

PERFORMANCE OF COTTON UNDER FRUIT BASED AGROFORESTRY SYSTEMS IN THE HIGH GANGES FLOOD PLAIN ECOSYSTEM OF BANGLADESH

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ABSTRACT

A study was conducted at Kedargonj area of Chuadanga district to know the performance of hybrid cotton in association with papaya, mango and litchi plants and assess the profitability. The land was medium high belonging to High Ganges Flood Plain (AEZ 11). The experiment was laid out in RCBD with four replications. The study revealed that the highest plant height was recorded in litchi field but the highest sympodial branch, boll per plant and yield of cotton was found in open field. Among the fruit trees, the highest yield of cotton was found at papaya field and the lowest yield of cotton was found in litchi field as a agroforestry system. Economic evaluation revealed that papaya + cotton was the most profitable agroforestry system.

Key words: Hybrid cotton, Fruit based agroforestry

INTRODUCTION

Cotton (*Gossypium hirsutum*) is an important natural fiber in the world (Munro, 1994) belongs to the family Malvaceae. It is grown primarily as a fiber crop, but after the lint, the long, twisted unicellular hairs are removed by ginning, the seed can be crushed to extract vegetable oil and protein rich animal food (Mathews, 1989). Cotton is grown in more than 80 countries all over the world. It provides food, feed, fiber and fuel. It sustained millions of people for their livelihood at farms, ginning factories, textile mills, edible oil and soap industry, etc. In Bangladesh, the annual requirement of raw cotton for textile industry is estimated at 1.7-1.8 million bales against the local production of about 0.1 million bale. Since 1977-1978 growing season, country's total area under cotton production experienced a grater jump from one thousand ha to over 24 thousand ha in mid-eighties. During the recent year, there has been a great deal of fluctuations in area under cotton, generally showing down trend. The area and production seemed to have stabilized at around 45000 ha and 85000 bales (Alam, 2005). It is estimated that the country has at least 250000 ha of land suitable for cotton cultivation (Alam, 2005).

Most of the arable land in Bangladesh is intensively used for food production, because the country is running shortage of food grains. For achieving self-sufficiency in food grain about 80 percent of arable lands are used for food grain (e.g. rice and wheat) production causing decline in area of other cash crops, including cotton. In agroforestry system, use of tree species whether fruit tree or timber tree depends on landscape and choice of farmers. Besides forest landscape, farmers would grow fruit trees because of multipurpose products and regular income. Trees not only provide suitable ecology for the understorey crops but also produce other basic requirements to the growers such as food, fodder, fuel wood and timber. The average annual net returns of the traditional agrisilvicultural practices were found much higher than the agriculture (Abedin and Quddus, 1991). Fruit plays a very important role at present days, as food as medicine and many other socio-economic aspects. Standard of living depends on fruit consumptions. Fruit contains almost all type of nutrient components but due to presence of vitamins, minerals and easy absorbable sugar (assimilation is easy), vitamins and minerals but due to boiling or cooking, most of the nutrient gets lost. Fruit as taken raw retains all of these nutrients and body can absorb them easily. There are different fruit gardens in the North-Western part of Bangladesh.

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Mango, Papaya and litchi are important fruits of in the North-Western part of Bangladesh. More than 65500 ha of lands are under mango, papaya and litchi production (BBS, 2008). Papaya is an important for nutritional source of certain vitamins and minerals. The area under mango cultivation in Bangladesh is more than 51000ha. The five years average data (2001-02 to 2005-06) showed that area under papaya cultivation in Bangladesh is about 12850 acres with production of 70 thousand metric tones (BBS, 2008). Litchi also was produced in about 5700 ha (BBS, 2008). High Ganges Floodplain agro ecological zone has the opportunity of cotton production in the orchards as agroforestry system. Hence an experiment was conducted to evaluate the growth and yield of cotton under fruit based Agroforestry Systems and to assess the profitability of fruit based agroforestry system in the High Ganges Flood Plain Ecosystem of Bangladesh.

MATERIALS AND METHODS

The experiment was carried out at Kedargonj area of Chuadanga district during July 2010 to March 2011. The land was medium high belonging to High Ganges Flood Plain (AEZ 11). The experiment was laid out in RCBD with four replications. Existing tree species (3 years old) viz. papaya, mango and litchi (5 years old) in the crop field were used. Unit plot size was 8 m X 8 m. Spacing of papaya was 3 m but mango and litchi spacing was 8 m. Cotton was sown in early August and harvested in January and February. Management practices of cotton were kept as per recommendation. Cotton yields were recorded and converted to ton per hectare. Data on yield and yield components of cotton were recorded and analyzed statistically after Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant Height

Plant height of cotton was grown under different fruit tree responded significantly (Figure 1). The tallest plant (131 cm) was recorded in litchi field which was followed by mango and papaya field. Plant height of cotton grown under mango and papaya field was statistically similar. The shortest plant (120 cm) was found in open field condition.

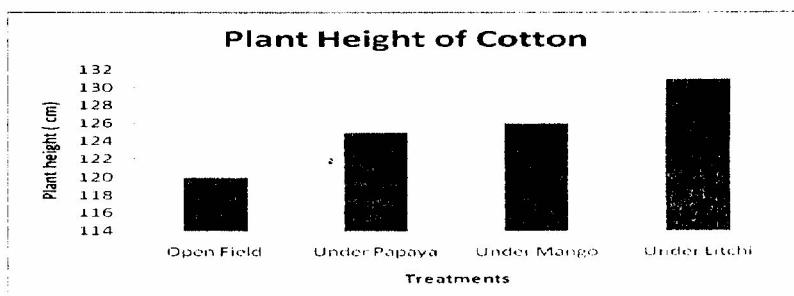


Fig. 1. Plant height of cotton grown with different fruit trees and open field condition

Sympodial branch

Number of sympodial branches (primary fruiting branch) per plant of cotton was varied significantly (Figure 2). Cotton plant grown at open field condition produced the highest number of sympodial branches per plant (16.9). The lowest number of sympodial branches per plant was recorded at litchi field.

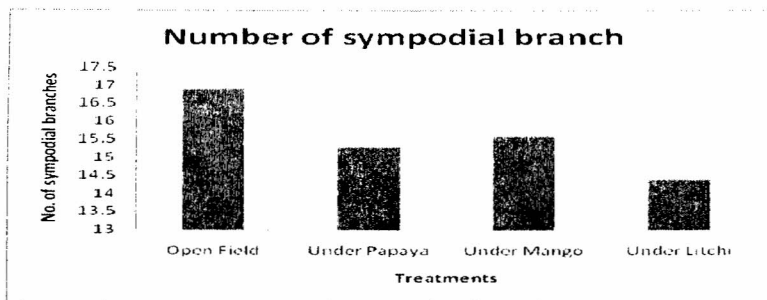


Fig. 2. Sympodial branches of cotton grown with different fruit trees and open field condition

Number of boll per plant

Cotton grown under different fruit trees were significantly influenced the number of bolls per plant (Figure 3). The highest mean number of boll per plant (40.50) was observed at open field condition, which was followed by papaya and mango field. The lowest number of boll per plant was observed at litchi field (30.0).

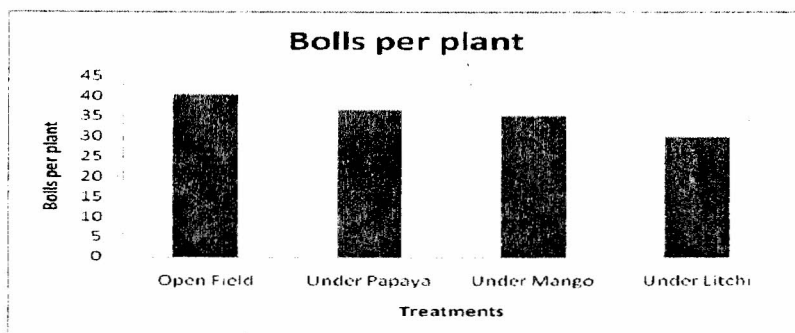


Fig. 3. Boll per plant of cotton grown with different fruit trees and open field condition

Boll weight

Individual boll weight is an important component of the yield and found significant difference among the different fruit tree based agroforestry system (Figure 4). The single boll weight varied from 4.51g to 4.43g. The highest single boll weight (4.51 g) was recorded in open field condition which was followed by papaya (4.47 g) and mango field (4.44). The lowest single boll weight (4.43 g) was observed in the litchi field.

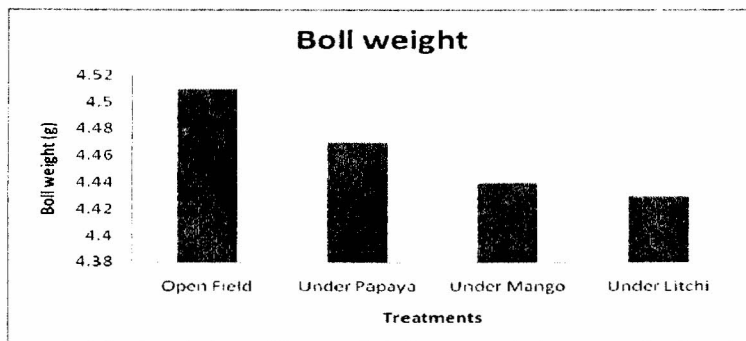


Fig. 4. Boll weight of cotton grown with different fruit trees and open field condition

Seed cotton yield

The weight of seed cotton was significantly influenced by different fruit tree based agroforestry system (Fig. 5). The yield of seed cotton ranged from 2311 to 3179 kg ha⁻¹. The highest seed cotton yield was recorded in open field condition (3179 kg) which was followed by papaya (2657 kg) and mango field (2537 kg). The lowest seed cotton yield was recorded in litchi field (2311 kg).

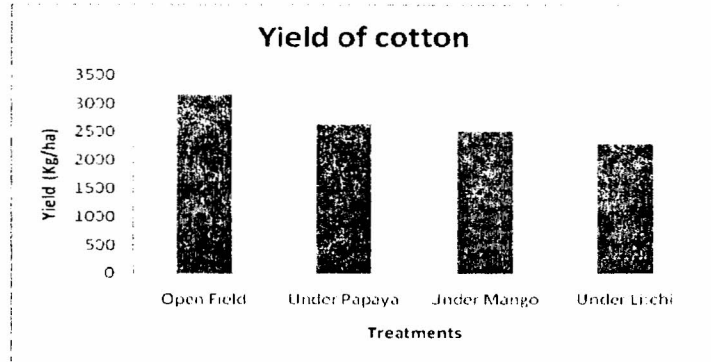


Fig. 5. Seed cotton yield grown with different fruit trees and open field condition

Economic Evaluation

The economic evaluation (Table 1) showed that the highest BCR was recorded in open field condition (3.53) followed by papaya (2.95) and mango (2.82) field. The lowest BCR was found in litchi field (2.57).

Table 1. Economic evaluation of cotton through BCR in fruit based agroforestry system

Treatment combination	Gross Return (Tk ha ⁻¹)	Cost of production (Tk ha ⁻¹)	Net Return (Tk ha ⁻¹)	BCR
T ₁	190800/-	54000/-	136740/-	3.53
T ₂	159420/-	54000/-	105420/-	2.95
T ₃	152220/-	54000/-	98220/-	2.82
T ₄	138660/-	54000/-	84660/-	2.57

T₁= Open field, T₂ = Cotton with Papaya, T₃ = Cotton with Mango, T₄ = Cotton with Litchi, Cotton price: 60/- per Kg

The highest income was recorded cotton + papaya based agroforestry system (Tk. 734600 ha⁻¹ yr⁻¹) which was followed by cotton + litchi (Tk. 722400 ha⁻¹ yr⁻¹) and cotton + mango (Tk. 624900 ha⁻¹ yr⁻¹)

Table 2. Yield and Economic evaluation of different tree and cotton combinations at fruit based agroforestry system

SL no.	Tree and Cotton Combination	Yield (t ha ⁻¹ yr ⁻¹)	Income (Tk ha ⁻¹ yr ⁻¹)	BCR
1	Sole Cotton	3.18	190800/-	3.53
2	Sole Papaya	50.00	500000/-	6.67
3	Sole Mango	8.34	417000/-	5.56
4	Sole Litchi	556000 (No. ha ⁻¹ yr ⁻¹)	556000/-	7.41
5	Cotton + Papaya	2.66 +57.5	159600 /- +575000/- =734600	9.79
6	Cotton + Mango	2.54 +9.45	152400/- +472500/- =624900/-	8.33
7	Cotton + Litchi	2.31 +583800 (No)	138600/- +583800/- =722400/-	9.63

Papaya price: 10/- per Kg, Mango price : 50/- per Kg, Litchi price : 1/- per piece

CONCLUSION

In respect of cotton yield, the highest yield was found in open field condition, but among the tree plot, higher yield was recorded in papaya field which was followed by mango and litchi field. From the economic point of view, highest BCR was recorded from papaya + cotton combination which was followed by litchi + cotton combination. To maximize the profit by the cotton production through fruit based agroforestry system should be encouraged and also need integrated crop management

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