HSD) was applied to determine the difference among treatments. Differences were considered at $p<0.05$.

C. *Variable Observations*

Harvesting *Indigofera* was done ± 90 days after planting, defoliated at 100 cm above ground level. *Brachiaria* were defoliated at height level of 10 cm above ground. Samples were dried at 60 ^{0}C for about 48 hours to determine the dried weight. The samples were analyzed for dry matter.

The variables include potential dry weight yield (ton/ha), potential carrying capacity and advantage based carrying capacity. Dry matter yield of each plot was calculated through the value of green forage production and dry-weight precentage. Carrying capacity was determined by the information obtained from the forage harvested; it was collected from productivity estimation of each plot and converted to one ha. Available forage was calculated based on 70% of the Proper Use Factor (PUF). It is assumed that animal consumes 6.29 kg DM of forage/day/head (Indonesian condition). The amount of dry matter required to provide 6.29 kg of digestible nutrients based on available forage (70% of PUF) was 9.0 kg.

III. RESULTS

A. Potential Yield

Dry matter yield have about 18.59 ton/ha/year until 27.41 ton/ha/year for sole and 24.2 ton/ha/year until 47.35 ton/ha/year for intercropping. Dry matter yield was highly significant effected by combination planting space, there was that intercropping at different spacing had highly significant effects on dry matter yield. For sole and intercropping, combination planting space 1mx1m *Li* and 0.25mx0.25m Gb have highest dry matter yield. It is well shown in Table 1.

B. Potential Carrying Capacity

Potential carrying capacity have about 5.66 AU/ha/year until 8.346 AU/ha/year for sole and 9.93 AU/ha/year until 14.414 AU/ha/year for intercropping. Carrying capacity was highly significant effected by combination planting space, there was that intercropping at different spacing had highly significant effects on carrying capacity. For sole and intercropping, combination planting space 1.00 m x 1.00 m Li and 0.25mx0.25m Gb have highest carrying capacity. It is well shown in Table 1.

Table 1. Potential Yield, Carying Capacity and Advantage of Intercropping

Planting Spacing		Potential Yield (DM ton/ha/yr)		Potential Carrying capacity (AU/ha/yr)		Advantage (%)
Indigofera	*Brachiaria*	sole	intercrop	sole	intercrop	
1.00m x 1.00m	0.25m x 0.25m	27.41[a]	47.35[a]	8.346[a]	14.414[a]	72.77[ab]
	0.25m x 0.5m	18.89[b]	24.2[c]	5.75[b]	7.368[c]	28.28[c]
1.00m x 1.50m	0.25m x 0.25m	27.11[a]	43.31[a]	8.254[a]	13.182[a]	59.85[b]
	0.25m x 0.5m	18.59[b]	32.63[b]	5.66[b]	9.93[b]	75.39[a]
P Value		<0.001	<0.001	<0.001	<0.001	<0.001
MSE		0.499	1.229	0.152	0.374	3.923

[a,b] *Means in the same row with different letters show differences ($p<0.05$).*

C. Gain Based Carrying Capacity

Gain based carrying capacity have about 28.28% for combination planting space 1mx1m Li and 0.25 m x 0.50 m Gb until 75.79% for combination planting space 1.00 m x 1.50 m Li and 0.25 m x 0.50m *Gb*. Gain based carrying capacity was highly significant effected by combination planting space, there was combination planting space 1.00 m x 1.50 m Li and 0.25 m x 0.50 m *Gb* have highest gain based on carrying capacity. It is well shown in Table 1.

IV. DISCUSSION

The primary justification for reception of intercropping is to create better return than an unadulterated stand of same land region in a given period. intercropping as a monetary technique for higher creation with lower levels of outside inputs (Wiley 1991). This increased use efficiency is crucial, particularly for small-scale farmers and in regions with a short growing season (Altieri, 1999) and in rainfed areas (Maitra *et al.* 2001a; Maitra *et al.* 2001b). The increased production in intercropping can be attributed to the increased growth rate, increased production of biomass, and effective utilization of space and resources (Telleng 2017). Besides, in any intercropping framework assuming that there are reciprocal impacts among the part crops, creation builds because of less contest among crops (Willey 1991). Intercropping work on the dirt's miniature climate (Salau et al., 2011). Microorganisms in the soil play a crucial role in the mineralization and mobilization of nutrients needed for plant growth, as well as in maintaining the function of the soil. Because of differential rhizodeposition, the microbial local area structure in the rhizosphere may shift with plant species, dietary status of the plant, manganese accessibility, soil type, and mycorrhizal colonization. Expanding N in the dirt is the most proficient technique to build the yield of plant dry matter. Dantata (2014) suggests that depending on the adaptation of the planting pattern and the selection of crops that are compatible, intercropping has an effect on the vegetative growth of the component crops.Intercropping with vegetable is a positive agronomic practice to support crop creation. Plant growth stage is affected by planting space. Diminishing plant thickness with expanding separating makes plants have a more drawn out opportunity to foster their foundations and collect photosynthetic (Telleng et al 2020). It is well shown in Table 1 that intercropping at different spacing had highly significant effects on dry matter yield, carrying capacity and advantage of intercropping. Planting space *Indigofera zollingeriana* in coconut plantation had effect leaf protein content, leaf crude fiber content and stem crude fiber content (Telleng et al 2020).

Intercropping can be an answer for differentiate agroecosystems by utilizing more leguminous yields and furthermore applying less mineral composts (Neugschwandtner and Kaul, 2015). Crop productivity and growth could be boosted through reasonable intercropping (Cecilio et al., 2011), effective utilization of the assets water, nitrogen and radiation (Lithourgidis et al., 2011), macronutrients (Salehi et al., 2018) and micronutrients (Neugschwandtner and Kaul, 2015), yield quality (Klimek-Kopyra et al., 2017) and bring down the harm brought about by infections and nuisances (Hauggaard-Nielsen et al., 2001). Advantages of intercropping vegetables with non-vegetables are made sense of by the integral utilization of assets due for non-contest for a similar asset specialty (Bedoussac and Justes, 2010).

Expanded supplement take-up in intercropping frameworks can happen spatially and transiently. Spatial supplement take-up can be expanded through the rising root mass, while worldly benefits in supplement take-up happen when crops in an intercropping framework have top supplement requests at various times (Anders et al., 1996). When the tree legume leaves were included in the diet, feed intake, live weight gain, and feed conversion all improved as a result of the improved digestibility. Combine dwarf elephant grass, *Gliricidia sepium*, *Leucaena leucocephala* and *Indigofera zollingeriana*, for all criteria, the goats fed the tree legume *Indigofera zollingeriana* recorded the best performance (Anis et al, 2020).

Advantages of intercropping are credited to a more productive usage of limited assets like light, supplements and water (Musa et al 2010). The supplement creation of plants impacted by ripeness pace of the developing media and a few variables of the biotic climate. Brief distance (expanded thickness) increments supplement prerequisite and daylight contest. The rod's capacity to absorb nutrients increased as a result of the plant space's influence on the microenvironment (light, temperature, and humidity) (Telleng et al 2020). Since light is provided from above plants, people that arrange their leaves over those of neighbors benefit straightforwardly from expanded photosynthetic rates and by implication by decreasing the development of those neighbors through conceal (Craine and Dybzinski 2013). Narrower row spacing of 1.00 m x 0.50 m reduced the number of branches (Kumalasari et al 2017). Almost certainly, the incredible separating between nearby plants inside lines upgraded the capacities of the plants to switch the caught sun based radiation over completely to leaf creation (Telleng et al 2015).

V. CONCLUSION

Based on the results of this study, it can be concluded that although the highest dry matter productivity and carrying capacity were obtained in the combination of 1.00 m x 1.00 m legume indigofera and 0.25 m x 0.25 m grass brachiaria, however the most suitable advantage based on carrying capacity in term of dry matter was obtained combination in the size area of 1.00 m x 1.50 m legum indigofera and 0.25 m x 0.50 m grass brachiaria as planting spacing underneath the mature coconuts.

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