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Economic Analysis of Growing Tea, Arecanut and Betelvine as Mix Crop

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ABSTRACT: *Monoculture of tea and mixed cropping of tea with arecanut and betelvine, were studied in a small tea estate situated at Potiagaon in Golaghat district with a view to find out the effect of mixed cropping on crop yields and profitability under both the cropping systems. The green leaf yield of tea in mono and mixed stand showed significant variations. The yield of green leaf was significantly higher in mono stand in comparison to the mixed cropping with arecanut and betelvine. However, in terms of gross return, mixed cropping of tea was found to be more profitable than mono cropping of tea. A gross return of Rs. 210590.00 per hectare was obtained from the mixed cropping of tea with arecanut and betelvine as against Rs. 152830.00 per hectare from mono cropping of tea. Thus the loss due to reduction in yield of tea leaf in mixed cropping was not only compensated, but also showed more return from mixed cropping through the component crops. It was also noteworthy that tea bushes in mixed cropping planted away from the arecanut palm yielded more green leaf than the bushes in mono cropping situation.*

Key words: *Mixed cropping, Tea, Arecanut, Betelvine.*

INTRODUCTION

Tea is widely consumed as non-alcoholic beverage and is made from tender apical vegetative shoots of the perennial shrubs of cultivated *Camellia* species. The plant is pruned/skiffed periodically to keep it in the vegetative phase for maximum leaf production. Arecanut (*Areca catechu Linn*) is one of the important cash crops of Assam. Most of the farmers of Assam grow arecanut in their homestead garden. Though Assam contributes a major share in the total arecanut production in the country, its productivity is low. Therefore the income generated from these holdings is insufficient to sustain the need of the farmer.

Small scale tea cultivation is a recent major development in the agricultural scenario in Assam. The high cash value has made it a popular crop among the farmers of this region. In some districts of middle and upper Assam like Golaghat, Sibsagar, Dibrugarh, Tinsukia, etc. where fallow high land is not available the farmers have started arecanut and tea intercropping. Bhat *et al*., (4) reported that arecanut equivalent yield from the arecanut based cropping system increased significantly indicating improvement in overall productivity of the system per unit area. In a system studied by Ray (12), it was concluded that all the vegetables and flowering crops can be grown suitably and profitably under young arecanut plantation.

In order to utilize the natural resources to the maximum extent growing different crops as inter/ mixed crops is a common practice. Contrasting to annuals, the potential for increasing the productivity per unit area of land, time and inputs through high density multi species cropping is considerably higher in perennial crops (Bavappa *et al*., 2).

Thus there is a need for studying the economics of planting tea as mix- crop with arecanut and betelvine. Though growing of tea as a monocrop is an age old practice in Assam, mixed cropping of tea with some suitable cash crops deserves serious attention under the changing scenario. Baruah *et al*., (1) concluded that interspaces available between tea rows can be utilized for growing some short term vegetable crops provided the growth of the main crop is not impeded. This is likely to give some return to the growers in the form of sales proceeds from vegetables

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MATERIALAS AND METHODS

The study was carried out in an established tea garden located at Potia Gaon in the district of Golaghat during 2009-10. The size of the experimental plot was 0.4 ha, out of which 0.2 ha was under mono-crop of tea and 0.2 ha was under mixed cropping of tea with arecanut and betelvine. The prevailing climatic condition of Golaghat, Assam is sub-tropical humid climate with wet summer and dry winter. The experiment was conducted under two cropping situations. Situation-I involved mono crop of tea and Situation-II consisted of tea, arecanut and betelvine grown as mix crops. The tea bushes under both the situation were of 4 years old and the variety was TV-19. Tea bushes were planted in between two rows of standing arecanut palms at a spacing of 120 × 70 × 70 cm. The plot of tea as mono crop had no shade tree. The 25 years old arecanut palm were in bearing stage and were spaced at 2.8 m apart. Betelvines (5-12 years old) were grown at a distance of 70 cm away from the arecanut palms which were used as standard. To study the effect of cropping systems in Situation-II (Mixed stand), two treatments were identified -(i) tea bushes near to arecanut palms and (ii) tea bushes away from arecanut palms. The plantation was raised rainfed and maintained well adopting scientific methods of cultivation. The design adopted for experimentation was a simple random design. For studying the effect of mixed cropping on green leaf yield of tea, eight tea bushes from mono crop plot and 16 tea bushes from mixed cropping plot were selected at random. Out of the 16 tea bushes in mixed stand, eight bushes were selected near to arecanut palm and rest eight bushes were selected away from the arecanut palms. Thus the experiment involved three treatments, viz., T_0-Control (mono crop), T1-Tea bushes near to arecanut palm and T_2-Tea bushes away from arecanut palm.

The green leaf yield of tea under each treatment was recorded separately in each plucking round. At the end of the plucking season, i.e., in December the total production in each treatment and plot was calculated. The yields of arecanut palms and betelvines were recorded only when they were harvested for selling. The total annual yield was calculated at the end of the year, i.e., in December, 2010. The monetary return from each of them was worked out considering the prevailing prices of the produce.

Plucking point density was determined by counting the number of shoots plucked in each plucking round. At the end of the plucking season, the number of plucking points and the area of plucking surface of tea bushes (5 Nos.) under each treatment were calculated and mean was computed. The plucking point density was expressed in number per 100 cm^2 per bush by using the following formula:

Plucking point density = No. of plucking point of the whole year x 100 Tea bush spread (cm^2)

Shoot weight were determined from both the cropping system .Samples of 25 numbers of fresh shoots (2 Leaf + Bud) were drawn at every plucking round from September to November 2009 and 2010 and their weights were recorded separately. The mean weight of individual shoot was calculated.

RESULTS AND DISCUSSIONS

Yield of Tea

Mixed cropping of tea with arecanut and betelvine influenced the green leaf yield of tea crop. From this investigation it was observed that tea planted as mono crop recorded higher yield than the tea under mixed cropping. The green leaf yield of tea from mono cropping plot was 8993 kg per hectare as against 7478 kg per hectare from mixed cropping plot (Table 1). Thus there was a decrease in green leaf yield of 1515 kg per hectare when tea was mixed with arecanut and betelvine. Reduction in green leaf yield of tea under mixed cropping system could not be attributed entirely due to the effect of mixed cropping with arecanut and betelvine. The lower plant population density of tea under mixed cropping might be one of the reasons for the low yield. The numbers of tea bushes in mixed cropping plot were 15037 per hectare whereas it was 16806 nos. in mono cropping plot.

Table1
Green leaf yield of tea under mono and mixed cropping system

	Green leaf yield in different treatments (kg)		*Green leaf yield in total area (kg)*		
	Mono	*Mix*	*Mono (0.2 ha)*		
Month	T0	T1	T2		*Mix (0.2 ha)*
May	0.757	0.640	0.767	335.26	231.98
June	0.797	0.587	0.830	274.75	194.08
July	0.663	0.538	0.807	187.04	229.94
August	0.526	0.603	0.707	229.24	195.13
Sept.	0.667	0.702	0.752	236.96	228.77
Oct.	1.047	0.898	1.046	314.99	281.38
Nov.	0.290	0.238	0.223	134.49	86.82
Dec.	0.213	0.150	0.153	85.33	47.58
Total	4.960	4.356	5.285	1798.06	1495.68
Mean (kg/bush)	0.620	0.545	0.661	8990.30 (per ha)	7478.40 (per ha)

Ghosh *et al.*, (5) also reported that increase in yield under higher plant population was attributed due to more plant population per hectare, even though some growth and yield components were superior with medium and wider spacing but plant population level could not compensate the total yield.

It was evident from the study that tea bushes near the arecanut palm (T_1) were affected by the presence of arecanut palm. Such bushes produced significantly lower green leaf yield. The lowest yield recorded for such bushes might be due to the overlapping of feeder roots of both tea and arecanut in the top layer of soil and competition for growth resources like space, sunlight, nutrients, moisture, etc., which was supported by the earlier findings(Singh *et al.*,13; Mohanty *et al.*, 10). Khader *et al.* (7) in a high density multi- species cropping model in arecanut plantation with six intercrops observed that there is competition for soil nutrients amongst the main crops and the mix crops, if they are not adequately fertilized. As tea was interplanted in an established arecanut plantation, probably it had to face stiff competition from arecanut palm for its establishment. The plucking point density and the weight of pruning litters recorded for such bushes were also significantly lower which was indicative for mutual competition between the two crops (Table 2).

Table 2
Plucking point density and pruning litters weight of tea bushes under mono and mixed cropping systems

	Mono	*Mix*	
Parameters	T_o	T_1	T_2
Numbers of plucking points (No./bush)	700	5.25	826
Plucking point density (No./100 cm^2)	10.04	8.79	11.74
Weight of pruning litters (kg/bush)	1.52	1.04	1.60
'*t*' test ($P = 0.05$)		*	*

*Significant

On the other hand, tea bushes away from the arecanut palm (T_2) produced significantly more yield compared to other bushes, even better than the bushes under mono cropping system. It was, thus obvious that although the bushes near the arecanut palm were affected, mixed cropping system showed favourable effects on the productivity of the tea bushes away from the arecanut palm. It was noted that the increase in yield from such bushes were due to the production of more shoots per bush and also heavier shoots (Table 3). The overall vigour of these bushes assessed by the pruning litter weight was also high. This might be attributed to the congenial microclimate that prevailed under the mixed cropping system. Bushes away from the arecanut palm were also not subjected to the root competition from arecanut for nutrients and moisture. Sujatha *et al.* (14) observed that better performance of value added intercrops in arecanut plantation might be attributed to congenial micro climate in the plantation and better soil fertility status. The research findings by Bavappa *et al.* (3) also revealed congenial microclimate conditions in arecanut based cropping system. Earlier reports also suggested that mixed cropping of coconut with cocoa had a buffering effect against drastic fluctuations in microclimate (Varghese *et al.*, 15). Similar reports are available in other crop combination of arecanut plantation (Kakoty, 6).

Table 3
Shoot weight under both mono and mixed cropping

	Weight of 25 numbers of shoots (2 + B) in gm	
Month	*Mono*	*Mix*
September	22.50 (0.90)	30.00 (1.20)
	21.00 (0.84)	28.00 (1.12)
October	20.00 (0.80)	27.50 (1.10)
	21.50 (0.86)	25.00 (1.00)
November	20.50 (0.82)	23.00 (0.92)
	19.25 (0.77)	22.00 (0.88)
'*t*' test ($P = 0.05$)		*

Figures in parenthesis indicate mean weight of individual shoot.
*Significant.

Economics

The economic return obtained from mixed cropping of tea, arecanut and betelvine was much higher than the mono crop of tea which was evident from a gross return of Rs. 210590 per hectare against Rs. 152830 per hectare in mono crop of tea (Table 4). The present

Table 4
Annual production and gross return derived from different crops under Mono cropping and mixed cropping systems during 2010 (area 0.2 ha each)

Cropping system	*Crops*	*Age(Yr) and variety*	*Production (kg)*	*Estimated Price (Rs.)*	*Value of produce (Rs.)*
Mix	Tea	4TV -19	1496	17.00 per kg	25432.00
Arecanut	23	Local	215	40.00 per kg	8600.00
Betelvine	5-12	Local	80860 (in nos.)	0.10 per piece	8086.00
Total return in 0.2 ha					42118.00 (210590.00)
Mono	Tea	4 TV-19	1798	17.00	30566.00 (152830.00)
Gross return over monocropping					11552.00 (57760.00)

Figures in parenthesis are the returns per ha.

results are also in good agreement with the earlier observations of (Maheswarappa *et al.,*8; Marimuthu *et al.,* 9; Nath, 11). This gross return might be even more with the introduction of black pepper instead of betelvine because black pepper has high cash value as compared to betelvine. So tea, arecanut and betelvine or black pepper as mix crop combinations bears a lot of expectations.

To sum up, mixed cropping of tea with arecanut and betelvine could be considered to be a viable crop combination under the present situation prevailing in the state. Although arecanut and betelvine could not be considered as ideal shade for tea plantation, a favourable microclimate required for growth and shoot production in tea could be achieved. Being the perennial ever green plants both arecanut and betelvine could maintain a congenial microclimate for tea crop.

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