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Studies on Intercropping Capsicum (*Capsicum annum* L.) with Bushitao (*Vigna unguiculata* L.)

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Abstract

Intercropping is the space dependent form of cropping system. It is growing two or more crops grown simultaneously on the same field. Capsicum (*Capsicum annuum*) and cowpea (*Vigna unguiculata*) are two important vegetable crops grown throughout the year in the Eastern region of Sri Lanka and is a suitable combination for intercropping. An attempt was made to study the effect of cropping system on the growth of capsicum (*Capsicum annuum)* intercropped with bushitao (*Vigna unguiculata)* and to select the suitable cropping system. This experiment was laid out in Randomized Complete Block Design (RCBD) with six treatments and four replicates. Sole cropping and intercropping (alternate row planting and paired row planting) of capsicum and bushsitao were practiced in this study. It was noted that intercropping system did not change the growth (plant height or number of leaf per plant) of capsicum or bushitao when increased plant population per unit area. Average yield of capsicum ranged from 5.4 to 6.4 tons/ha. The yield of capsicum in the sole crop was slightly higher (6.4 tons/ha) than other treatments. In the present study, 30/60 cm-paired rows planting of capsicum is the suitable cropping system in the sandy regosol.

Introduction

The subsistence farmers commonly use age-old farming practices worldwide especially in the continents of Asia, Africa and South America. Multiple cropping is a widespread practice throughout the tropics [1]. It is estimated that 98% of cowpeas, probably the most important legume in Africa, is grown in association with other crops [2]. Mixed cropping practices could well be advantageous in traditional cropping system. In Sri Lanka, where population is already high and farm size is small. An attractive strategy for increasing productivity per unit area of available land is to intensify the land use. This can be done by growing several crops simultaneously or in succession with each other in farms devoted to short maturing annul crops. In Sri Lanka, many researchers have worked out intercropping with cereals and other crops. However, there is no evidence on the feasibility and effects of intercropping (alternate row planting and paired row planting) yield-wise.

Cowpea is a very important subsistence crop and is part of several foodstuffs found in the world. Cowpea is thus an integral component of crop and livestock farming systems in the world. It is a leguminous plant with seeds that are very rich in protein. Cowpea gives good yield under adverse climatic condition. The plant's ability to fix atmospheric nitrogen helps maintain soil fertility. In Sri Lanka, capsicum is cultivated all parts of the country throughout the year when climate is favoured. Cowpea (*Vigna unguiculata*) and capsicum (*Capsicum annuum*) is a suitable combination for intercropping because both crops have the outstanding potential for heat-loving, drought-tolerant, shade tolerant and lower soil fertility requirements than many other crops [3].

Cowpea will plant within the capsicum rows or alternative rows due to their exceptional shade tolerance and their deep roots systems [4]. Crop intensification is in both time and space dimensions. Farmers manage more than one crop at a time in the same field. Dry zone has a good scope for intensifying cultivation if suitable cropping system is adopted. Therefore, this study was aimed to select the suitable planting system for intercropping of capsicum and cowpea in the Eastern region.

Materials and Methods

This experiment was carried out at the Agronomy farm, Eastern University of Sri Lanka to study the effect of planting pattern of capsicum intercropped with vegetable cowpea (bushitao) on its growth and to select the best planting system that gives higher yield. This experiment was laid out in Randomized Complete Block Design (RCBD) with six treatments and replications. A spacing of 0.5 m separated the plots from each other. Each plot size was 1.7 m x 1.7 m. The land was prepared by two-wheel tractor before planting. Leveling of the land was done manually with mammoty. Then well-decomposed cow-dung was broadcasted uniformly at the rate of 10 mt per ha and incorporated into the soil one week before transplanting.

Treatments

Six treatments used in this study were T1, T2, T3, T4, T5 and T6 as shown in Figure 1. Capsicum variety, CA 8 is widely used as vegetable and was obtained from the Agronomy farm, Eastern University of Sri Lanka. Vegetable cowpea variety, bushitao was bought from the Department of Agriculture.

Nursery Management

Nursery beds (1.8 m x 1 m) were prepared. Paddy straw and plant debris were burnt on the prepared beds then decomposed cow-dung was incorporated into the soil at the rate of 3 kgm^{-2}. Seed treatment was done using captan at the rate of 375 g per 100 kg seeds to control fungal disease. Seeds of capsicum were sown at the depth of 1 cm in rows, 15 cm apart and covered with straw mulch. Seedlings were maintained for 4 weeks in the nursery bed.

Planting and After Care Operation

Four week-old seedlings of capsicum collected from nursery bed were transplanted at the specified spacing as mentioned in Figure 1. Shade was given to the seedlings soon after transplanting until well established. Cowpea seeds were then sown between the capsicum (base crop) rows and the spacing of cowpea seeds was reduced in successive treatments to identify optimum crop density. Seven days after

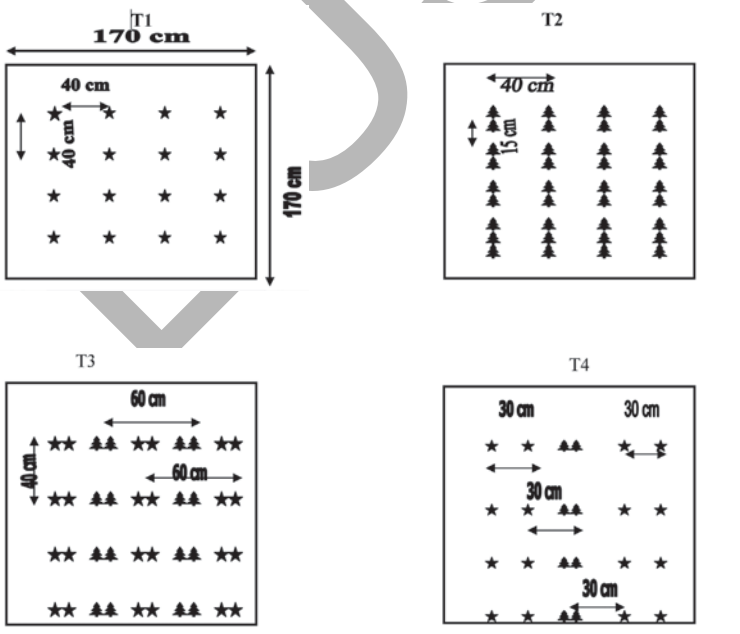
transplanting of capsicum, all vacant hills were filled with seedlings. All the cultural practices were done as recommended by Department of Agriculture, Sri Lanka.

Measurements

Plant height and number of leaves of five plants from each plot were taken to determine the growth of the capsicum and cowpea at 30 days after planting and then continued once in 15 days. Pods of capsicum were picked separately from each plant when they reached harvestable stage and their number was counted. Fresh weight of picked capsicum was thereafter recorded using an electronic balance. Five pickings were done during the period of 45-80 days after planting of capsicum.

Statistical Analysis

The data were analysed using SAS version 6.3. The means were compared using Duncan's Multiple Range Test at 5% level.



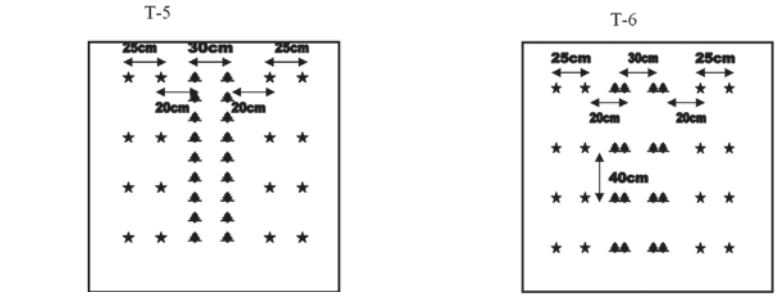


Figure 1: Diagrammatic illustration of capsicum and bushitao in each treatment

Results and Discussion

This experiment was done for the purpose of finding out whether the change in planting system would influence the growth and yield of capsicum and bushitao intercropping.

Plant Height

The average height of capsicum planted as base crop ranged from 27.9 cm to 33.0 cm at 60 days after transplanting (Figure 2). The plant height of capsicum in treatment T1 at 45 days after planting was significantly different from other treatments at P =0.05 and there was no significant difference in plant height between the treatments T4 and T6. The plant heights of capsicum at 30 and 60 days after planting were not significantly different among the tested treatments. The variations in plant height might be attributed to shading created by closed planting and competition for light. The results showed that the plant heights of bushitao at 30, 45 and 60 after planting were not affected either by planting of monocropping or by intercropping capsicum (Figure 3). The plant height in capsicum is influenced by photoperiod, temperature and available moisture. Intercropping between high and low canopy crops are common practices in tropical agriculture and to improve light interception.

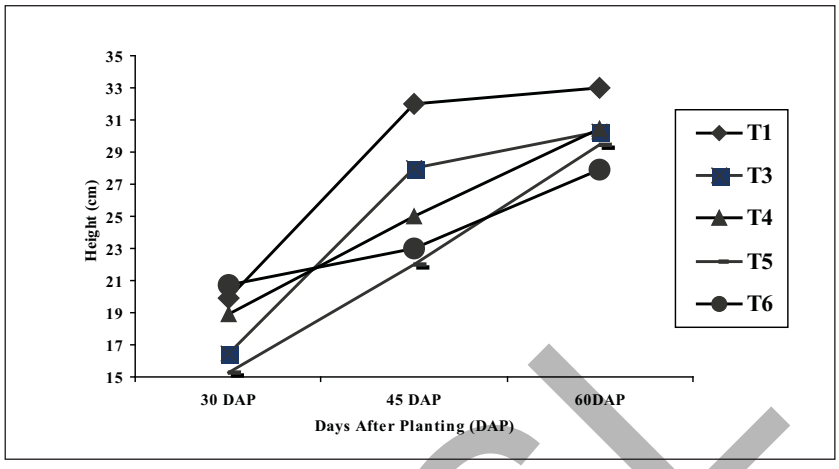


Figure 2: The mean height of capsicum (planted as a base crop) at different periods after transplanting

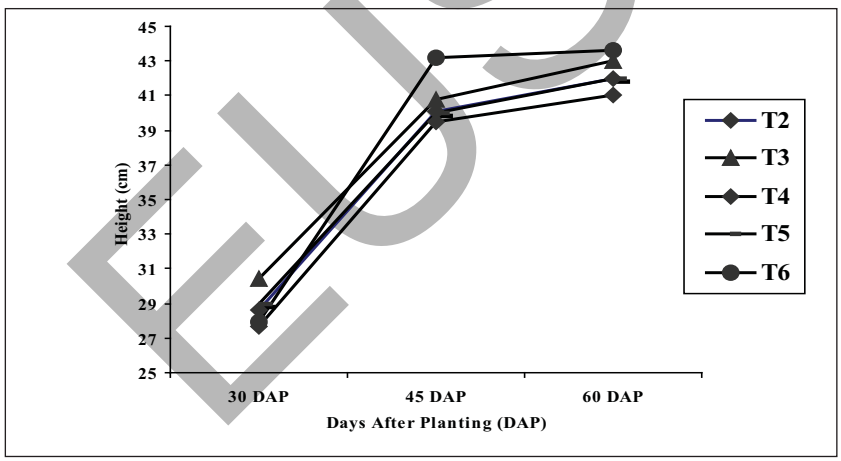


Figure 3: The mean height of cowpea (planted as intercrop) at different periods after planting

Leaf Number

The average leaf number of capsicum planted, as base crop ranged from 86.1 to 63.0 at 60 days after transplanting (Figure 4). The leaf number of capsicum in treatment T1 at 30 days after planting was significantly different ($P<0.05$) from other treatments. And the

leaf number of capsicum at 45 and 60 days after planting were not significantly different among the treatments. The results showed that the leaf number of bushitao at 30, 45 and 60 after planting ware not affected either by planting of monocropping or by intercropping with capsicum (Figure 5). The performance of the intercropped sorghum was significantly better than that of the monoculture in terms of plant height, dry matter, leaf number and leaf area index [5].

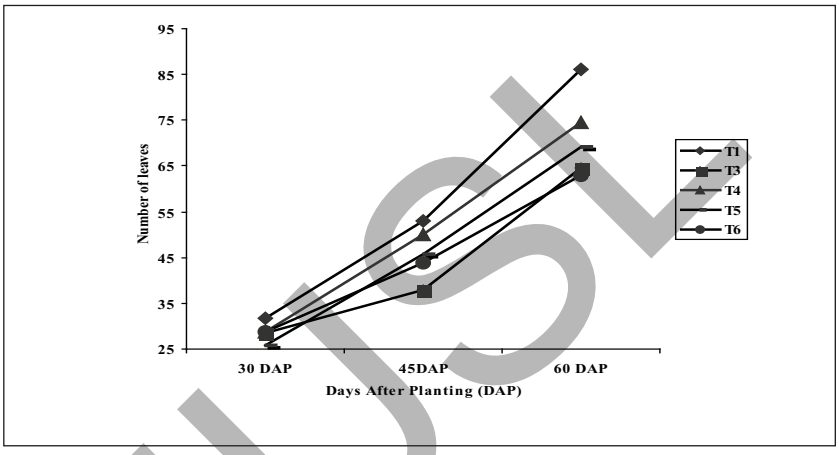


Figure 4: The mean number of leaf per capsicum plant at different periods after transplanting

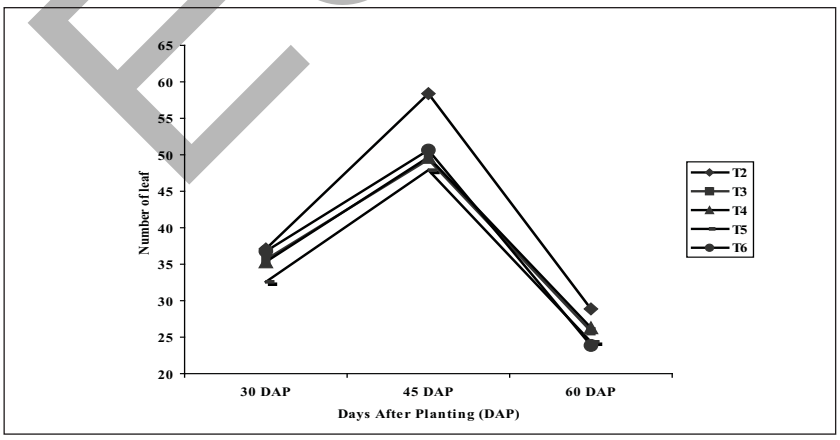


Figure 5: The mean number of leaf per bushitao plant at different periods after planting

Pod Yield

The pod yield of capsicum in each treatment is showed in Table 1. There were no significance differences among the tested treatments. Average yield of capsicum ranged from 5.4 to 6.4 tons/ha. The pod yield of capsicum in sole crop showed slight increase compared to other treatments. This may be due to light and nutrient competitions between capsicum and bushitao. In paired row or alternate planting system (intercropping system) compared to monoculture system, light intensity is an important constraint for higher yield of the crops. The pod yield of bushitao was high (2.1 ton/ha) in treatment T2.

Table 1: Yield of Capsicum and Bushitao in each treatment

Treatment	Yield (tons/ha)	
	Capsicum	**Bushitao**
T1 (capsicum – sole crop)	6.40	-
T2 (bushitao – sole crop)	-	2.10
T3 (intercropping - alternate planting system)	5.80	1.70
T4 (intercropping – 30/60 cm paired row planting system)	6.20	1.00
T5 (intercropping – 25/70 cm paired row planting system; Bushitao – one plant per hill)	5.40	1.75
T6 (intercropping - 25/70 cm paired row planting system; Bushitao – two plants per hill)	5.60	1.60

Low plant population per unit area is one of the causes for low yields. A sizeable income would be produced through intercropping system to improve the low income of the farmers in the Eastern region. Crops shown as intercrop combination may be able to make better overall use of resources than when growing separately [6]. The biggest complementary effects and thus biggest yield advantages have been seen to occur when components crops have different growing periods and therefore make their main demands on resources at different times [7, 8, 9 &10].

Conclusion

The present results showed that modification of planting pattern of capsicum would make intercropping of bushitao feasible in the Eastern region. Pod yield of capsicum planted as base crop, increased in sole cropping than in intercropping. However, there was no significant difference in its yield by paired row planting when maintaining a constant population or alternate planting system as compared to monocropping of capsicum. In this study, base and inter crops are capsicum and bushitao respectively. 30/60 cm-paired row planting of capsicum (treatment T4) is the most productive system in the sandy regosol.

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