Original Research Article

PERFORMANCE OF GINGER (*Zingiber officinale)* UNDER MULTIPURPOSE FOREST AND FRUIT TREE SPECIES IN MID ELEVATION AREAS OF CONNER, APAYAO

ABSTRACT

This study was conducted to determine the growth and yield performance of ginger integrated as cash crop in Guina-ang, Conner, Apayao. Ginger cultivated under multipurpose forest and fruit tree species in mid elevation areas. Specifically, to determine the performance of ginger in the partially shaded areas in terms of plant height, number of tillers, number of leaves/ tiller, length of leaves, length of rhizomes, width of rhizomes, weight of rhizome and total weight of harvested rhizomes. Two cropping combinations were used in the study. Results of the study showed that the ginger plants cultivated under Forest Trees + Coffee + Banana + Mangosteen + Ginger + Tannia crop combination had significantly higher plant height (68.80 cm), number of tillers (11.90), number of leaves/tiller (15.10), length of leaves 22.80 cm), length of rhizomes (24.20 cm) , weight of rhizome (78.53g) and total weight of harvested rhizomes (40.50 kg) compared with ginger cultivated under Forest Trees + Lanzones + Cacao + Black Pepper + Ginger cropping combination . However, no significant difference was recorded in the width of rhizomes between the two cropping combinations.

Keywords : ginger, growth, yeild, cropping

INTRODUCTION

Ginger, scientifically known as *Zingiber officinale Rosc.* is one of the earliest important species grown in the Western hemisphere reported to be a native of Southeast Asia. Locally, it is popularly known as luya or laya. In the Philippines, it is grown as an important spice crop. It is used as a raw material in the production beverages, perfumes and medicines.

Ginger requires a warm temperature (29-35 ° C) and a humid climate for growth. It also requires a distinctive pattern of rainfall of at least 150 to 200 cm during the growing period and no rainfall a month prior to harvest. In the absence of rain, however, adequate irrigation is essential. Ginger also thrives on fairly high rainfall-about 3,000 mm on the average. Although able to grow at sea level or up to 1,500 meters above it, ginger thrives at an optimum elevation of 300-900 meters.Being a shade tolerant crop, ginger can be grown with tall crops and crops that grow on poles. An experiment shading using wooden slots showed that 25 to 50 percent shading resulted in optimum yield.Ginger grows best on sandy loam, clay loam and porous deep soils.Soil must be well-drained, friable and rich in organic matter [1]. There is high domestic demand for ginger. It can be harvested as young ginger (3–4 months) or mature ginger (8 –9 months) [2].

The Conservation Agriculture in Forest Ecosystem (CAFÉ) Project was established as a demonstration project of the Apayao State College in 2015 to develop suitable forest-based farming systems to increase the income of the upland farmers. This project of the College enable the farmers to better exploit opportunities to produce high value commercial crops under existing forest cover as a path to poverty reduction, better food security, and stimulation of the rural economy and preserving the grandeur of Apayao's forest cover. The integration of ginger in the cropping combinations of the CAFÉ project was done to maximize the utilization of the area.

In this study, the two areas were cultivated with ginger. The first area Forest trees + Fruit Trees Cacao + Lanzones + Ginger and Forest Trees + Coffee + Banana+ Mangosteen + Ginger + Tannia) were planted to evaluate its growth and yield performance on the partially shaded areas of the CAFÉ Project.

OBJECTIVES

This study was conducted to determine the performance of ginger integrated cash crop in the CAFÉ Project site. Specifically, ginger was cultivated two cropping combinations under multipurpose forest and fruit tree species in mid elevation areas of Conner, Apayao to determine difference in the performance of ginger in the partially shaded areas in terms of plant height, number of tillers, number of leaves/ tiller, length of leaves, length of rhizomes, width of rhizomes, weight of rhizome and total weight of harvested rhizomes.

METHODOLOGY

Description of the Experimental Site.

A one hectare upland area owned by Mr. Romeo Banco located at Guina-ang, Conner, Apayao was chosen as the experimental area. Specifically, it is located at 17^{o} 52'N and 121^{o} 14'E with an elevation of about 580 MASL. The CAFÉ site is bounded in the north by Sitio Buguit, Guina-ang, in the east by Manag, in the south by Centro Guina-ang, and in the west by Baduat, Kabugao. It has a semi-rolling topography with slopes up to 65^{o} on sandy clay loam type of soil

Selection of Varieties

The variety of ginger (Native) which was commonly planted by the farmers in the locality was chosen as experimental plants.

Experimental Treatments and Design.

Ginger was integrated in two (2) of the eight (8) cropping combinations of the CAFÉ Project site. The area utilization in the CAFÉ Project was designed at 20% forest trees, 20% fruit trees, 10% infrastructures and 50% cash crops. The cropping combination included:

Cropping Combination 1. Forest Trees +Lanzones + Cacao + Black Pepper + Ginger

Cropping Combination 2. Forest Trees +Mangosteen + Coffee + Banana + Ginger + Mungbean

Planting

Each of the rhizomes was cut into smaller pieces of about 15-20 g in weight. Each of the seed rhizomes contained 2 – 3 point buds. Planting of the seed pieces at 5 cm. deep at the ridges of the furrows, 30 cm between hills.

Inter Tillage and Cultural Management

Weeding was done manually and the weed materials were used as mulching for the ginger plants. Since the study area was in a hilly forest zone, the plants were dependent on rainfall for its water needs.

Harvesting and Determination of Yield

Harvesting of ginger was done when stalks exhibit yellowing and withering (about nine months after planting).

Statistical Analysis of Data

Data gathered for various characteristics were subjected to t- test to compare the performance of ginger in two cropping combinations.

Agronomic data Gathered

The different parameters gathered included plant height, number of tillers, number of leaves per tiller, length of leaves, length of rhizomes , width of rhizomes, weight of rhizome and total weight of harvested rhizomes.

RESULTS AND DISCUSSION

Table 1. Plant height, number of tillers, number of leaves/ tiller and length of leaves of the ginger plant

Cropping Combination	Plant height (cm)	Number of tillers	Number of leaves/ tiller	Length (cm) leaves
Cropping Combination 1	50.3	8.5	12.4	20.2
Cropping Combination 2	68.8	11.9	15.1	22.8
t-value	6.635	5.949	4.439	3.153

Plant Height (cm)

As viewed from Table 1, the ginger plants cultivated under Forest Trees + Mangosteen + Coffee + Banana + Ginger + Mungbean combination were taller compared with ginger cultivated under Forest Trees + Lanzones + Cacao + Black Pepper + Ginger combination with means of 68.8 cm and 50.3 cm. Moreover, t- test result disclosed that there is significant difference in plant heights of the ginger in the two cropping combinations.

Number of Tillers

There were more number of ginger tillers in cropping combination 2 compared with cropping combination (8.5). t- test revealed a highly significant difference between the ginger cultivated in the two areas.

Number of Leaves per Tiller

In terms of number of leaves per tiller, results also revealed a highly significant difference between the treatments.

Length of Leaves (cm)

The length of leaves of the sample plants is presented in Table 1. It can be noted that there were significantly difference in terms of length of leaves of the ginger plants. The ginger cultivated under Forest Trees +Mangosteen + Coffee + Banana + Ginger + Mungbean cropping combination resulted 22.8 cm compared with 20.2 cm in the other cropping combination.

Table 2. Length of Rhizome, Width of Rhizome, and Weight of Fresh Rhizome

TREATMENTS	Length Rhizome (cm)	Width Rhizome (cm)	Weight of Fresh Rhizome (g)
Cropping Combination 1	**19.7**	**3.84**	**59.01**
Cropping Combination 2	**24.2**	**3.95**	**78.53**
t- value	**6.315**	**0.926**	**10.222**

Length of Rhizome (Cm)

There was significant difference in the length of the rhizome of the ginger in the two treatments. The cropping combination resulted with mean length of 19.7 cm and 24.2 cm, respectively

Width of Rhizome (Cm)

There was no significant difference on width of rhizome of the two crop combination. The gingers cultivated in the two cropping combination had nearly similar width of rhizome of 3.84 cm and 3.95 cm.

Weight of Fresh Rhizome (kg)

As presented in Table 2, the weight of fresh rhizome registered means of 59.01 grams and 78.53 grams and revealed highly significant differences.

Table 3. Total weight harvested rhizomes

TREATMENTS	TOTAL WT HARVESTED RHIZOMES (kg)
Cropping Combination 1	28.75
Cropping Combination 2	45.5

Total weight harvested rhizomes

The total weight of the rhizomes of ginger cultivated under Forest Trees + Mangosteen + Coffee + Banana + Ginger + Mungbean cropping combination was 45.5 kg which is much higher from that of the total weight of the rhizomes in cultivated under Forest Trees +Lanzones + Cacao + Black Pepper + Ginger cropping combination with 28.75 kg. Ginger is a shade loving crop known to grow under tree shades and able to take advantage of the decaying leaves which drop from the trees to become a source of nutrients like humus. Both shade and humus help to improve ginger yields [3]. In addition, the partially shaded growing condition favors optimum growth and yield of ginger [4]. The use of large seed rhizomes is essential in maintaining high rhizome yield of ginger [5].

CONCLUSION

The ginger plants cultivated in of the CAFÉ Project site under Forest Trees + Coffee + Banana+ Mangosteen + Ginger + Tannia crop combination have significantly higher plant height, number of tillers, number of leaves/ tiller, length of leaves, length of rhizomes ,

weight of rhizome and total weight of harvested rhizomes compared with ginger cultivated under Forest Trees + Lanzones + Cacao + Black Pepper + Ginger combination . However, no significant difference in the width of rhizomes.

RECOMMENDATION:

It is highly recommended that:

1. A follow-up study be conducted for another cropping season
2. Another study be conducted to evaluate the effect of the bio-fertilizers on the crops

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