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Short Communication

Evaluating Intercropping Taro (*Colocasia Esculenta* L.) with Common Bean (*Phaseolus vulgaris* L.) in Cheha and Silti Districts, Southern Ethiopia

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ABSTRACT

Taro is a staple food for millions of people and it is commonly grown by small scale farmers. As taro is long duration crop and develops slowly during its early growth, it has the potential for intercropping during this period. The crop has been intercropped with longer maturing crops such as coffee and other fruit trees. Intercropping of short duration crop appears most suitable to improve land usage and food security for small-scale farmers. A field experiment was conducted in Cheha district of Guraghe zone and Misrak silti district of Siltie zone in 2019 and 2020 cropping seasons to evaluate taro and common bean intercropping. Four treatments (sole taro, sole common bean, 1taro:1common bean and 1taro:2common bean) were involved. Both 1taro:1common and 1taro:2common bean intercropping was advantageous over sole cropping of the component crops. Due to easy workability1taro:1common bean is advisable. Since, improved implements cannot be used efficiently;this practice is practical in areas where intensive agriculture is the peculiar option to improve crop production where there is no labor shortage.

Keywords: Land equivalent ratio; Intensive agriculture; Sole cropping; Intercropping

INTRODUCTION

Taro belongs to avoid family (Aracaceae) and it is in the genus *Colocasia*. It is widely produced throughout the world for its underground corms [1]. Plants of the genus *Colocasia* are edible aroids with large leaves and one or more food storing in their underground stems (corms) [2]. Taro plant is best planted in soil with pH around 5.5–5.6 and in an environment that is high in humidity with rainfall level of 1000 mm each year and optimum temperature around 21°c –27°c [3]. Permanently moist soils appear to be most desirable to maximize growth and yield [4].

Taro is a staple food for millions of people and it is commonly grown by small scale farmers who operate within the subsistence economy. The crop yield well if the annual average rainfall is at least 1500 mm and is evenly distributed throughout the growing season.

Taro is mostly produced and consumed on a subsistence basis and surpluses are sold as cash crops, which plays a huge role in combating poverty [5]. Its primary use is the consumption of its edible corms and leaves, since they are a good source of carotene, potassium, calcium, phosphorus, and iron [6].

Taro is naturally a perennial monocotyledonous herb, but for practical purposes is harvested after 5 to 12 months of growth. It grows to a height of 1 to 2 m consisting of a central corm, lying just below the soil surface, from which leaves grow upwards, roots grown downwards, while cormels, daughter corms and runners grow laterally [7-9].

As taro is long duration crop and develops slowly during its early growth, it has the potential for intercropping during this period. It has been intercropped with longer maturing crops such as coffee and other fruit trees. Intercropping of short duration crop appears most suitable to improve land usage and food security for small-scale farmers. Farmers are complying to grow taro due to its long time to mature.

Intercropping is more beneficial when the two crops are morphologically different. Very important point in intercropping is to select the best ratio of the component crops, which result in the lowest competition and the highest yield. Hence, this research evaluated intercropping taro with different ratios of common bean in the study areas.

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MATERIALS AND METHODS

Description of the study areas

The field experiment was conducted in 2019 and 2020 at Cheha district of Guraghe zone and Misrak Silti district of Siltie zone, Southern Nations Nationalities and Peoples' Regional State of Ethiopia. Cheha is situated at 08o10'18"N and 037o50'15"E, and altitude of 1945 m.a.s.l. Misrak Silti is located at 07o55'56"N and 038o21'58"E, and 1824 m.a.s.l. Rainfall is distributed between the short rainfall season (March to April) and the main rainy season (June to September). The rainfall pattern is, however, extremely variable with high probability. Mixed crop-livestock farming is the dominant economic activity in the rural areas.

Treatments, design and data collection

Four study treatments (sole taro, sole common bean, 1taro: 1common bean and 1taro:2common bean) were laid out in randomized complete block design with four replications. Boloso-I tarovariety was planted at spacing of 80 cm and 40 cm inter and intra row spacing, respectively both in sole and intercrops. Common bean was sown at inter and intra row spacing of 40 cm and 20 cm, respectively. 'Hawassa dume' common bean was sown at first cultivation time of taro. Taro was sown before start of rain. The component crops were harvested separately from the whole plot. Seeds of common bean was weighed and adjusted to moisture levels of 10%. The fresh total tuber yield was measured on plot basis.

The relative advantage of intercropping compared to sole crop was calculated for each intercropping system using total land equivalent ratio (LER) as:

LER= Yij/ Yii+ Yji/Yjj

Where Yiiand Yjjdenote yields of crops i and j in sole crop and Yijand Yjiare the corresponding yields in intercrop. Also, Relative Total Yield (RTY) which is used to examineresource demand status of component crops wasdetermined by:

RTY=p1/m1+p2/m2where, p1 and p2 are the yields of two crops in intercropping, and m1 and m2 are the yields of each cropin a monoculture system. Values of RTY>1 indicate thatthe species make different demands on resources oravoid competition in some way, while values of RTY< 1imply mutual antagonism, RTY values of 1 indicate that the components fully share the same limiting resources.

RESULTS AND DISCUSSION

Effect of intercropping on yield of component crops

Analysis of variance of yield of taro reveled that there was none significant differences ($p>0.05$) between sole and intercropping of the component crops in both Cheha and MisrakSilti experimental sites. Also the yield of common bean was not significantly affected by intercropping.

This means that intercropping did not adversely affect the yield of taro and common bean (Table 1).

Land Equivalent Ratio (LER)

Land Equivalent Ratio (LER) was calculated for intercropping treatments to determine advantage to be realized from the intercropping. Intercropping in this experiment gave LER greater than 1.0. Both1taro:1common bean and 1taro: 2common bean ratio intercropping showed advantage over sole cropping of taro and common bean (Table 1).

Table 1: Effect of intercropping on yield of component crops in Cheha and MisrakSilti.

Treatment	Cheha				MisrakSilti			
	T (t/ha)	Cb (kg/ha)	LER	RYT	T (t/ha)	Cb (kg/ha)	LER	RYT
ST	32.59	-	1.00b	-	29.01	-	1.00b	-
SCb	-	2425	1.00b	-	-	2303	1.00b	-
1 T:1Cb	27.63	1900	1.55a	0.92	28.30	1947	1.81a	0.95
1 T:2Cb	26.15	2050	1.51a	0.89	20.15	1805	1.68a	0.69
LSD(0.05)	Ns	ns	0.24	-	ns	ns	0.41	-
CV (%)	10.97	19.80	12.04	-	16.98	20.20	12.56	-

Cb=common bean, T=taro, ST=Sole Taro, SCB=Sole Common Bean, LER=land Equivalent Ratio, RYT=Relative Yield Total

Relative Total Yield (RTY)

For both the intercrops the value of relative yield total, which is used to examine resource demand status of component crops is smaller than 1 in both Cheha and Silti experimental sites. This indicates that the component crops are slightly competing for the same limiting resource. Relatively 1taro:1common bean intercropping showed higher RTY value compared to 1taro: 2common bean indicating that there is higher resource competition between taro and common bean in 1taro:2common bean intercropping (Table 1).

CONCLUSION AND RECOMMENDATION

Based on the results, in both experimental sites, intercropping of taro with common bean is recommended. For better workability and to reduce resource competition, it is recommended to use 1taro:1common bean. This practice is practical for small scale farmers for whom the intensive agriculture is peculiar option to improve food security where there is no labor shortage.

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