



RESEARCH PAPER

Profitability assessment of tea based inter cropping in Golaghat district of Assam

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Abstract : A study was conducted to find out the profitability obtained in different intercropping systems in tea gardens of small tea growers in Golaghat district of Assam. The production and income from tea, was significantly influenced by the intercrops in different cropping systems. Mostly, the small tea growers planted areca nut and agarwood as intercrops in tea in Golaghat district. Higher yield was recorded in sole tea crop than inter cropping with Agarwood and areca nut. However, sole tea crop was recorded lower gross return compared to different intercropping systems. The average return over variable cost from mix cropping of tea with areca nut (1,98,896.81 Rs./ha), with Agarwood (2,49,152.72) and with areca nut and Agarwood (2,98,201.31) intercropping system combined was recorded much higher than that of conventional cultivation of sole tea (130389.24 Rs./ha). Thus, this study reveals that mix cropping system of tea can add an extra income for the small tea growers and can also act as a backup against high risk of sole tea cultivation due to price fluctuation in green tea leaves. Moreover, tea+areca nut+ Agarwood intercropping system had the highest B:C ratio of 3.06 amongst all the studied intercropping systems but, tea + agarwood recorded the highest LER value of 1.61 which suggested that though the return was higher in tea + areca nut + agarwood intercropping system, the suitable land utilization was observed in tea + agarwood cropping system.

Key Words : Intercropping, Tea, Areca nut, Agarwood

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INTRODUCTION

Assam is the largest tea growing region among all the other states of India. The first commercial organized tea growing was started in the year 1839 by the Assam Tea Company and by the middle of the 19th century, corporate companies were organized to operate in Assam (Banerjee, 2005). The climatic condition of Assam favoured the growth of tea and, therefore, a majority of

large tea plantations was being set up. Towards the latter part of the 1970s, the state witnessed the emergence of small tea growers who cultivated tea in a small scale on less than 10.12 hectares of land (Ganguli, 2014). A huge number of more than 80,000 small tea growers of Assam (Anonymous, 2015c) contributes 45 per cent of the total crop (610.97 million kg) production in Assam in 2014 (Anonymous, 2015b).

The small scale tea cultivation gained momentum

Size groups	I (upto1ha)	II (1.01-2.00ha)	III (2.01-3.00ha)	IV (3.01-4.00ha)	V (Above 4ha)	Total
Number of small tea growers	13	10	8	5	4	40

in the districts of upper Assam in recent years and a majority of farmers have brought their available highland areas under tea to generate augmented income from their farms. In Assam and India tea is mostly grown as monocrop (Buragohain, 2015). The small tea growers can generate income from their tea gardens during April to November in a year and the remaining months generate no income because there is no production of green leaves. Moreover, there is a high risk of low income generation due to the fluctuation of prices in the green leaves., Thus, to overcome the fluctuation of prices of green leaves and to generate income during the lean period of tea cultivation, small tea growers have adopted mixed cropping in their tea gardens with Areca nut, Khasi mandarin, Agarwood, etc. Additional income from one crop is obtained if the other crop fails in an intercropping system (Dhanapal *et al.*, 2001). Intercropping provides some additional return to growers in the form of sales proceeds from the intercrops (Barua *et al.*, 2005).

Most of the farmers of Assam grow Areca nut in their homestead garden but due to low productivity, it is insufficient for them to sustain a livelihood out of sole Areca nut planting, so they prefer intercropping with tea. Bhat and Sujatha (2007) reported significant improvement in the overall productivity of the areca nut based cropping system per unit area due to increase in the yield of areca nut from this cropping system. The photosynthetic activity of tea plant is not hindered by the shade provided from Areca nut in fact in addition to adequate shade areca nut provides a perfect support for black pepper which is an excellent crop for mixed cropping with arecanut and provides high economic returns (Abraham, 1974). However, the yield of green tea leaf was significantly lower in mix cropping system with arecanut and betelvine in comparison to monocrop of tea (Dutta and Gogoi, 2015), but in terms of gross return, the mixed cropping of tea with betel vine and arecanut was more profitable than mono cropping of tea under Assam condition (Deka, 1999). Also, the small tea growers of Tinsukia district gains maximum by planting orange with tea as a multi cropping system but productivity of green leaf was low in Tinsukia district (76,679.48 kg/ha) to that in Dibrugarh district (89,211.27 kg/ha) (Saikia, 2012).

MATERIAL AND METHODS

The study was conducted in Golaghat district of Assam. The district was selected as it is one of the oldest tea growing regions of Assam where 9,503 numbers of small tea growers are recorded, comprising of 11.23 per cent of total small tea growers of Assam (Anonymous, 2015c). In Golaghat district areca nut (7.83 %) is widely grown in an area of 1,120 ha (Anonymous, 2015a), while agarwood is a tree which is enlisted as endangered species and is widely grown in Golaghat district for its fragrant wood. Home garden products including agar and tea contribute to 1 to 45 per cent (mean 14% \pm 1.15) of the total annual income of the family for Jorhat and Golaghat district of Assam (Saikia and Khan, 2012).

For collection of data for the present study a multistage stratified random sampling technique was used. A total of 40 numbers of small tea growers were selected as sample growers from two blocks of Golaghat district and each of these block again constituted two villages. In the final stage, a list of small tea growers from the selected villages who grow tea besides other crops was prepared and then categorized into five size groups on the basis of area under tea cultivation (Table A) *viz.*, Group I (upto 1ha), Group II (1.01-2.00 ha), Group III (2.01-3.00 ha), Group IV (3.01-4.00 ha), Group V (Above 4.00 ha).

Both primary data and secondary data have been collected and used for this study. The primary data were collected with the help of a pre-tested schedule designed for the study by personally interviewing the sample small tea growers. Data pertaining to area under tea cultivation and different intercropping, utilization of human labour, fertilizers, plant protection chemicals, production (green leaf, areca nut, agarwood), prices (green leaf, areca nut, agarwood), mode of disposal (green leaf, areca nut, agarwood) etc. have been collected from the grower by personal interview method for the year 2016-2017. Cost of cultivation used in the present study comprises of Variable cost. It includes the cost of human labour (involved in applying manures and fertilizers, plant protection chemicals, pruning, plucking of tea leaves, or harvesting of intercrop produce, repairs and maintenance

etc.), cost of variable inputs (manures and fertilizers, plant protection chemicals, weedicide etc.) and interest on working capital @ 10% per annum. While calculating return, gross return and return over variable cost from tea and different intercropping systems were considered for the purpose of analysis.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads :

Yield of different intercrops :

The yield of all the intercrops is significantly influenced in different cropping systems. It was observed that the yield of tea recorded lower yield in tea + areca nut, tea + agarwood and tea + areca nut + agarwood

cropping system in comparison to tea grown as a sole crop. The average green tea leaf production in sole crop system was recorded as 159.30 quintal per hectare against 116.83, 111.61 and 110.87 quintal per hectare in tea + areca nut, tea + agarwood and tea + areca nut + agarwood cropping system, respectively (Table 1). Similarly, average yield of areca nut in pooled data was observed to be 2,185 pun per hectare in tea + areca nut cropping system whereas 1,378 pun per hectare in tea + areca nut + agarwood cropping system. The yield of agarwood was higher (67.10 q/ha) in tea + agarwood cropping system than the yield (55.98q/ha) of agarwood in tea + areca nut + agarwood cropping system.

Economics :

The economic return over variable cost obtained

Table 1 : Yield of tea, areca nut and agarwood in different intercropping system

Crop	Cropping system	Size groups					Pooled
		I	II	III	IV	V	
Tea	Sole tea (q/ha)	157.50	155.00	162.00	163.00	159.00	159.30
	Tea + Arecanut (q/ha)	111.92	109.75	121.32	123.85	117.32	116.83
	Tea + Agarwood (q/ha)	109.45	107.81	120.06	122.98	115.62	111.61
	Tea + Agarwood + Arecanut (q/ha)	104.50	103.35	116.15	117.85	112.50	110.87
Areca nut	Tea + Arecanut (pun/ha)	2115.00	2198.00	2073.00	2243.00	2295.00	2185.00
	Tea + Arecanut + Agarwood (pun/ha)	1342.00	1377.00	1294.00	1413.00	1463.00	1378.00
Agarwood	Tea + Arecanut (q/ha)	68.30	67.13	65.24	66.51	68.32	67.10
	Tea + Arecanut + Agarwood (q/ha)	57.54	56.85	54.52	52.33	58.64	55.98

1 pun = 80 nos. of areca nut

Table 2: Cost and return from conventional tea cultivation

Size group	Gross return (Rs./ha)	Total variable cost (Rs./ha)	Return over variable cost(Rs./ha)
I	236250.00	107324.80	128925.20
II	232500.00	106344.70	126155.30
III	243000.00	109890.00	133110.00
IV	244500.00	110613.80	133886.20
V	238500.00	108630.50	129869.50
Pooled	238950.00	108560.76	130389.24

Table 3 : Cost and return from tea + areca nut intercropping system

Size group	Areca nut		Tea		Total		
	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Return over variable cost (Rs./ha)
I	158598.00	33363.00	167880.00	107325.00	326478.00	140688.00	185790.00
II	164877.00	31583.20	164625.00	106345.00	329502.00	137928.20	191573.80
III	155494.50	29714.30	181980.00	109890.00	337474.50	139604.30	197870.20
IV	168206.25	30402.90	185775.00	110614.00	353981.25	141016.90	212964.35
V	172149.00	33212.30	175980.00	108631.00	348129.00	141843.30	206285.70
Pooled	163864.95	31655.14	175248.00	108561.00	339112.95	140216.14	198896.81

from sole tea cropping as well as different intercropping system is presented in Table 3 to 6. The average return over variable cost from sole tea cultivation was found to be rupees 1, 30,389.24 per hectare (Table 2) which is much lower than intercropping of tea with areca nut *i.e.*, rupees 1,98,896.81 per hectare (Table 3) followed by tea + agarwood intercropping system *i.e.*, rupees 2,49,152.72 per hectare (Table 5) and tea + areca nut + agarwood intercropping system *i.e.*, rupees 2, 98,201.31 per hectare (Table 4).

In tea + arecanut cropping system (Table 3), the pooled data revealed that there was no significant variation among the farm size groups on gross return for both tea and areca nut crops. In case of gross return, tea contributed to the highest gross return (1,75,248.00 Rs./ha) as compared to that of areca nut (1,63,864.95 Rs./ha). Total gross return from tea + areca nut cropping system was found to be rupees 3,39,112.95 per hectare

against the total variable cost of rupees 1,40,216.14 per hectare resulting a gross return over variable cost of rupees 1,98,896.81 per hectare. However, the variable cost was very high for tea (1,08,561.00 Rs./ha) as compared to areca nut (31,655.14 Rs./ha). This may be due to the huge quantity of mandays required for tea production as compared to areca nut production.

Again, in Tea + Arecanut + Agarwood cropping system the pooled data in Table 4 reveals that the lower farm size groups earned a lower gross return as compared to the bigger farm size groups with a slight variation among them. Among the three crops *viz.* tea, arecanut and agarwood, the gross return was higher in case of agarwood (173525.60 Rs./ha) followed by tea (166305.00 Rs./ha) and areca nut (103359.75 Rs./ha), respectively. In this cropping system, the total return over total variable cost was observed to be rupees 2,98,201.31 per hectare against the total variable cost of rupees

Table 4 : Cost and return from tea + areca nut + agarwood intercropping system

Size group	Areca nut		Tea		Agarwood		Total		
	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Return over variable cost (Rs./ha)
I	100684.50	20714.10	156750.00	107325.00	178374.00	18216.00	435808.50	146255.10	289553.40
II	103285.50	18933.20	155025.00	106345.00	176235.00	17331.60	434545.50	142609.80	291935.70
III	97074.00	16958.70	174225.00	109890.00	169012.00	15906.00	440311.00	142754.70	297556.30
IV	105993.75	17575.80	176775.00	110614.00	162223.00	16310.80	444991.75	144500.60	300491.15
V	109761.00	20097.00	168750.00	108631.00	181784.00	20097.00	460295.00	148825.00	311470.00
Pooled	103359.75	18855.76	166305.00	108561.00	173525.60	17572.28	443190.35	144989.04	298201.31

Table 5 : Cost and return from tea + agarwood intercropping system

Size group	Agarwood		Tea		Total		
	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Gross return (Rs./ha)	Variable cost (Rs./ha)	Return over variable cost (Rs./ha)
I	211730.00	23716.00	164175.00	107325.00	375905.00	131041.00	244864.00
II	208103.00	22831.60	161715.00	106345.00	369818.00	129176.60	240641.40
III	202244.00	21406.00	180090.00	109890.00	382334.00	131296.00	251038.00
IV	206181.00	21810.80	184470.00	110614.00	390651.00	132424.80	258226.20
V	211792.00	25597.00	173430.00	108631.00	385222.00	134228.00	250994.00
Pooled	208010.00	23072.28	172776.00	108561.00	380786.00	131633.28	249152.72

Table 6 : Benefit : Cost ratio (BCR) and land equivalent ratio (LER) in different intercropping systems

Cropping systems	LER	BCR
Tea		2.20
Tea + Areca nut	1.34	2.42
Tea + Agarwood	1.61	2.89
Tea + Areca nut + Agarwood	1.17	3.06

1,44,989.04 per hectare. As seen in the above intercropping system (Tea + areca nut) tea has the highest variable cost (1,08,561.00 Rs./ha) followed by arecanut (18855.76 Rs./ha) and agarwood (17572.28 Rs./ha) in tea + arecanut + agarwood intercropping system.

Visualizing the pooled data for Tea + Agarwood cropping system (Table 6), it was revealed that there was no such significant variation in gross return among the farm size groups..Agarwood contributed the highest gross return (2,08,010.00 Rs./ha) as compared to that of tea (1,72,776.00 Rs./ha). Total gross return from tea + agarwood cropping system was found to be rupees 3,80,786.00 per hectare against the total variable cost of rupees 1,31,633.28 per hectare resulting a gross return over variable cost of rupees 2,49,152.72 per hectare.

Tea + Arecanut + Agarwood intercropping system has the highest benefit: cost ratio of 3.06, whereas the lowest was observed in sole Tea with 2.20, but the LER value is highest in terms of Tea + Agarwood (1.61) intercropping system. This shows that due to the increase in the component crop the revenue increases but it affects the yield of individual crops and Tea + Agarwood cropping system utilizes the land more efficiently than the other cropping systems.

Conclusion:

Amongst all the intercropping systems, the net return over variable cost was found to be the highest (2,98,201.31 Rs./ha) in Tea + Areca nut + Agarwood intercropping system. The benefit: Cost ratio (BCR) (variable cost) was also highest (3.06) for Tea + Areca nut + Agarwood intercropping system over all intercropping systems for the district. Also, the total variable cost was highest (144989.04 Rs./ha) for Tea + Areca nut + Agarwood intercropping situation as compared to all the other intercropping systems.

In conclusion, it may be stated that intercropping has a higher potential for developing the economic status of small tea growers of Assam. It can be a source of profitization for the small tea growers and can also act as an insurance against price fluctuation of green tea leaves. Amongst all the intercropping systems studied Tea + Arecanut + Agarwood was observed to be the

most profitable with the highest B:C ratio but the cost of production also increases with the addition of component crops. However, the highest LER was found in Tea + Agarwood intercropping system which denotes proper utilization of land in this system among all the other systems in Golaghat district of Assam.

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