

Profitability Analysis of Major Crops Cultivated in Assam: Evidence from the analysis of primary data Submitted By

1. Mr. Hitesh Barman

Research Scholar
Department of Economics
Gauhati University, 781001
E-Mail: hiteshbarman440@gmail.com

2. Dr. Archana Sharma

Retd. Professor & Ex. Head of Department
Department of Economics
Gauhati University, 781001
E-Mail: archasharma@gmail.com

Abstract:

The study analysed the profitability of various crops cultivated by the farmers and the factors influencing of farm profitability. Multi-stage sampling was used and 60 farmers were sampled randomly to collect information relevant for the study. The study also used CACP Cost concept to calculate cost of cultivation and used multiple regression analysis to find out factor influencing farm profitability. Study indicated large variation of cost of cultivation among the category of farmers; it was mainly due to difference in use of fertilizer, seeds, rental value of land, use of human labour, interest on fixed capital etc. it also revealed that farmers got reasonable profit and were economically viable and sustainable by cultivating Spice, Brinjal, Tomato, Potato etc. as compared to other crops. The results of the multiple linear regression analysis revealed that Education of farmers, Farming experience, Agricultural training, Extension Services, Farm mechanization, Awareness about MSP, had a direct relationship with profitability age, Land size, Distance from home to Market place had negative influence on farm profitability. The study recommended for encouraging farmers to use more area on vegetables or horticultural crops rather than paddy and oilseeds, for better profit and sustainability of farming.

Key Words: Profitability, Costs, Cultivation, economically viable, Sustainable, farming.

Contribution of the Study:

Farmers in most of the regions in Assam are struggling under severe stress because of poor returns from crop cultivation and high cost of inputs. Without proper incentives in the form of increased profitability, farmers may not be willing to adopt agriculture for the long time. Unless the issue of profitability of crops is addressed immediately, we may not be able to rescue the agriculture from its current mire. Therefore the study has given a clear picture of the current mire of agriculture in Assam and recommended possible strategy to overcome the situation.

Introduction:

Assam is largely an agrarian state of North-East India having higher share of agriculture in domestic product. Agriculture is considered as the mainstay of the economy of Assam and plays vital role in the state economy. The state agriculture has been characterized by the presence of large number of small and marginal farmers. According to Economic Survey, Assam, 2017-18 more than 85% of farm families are small and marginal with average land holding of only 0.63 hectare.

The agriculture sector of Assam has been recognized impressive growth in production and productivity of crops since Independence. After the introduction of green revolution during the mid-sixties, helped to generate more employment opportunities in the rural areas (Dev 2012). Today Assam is not only self sufficient in food production but an exporter in many countries. Despite these achievements, the agriculture scenario of Assam is quite pathetic; there have been large number of challenges faced by the farm sector since the early 1990s. Most of the challenges, however, are caused by Flood, small and fragmented land holdings, indebtedness, declining soil fertility, high cost of cultivation, low returns, infestation of plant disease and pest attack, Market risks, etc. Due to which farming gradually becomes an unprofitable venture (NITI Aayog 2017), and have created uncertainties as well as threatened the economic viability of the farmers in the long run. Due to which, most of the young farmers leaving agriculture, even the farmer's children are not interested in agriculture and will not like to take agriculture as a profession. Therefore, concerns have been expressed by researchers and policy planners to study the issue of profitability of different crops cultivated by the farmers in depth manner to sustain as well as to make agriculture profitable venture.

Some recent studies have analysed this issues by using temporal data on cost of cultivation. Dev and Rao (2010) and Narayanamoorthy (2013) had analysed the issue of profitability utilising temporal data, but only focusing on paddy and wheat and few crops. Except this study, No studies have been found on detailed analysis of cost, return and profit of major crops cultivated in Assam by using primary data and CACP cost concept. Therefore, this will be the focus of this study. In doing so the study explore the cropping pattern and calculated cost and return of different crops cultivated by various categories of farmers as well as examine the factor influencing farm profitability. The present study helps to find out economic viability and sustainability of farming with the help of analysis of cost, return and fill the gap of existing research.

Review of Literature:

Several recent studies have analysed related issues, one literature has examined profitability of crops cultivation in Indian prospective by using secondary data and found that Farmers have suffered substantial losses by cultivating different crops most of the time. In majority cases he was found that there were less than 30 per cent profit over the cost of cultivation (Narayanamoorthy 2013). Another study has brought out that alternative crops gave lower returns as compared with paddy. The present set of marketing infrastructure and agricultural

technological know-how, the rice-wheat cropping pattern is likely to produce the highest and more stable income. The sustainability of natural resources can be achieved only if same platform of technology-market-Govt. assurance for other alternative crops will be provided to the farmers Market incentives for other crops should be explored so that farmers could move away from thirsty crops such as rice (Sukhpal Singh, Parminder Kaur*, Jatinder Sachdeva, and Sumit Bhardwaj 2017). Another study also found that among various farming system i.e. horticultural crops were found most profitable in the study area. There is ample scope for increasing the farm income if farmers adopted diversification farming system in the study area. In this way more income and employment may be generated and improved the economic condition of farming community (**Sangeeta Mawase 2018**). Another study found that **Small** category farmers had more area under vegetables as percent of operational area fetching them good profits as compared to vegetable growers having large land holdings (**Navjot Singh Samra and Poonam Kataria 2014**). Another study **had** analyzed the costs in and returns for vegetable crops and found that the returns per rupee invested from pea, cabbage, tomato, bean were 1.56, 1.25, 1.20 and 1.10 respectively. Therefore he concluded that vegetable cultivation is profitable in the study region (**Harshika Choudhary 2017**). Yet, the study on this issue and empirically analysis among categories of farmers are hardly to come. This is considered as research gap, which is addressed the study.

Objectives of the study:

The main objectives of the study were:

1. To explore the cropping pattern of the sampled farmers,
2. To find out cost and return of different crops cultivated by the sampled farmers,
3. To find the factor influencing profitability of crops cultivation.

DATA AND METHOD:

The study was purely based on farm level primary data generated through field survey and was collected with the aid of well framed pre-tested questionnaire based on multi-stage random sampling technique. At the first stage Nalbari Districts was selected by purposive sampling, at the second stage, two blocks namely Pub-Nalbari and Madhupur Development Block were selected at the third stage, two villages from each block namely Namati and Naherbari villages from Pub-Nalbari Development Block and Kashimpur and Silaguti village of Madhupur Development Block were selected. The Block and villages were selected on basis of availability of irrigation facilities, agricultural activities of farmers. In the final stage, households were selected at random from each village and required information was collected. The sample size was 60 farm households. The collected data were processed and analyzed using various statistical techniques.

Analytical Technique:

In order to find out farm profitability, the study calculated both cost of cultivation of selected crops and their respective gross return. The cost of cultivation was calculated by

using Commission of Agriculture Cost & Prices (CACP) cost concept. CACP has been using different cost concepts, which are the followings:

Cost A₁ = All actual expenses in cash and kind incurred in production by owner.

Cost A₂ = Cost A₁ + rent paid for leased-in land.

Cost B₁ = Cost A₁ + interest on value of owned capital assets (excluding land).

Cost B₂ = Cost B₁ + rental value of owned land (net of land revenue) and rent paid for leased-in land.

Cost C₁ = Cost B₁ + imputed value of family labour.

Cost C₂ = Cost B₂ + imputed value of family labour.

Cost C₂* = Cost C₂ estimated by taking into account statutory minimum or actual wage whichever is higher.

Cost C₃ = Cost C₂* + 10 per cent of cost C₂* on account of managerial functions performed by farmer

The return from cultivation of each crops are measured by multiplying the volume of production by their respective prices. Thus, the farm profitability is calculated by deducting the cost of cultivation of each crop from their respective gross return. The study measured Cost and return in per acre for each crops.

Net Farm Income (profit): Gross Returns – Cost C₃

For evaluation of the factors influencing farm profitability, the study used a multiple linear regression analysis, the model was specifies as below:

$$NFI = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \epsilon_i \dots \dots \dots (3)$$

Where, NFI = Net Farm Income per Acre for each household, X₁ = Age, X₂= Education, X₃= Farming Experience, X₄= Training X₅= Land Size, X₆= Extension Services, X₇= Distance from the Market and X₈ = Farm Mechanization and ϵ_i = error term which is assumed to be normally distributed with zero mean and constant variance. The data were analyzed using statistical software packages such as MS Excel, and Stata.

Cropping pattern of the sampled Farmers:

Cropping pattern of the sampled farmers reflected the sequence of the crop grown in the study area. The appropriate choice of the crop and the cropping pattern help to achieve the maximum economic returns. The detailed cropping patterns of sample farmers were presented below:

Table 1: Cropping pattern of sampled farmers

Area (In Acre)					
Crops	Farm Size and category				Overall
	Marginal	Small	Medium	Large	
Kharif Crops					
Paddy	25.33 (48.40)	56.66 (55.92)	68.66 (54.93)	86.66 (68.02)	237.31 (58.94)

Ridge Gourd	2.33 (4.45)	4 (3.94)	5 (4)	5 (1.30)	16.33 (4.05)
Cucumber	3.33 (6.36)	2.30 (2.30)	4 (3.2)	2.66 (2.09)	12.29 (3.06)
Pumpkin	1.66 (3.18)	3.36 (3.20)	1.66 (1.33)	1 (.07)	7.68 (1.90)
Ash Gourd	1.30 (3.18)	1 (.09)	2 (1.6)	4 (3.14)	8.30 (2.15)
Total Kharif Crops	33.95 (61.81)	67.32 (69.39)	81.32 (70.12)	99.32 (74.69)	281.91 (73.57)
Rabi Crops					
Mustard	3.33 (6.36)	6.70 (6.57)	13.33 (10.66)	11.60 (9.16)	34.96 (8.69)
Tomato	.66 (1.27)	4(3.94)	2.66 (2.13)	3.66 (2.61)	10.98 (2.64)
Potato	.66 (1.27)	3.30 (3.20)	4.66 (3.75)	2.66 (2.09)	11.28 (2.81)
Cabbage	5.33 (10.19)	9 (8.88)	7 (5.6)	2.66 (1.30)	23.99 (5.79)
Spice	1 (1.27)	3.30 (3.20)	2.66 (2.13)	4 (3.14)	10.96 (2.64)
Brinjal	1 (1.91)	3.30 (3.20)	2.33 (1.86)	2.66 (2.09)	9.29 (2.31)
Total Rabi Crops	11.98 (38.19)	29.6 (30.61)	32.64 (29.88)	27.24 (25.31)	101.46 (26.43)
Gross Cropped area	45.93 (100)	96.92 (100)	113.96 (100)	126.56 (100)	383.87 (100)

N.B: Within Breaket represent percentage of Area

Sources: Primary Data

The data on the above table revealed that the kharif crops occupied a total of 73.94% of gross cropped area. Among the kharif crops paddy was the only cereals grown by the sampled farmers, and occupied maximum area (58.94%) for all categories of farmers followed by Ridge Gourd (4.05), Cucumber (3.06) and Ash Gourd (2.15) cultivation. Pumkins occupied less area among the kharif crops. In case of Rabi Crops it was found that the all categories farmers in the study area used less gross cropped area (26.43 %) on Rabi crops as compared to kharif crops. Among the Rabi Crops, Mustard occupied highest area (8.69) in cultivation followed by Cabbage (5.79), Potato 2.81 Tomata ans Spices (2.64), Brinjal (2.31). Thus, it can be concluded that farmers have seemingly moving towards commercialization and diversification from subsistence agriculture in the study area. Although farmers have diversified their cropping pattern towards vegetables and some cash crops but still cropping pattern is dominated by paddy cultivation.

Cost of Cultivation, Gross Return and Farm Profit

The following tables showed cost of cultivation of major crops cultivated by the sampled farmers, their respective gross returns, along with profitability.

Cost of Cultivation:

The cost of cultivation of major crops cultivated by the sampled farmers, were calculated by computing as per CACP cost concept. Here we calculate and present the C₃ cost as it involved all the component of CACP cost.

Table 2: Cost of cultivation per acre as per CACP Concept

Crops	Cost of cultivation (In Rs. Per Acre)				
	Mar	Sml	med	Lar	Avg
Paddy	30590	32406	37394	72050	43110

Ridge Gourd	73075	89325	103152	149169	103680
Oilseeds	16500	21796	27043	66905	33061
Spice	73272	148330	162558	142560	131680
Cabbage	53616	60533	80726	150342	86304
Tomato	85421	92961	137229	174020	122407
Potato	53154	72600	85167	104810	78932
Cucumber	31594	40737	56647	90587	54891
Muskmelon	117922	121566	166930	190212	149157
Ash Gourd	34701	42487	77302	112612	66775
Brinjal	152858	163944	108635	208670	158526

Sources: Authors own calculation based on Primary Data

The cost of cultivation of different categories of sampled farmers and their average value showed that the marginal farmers incurred maximum cost in cultivation of Brinjal (Rs. 1,52,858) and Muskmelon (Rs. 1,17,922) followed by other crops. While the small farmers incurred maximum cost in cultivation of Muskmelon (Rs. 1,21,566) Spice (Rs. 1,48,330) Brinjal (Rs. 163944) tomato of Rs. 92961 followed by other crops produced by them. The Medium farmers incurred maximum cost in Ridge Gourd of Rs. 103152, followed by Spice of Rs. 162558, and other selected crops. The large farmers invested maximum cost in cultivation of Tomato (Rs. 174020), Cabbage (Rs. 150342), Ridge gourd (Rs. 149169) followed by Spice of Rs 142560, and other crops.

The average cost of cultivation per acre for all selected crops for various categories of farmers were observed to be Rs. 158526 for Brinjal, Rs. 149157 for muskmelon, Rs. 131680 for spice, Rs. 122407 for tomato, Rs. 103680 for ridge gourd followed by other crops. While average cost of cultivation of paddy was Rs. 43110. It was observed from the table that cost of cultivation of all selected crops were not uniform for all farmers, this is mainly because of the difference in used of human labour, family labour. Machine labour, seeds, fertilizer, rental value etc. The table also revealed that horticultural crops involved more cost as compared to paddy. This is because as the horticultural crops needs more human labour, uses more plant protection/insecticide, more fertilizer, which have more cost due to higher prices of inputs.

Gross Return from farming system:

As far as gross return of the sampled farmers was concerned, it varied from crop to crop and among categories of sampled farmers, due to difference in prices of produced as well as volume of production. The estimated gross Return of selected crops have been given in Table

Table 3: Gross Return per acre for the sampled farmers.

Crops	Gross Return (In Rs. Per Acre)				
	Mar	Sml	med	Lar	Avg
Paddy	23,625	27400	28200	30000	27306
Ridge Gourd	120,000	180,000	240,000	150,000	172500
Oilseeds	18,000	18,000	18000	24,000	19500
Spice	90000	450,000	450000	270,000	315000

Cabbage	60,000	120000	120000	120,000	105000
Tomato	96000	192000	240,000	144000	168000
Potato	112500	150,000	186,000	112500	140250
Cucumber	90000	135000	135000	112500	118125
Muskmelon	120000	180000	180000	180000	165000
Ash Gourd	112500	135000	135000	135000	129375
Brinjal	600000	600000	360000	600000	540000

Sources: Authors own calculation based on Primary Data

The above data revealed that all categories of sampled farmers received maximum return from the cultivation of Ridge gourd, Muskmelon, Ash gourd, Spine gourd, Brinjal, Spice, Tomato, Potato etc. and less from the cultivation of Paddy and Oilseeds cultivation. It was observed from the data that marginal farmers received maximum return from the cultivation of Brinjal (Rs. 600000), Ridge gourd (Rs.120000), Muskmelon, Ash gourd followed by other crops and lowest in cultivation of Oilseeds (Rs.18000). Small farmers get maximum return from the cultivation of Brinjal (Rs.600000), Spice, Spine gourd, Tomato, Ridge gourd, Potato, Muskmelon etc. The Medium farmers get highest return from the cultivation of Ridge gourd, spice, tomato, potato, brinjal followed by other crops. The large farmers get maximum return from Spice, Ridge gourd, Tomato, Brinjal followed by other crops.

The average maximum gross return per acre was found in Brinjal 5,40,000.00 cultivation followed by Spice Rs. 3,15,000.00 Ridge gourd Rs.172500, Tomato Rs.168000, Muskmelon Rs.165000, Potato Rs.140250, Cabbages Rs.105000, Ash Gourd Rs.129375, Cucumber Rs.118125, Paddy Rs.27306 and Oilseeds Rs.19500. respectively for all size of farmers. Like cost of cultivation, gross return also not uniform to all crops for various categories of farmers, this may be due to difference in cost of input, price difference, marketing problems etc.

Farm Profitability:

Study of Farm profit is very much important in order to know the economic viability and sustainability of farming and to make best alternative use of resources. The data on profit level of different crops for various categories of farmers were presented in the following table:

Table 4: Farm Profit / Net Return per acre for the sampled farmers

Crops	Farm Profit / Net Return (In Rs. Per Acre)				
	Mar	Sml	med	Lar	Avg
Paddy	-6965	-5006	-9194	-42050	-15803
Ridge Gourd	46925	90675	136848	831	58261
Oilseeds	1500	-3796	-9043	-42905	-13561
Spice	16728	301670	287442	127440	183,320
Cabbage	6384	59467	39274	-30342	18695
Tomato	10579	99039	102771	-30020	45592
Potato	59346	77400	100833	7690	61317

Cucumber	58406	94263	78353	21913	63233
Muskmelon	2078	58434	13070	-10212	15842
Ash Gourd	77799	92513	57698	22388	62599
Brinjal	447142	436056	251635	391330	381540

Sources: Authors own calculation based on Primary Data

The profit level of different categories of sampled farmers revealed that they received more profit from the cultivation of Cabbage, Tomato, Muskmelon spice, Ridge Gourd Tomato, Potato etc. while they received negative profit from the cultivation of paddy and mustard. The marginal farmers received maximum profit from the cultivation of Brinjal (Rs. 447142) followed by other crops. Small farmers received maximum profit from the cultivation of Brinjal (Rs. 447142), Spice (Rs. 301670), Tomato (Rs. 99039) followed by other crops, while they incurred loss in cultivation of paddy and oilseeds. The medium farmers received maximum profit from the cultivation of Spice (Rs. 287442), Brinjal (Rs. 251635), Ridge Gourd (Rs. 136848), and Tomato (Rs. 102771), Potato (Rs. 100833), etc followed by other crops. The large farmers received maximum profit from the cultivation of Brinjal (Rs. 391330), and Spices (Rs. 127440), while the average profit for all categories of farmers revealed that Brinjal was most profitable crops (Rs. 381540), followed by spice (Rs. 183,320) and other crops.

The above revealed that all farmers get lose from the cultivation of paddy and oilseeds, their average profit also negative, thus paddy and oilseeds cultivation are not profitable for farmers. Large farmers received negative profit in the cultivation of crops like Paddy, Oilseeds, Cabbage, Tomato, Muskmelon, while the profit margin from other crops also negligible for large farmers as compared to the others. They get a reasonable profit from the cultivation of Spice and Brinjal.

All farmers get maximum profit from the cultivation of Brinjal, Spices, Tomato, potato, Ridge gourd etc. cultivation of all these crops are economically viable and farmer get sustainable.

Factors Influencing Farm Profitability:

Multiple linear regression was used to identify the factors influencing of farm profitability. Net farm income per acre was used as a proxy for profitability as it measures relative profitability. The study revealed that the age of the farmers had a significant negative influence on farm profitability at the 1% level of significance. This implies that an increase in the age of the farmer by 1 year will decrease farm profitability by Rs.143.84. Therefore, as the farmer gets older, he/she becomes weaker and unable to provide the needed labor for production. The education of the farmers had a significant positive influence on farm profitability at 1% level of significance. The results indicate that with an additional year of education, profitability would increase by Rs.344.18. Farming experience of the farmers had a positive influence on the farm profitability at 5% level of significance, which indicated that as Experience increased it reduces the mistakes and makes improved farm performance for significantly higher profit. Agricultural training had positive influence on farm profitability by Rs. 1827.56 at 10 % level of significance. Which indicate that agricultural training among

farmers enhances ability and willingness for successful change and which improved farm profitability. Size of Land had a negative influence on profit realize by all categories of farmers by Rs. -550.4 at 5% level of significance; This is because, as the farm size increased farmers are unable to meet the input requirements for such farms leading to low yield and consequently a low profit. small farm sizes are more likely to adopt new technologies. This may possibly be to maximize land utilization of their small farm sizes under cultivation. Distance from market had negative influence on farm profitability at 10% level of significance. The result of the study indicates that the distance to the nearest market had a negative effect on the profit margin of the farmers. One percent increase in distance to market in hour causes a decrease the profit margin by 0.09 percent at 5% level of significance (see Table 3). This could be because of marketing costs like grain transport cost which increases with distance. Extension service had positive influence on farm profitability at 5% level of significance. extension contacts in promoting new farming technologies and increase in farmers contact profitability will be increased. Farm mechanization had a positive relation with farm profitability at 5% level of significance.

Table 3: Factor influencing farm profitability

Variable	Coefficient	Std. Error	T Value	Significance Level
Age	-143.84***	50.53	-2.85	0.006
Education	344.18***	126.99	2.71	0.009
Land Size	-550.46**	260.00	-2.12	0.039
Agricultural Training	1827.56*	1065.41	1.72	0.093
Extension Services	3037.86**	1219.12	2.35	0.023
Distance to Market	-398.34*	211.65	-1.88	0.066
Farm Mechanization	1719.27**	845.37	2.03	0.048
Farming Experience	176.14**	73.34	2.40	0.020
Awareness about MSP	2147.07*	1070.82	2.01	0.051
R ²	0.90			
Adj. R ²	0.88			
F	41.77 with d, f (11 48)			

*** for 1% Level of Significance, ** for 5% Level of Significance, * for 10% Level of Significance

Conclusion:

The main focus of the study was to find out profitability of major crops cultivated by various categories of farmers in the study area and the factor influencing farm profitability. The study concluded that the cultivation of paddy and mustard are not profitable for the sampled farmers because the average net farm income of paddy and oilseeds cultivation is negative for all categories of farmers. This is mainly due to high cost of cultivation as compared to its gross return. When profit earned by the farmers, it is found in majority cases to be less than 50 per cent over the cost of cultivation. Except in Ridge gourd, potato, spice, Brinjal the returns over the cost of cultivation has also worsened in all other crops. It is found

that the farmers have suffered losses both due to increased cost of cultivation in some crops and due to reduction in value of output in some other crops. Thus, it can be concluded that, the cultivation of Ridge gourd, potato, spice, Brinjal are profitable and the farmers cultivated these crops are economically viable and sustainable, because their return is 50% above the cost of cultivation (As recommended by NCF 2006). Although farmer received positive profit from the cultivation of Cabbage, Ridge gourd, Muskmelon, still their cultivation is not economically viable and farmers are not sustainable as gross return is not equal or above 50% the total cost. While the factor such as Education, Experience, Training, Extension Services, mechanization etc. have positive influence on the farm profitability and age, Land size, Distance from home to Market have negative significant in the farm profitability.

The study recommended that farmers should use more area on crops like Ridge gourd, potato, spice, Brinjal to get more income and for sustaining their livelihood and farming. Government should closely monitor and regulate the prices of inputs and prices of output in the market and aware people for collective selling of produced and collective purchasing of inputs for minimizing cost and raising profit.

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Conflicts of Interest: The authors declare no conflict of interest.

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Appendix 1: the result of Multicollinearity Test

Variable	VIF	Tolerance
Age	2.17	0.469
Education	2.47	0.289
Land Size	1.60	0.640
Agricultural Training	2.04	0.489
Extension Services	2.00	0.335
Distance to Market	2.36	0.298
Farm Mechanization	1.26	0.843
Farming Experience	2.00	0.570
Awareness about MSP	2.05	0.516

The larger the value of VIF, the more collinear is the variable, as a rule of thumb, if the VIF greater than 10 the variable is said to be highly collinear (Gujarati 2003). Multicollinearity of explanatory variable can also be tested through Tolerance. Tolerance is 1 if explanatory variable are not correlated. Whereas it is zero if it is perfectly correlated. There is no problem of multicollinearity in the model because of VIF is less than 3 in all cases.