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Profitability Analysis of Vegetable production in a selected area of Paschim Medinipur District of West Bengal

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Abstract: The government of west Bengal has given emphasis on vegetable production in the year-round to meet the nutritional and caloric need for the growing population and for increasing employment opportunities and income of farmers. The present study makes an attempt to analyze profitability of summer and winter season vegetables so that it can identify the major factors that affect the yield of these vegetables. Therefore, the individual farmer would be benefited from this study for effective operation and management of their farms. Among all types of costs Labour cost, fertilizer cost, rent of land and seed costs are the most important cost components in both the seasons. Benefit-Cost ratio (B-C ratio) for winter season reads at 1.78 compare to 1.88 for summer season. The most important observation from this area is that in the last three years the B-C ratio has been decreased. There is a positive relation between value of total revenue and inputs of production (mainly labour employment, seeds, fertilizer and pesticides) for all types of vegetable production. Among all types of constraints, uncertainty about the Price of Vegetables, shortage of human labour, fly ash from surrounding industries are the most important problems faced by farmers. Thus if government fixes price for vegetables to reduce the uncertainty, it is only the efficient production system which can increase productive efficiency on the one hand and also supply vegetables to the consumers with better quality at the least possible price. Modern technology in the agricultural sector can be applied to solve the labour shortage but it is constrained by low family income. Either Government support or cooperative system is the expected solution in this regards.
Key Words: Agriculture, GVA, Productivity, NPV, BCR, Efficiency.

1. Introduction

1.1 vegetables Production in India

Agriculture plays a vital role in India's economy. 54.6% of the population is engaged in agriculture and allied activities (census 2011). The contribution of agriculture to the GVA has decreased from 18.2% in 2014-15 to 16.5% in 2019-20. The decline was mainly due to a decrease in share of GVA of crops from 11.2% in 2014-15 to 10% in 2017-18. The share has been declining on account of relatively higher growth performance of non-agricultural sectors. Given the importance of agriculture sector, Government of India took several steps for its sustainable development. Doubling farmer's income will require addressing issues such as access to credit, insurance coverage, and investments in agriculture. India has relatively lower farm mechanization which needs to be addressed. Total Indian horticulture production in 2019-20 is 313.35 million tons, about 0.84 per cent higher than 2018-19. Vegetables

production was estimated to be around 183.17 million tons, while fruits production was estimated to be around 97.97 million tons. Vegetable production is likely to increase by 2.64 percent in 2019-20 than 2018-19 due to increased production of onion, potato and tomato. Tomato production is expected to be 19.33 million tons as compared to 19.01 million tons in 2018-19.

The area under vegetable cultivation increased from 6.74 million hectare (mh) in 2004-05 to 10.10 mh in 2018-19 which is about 3% of the total area under cultivation in the country. Potato, tomato, onion, cabbage and cauliflower account for around 60% of the total vegetable production in the country. The major vegetable crops grown in India, which accounts for 11.2 per cent of global vegetable production, are potato, tomato, onion, brinjal, cabbage, cauliflower, peas, and okra.
Vegetables are good sources of nutrients; dietary farmer, vitamins etc. Vegetables with shorter duration, higher productivity, have resulted in greater economic returns to farmers. India is the second largest producer of vegetables next to China in the world. In India, it is grown in an area of 9.575 million hectors with the productivity of 17.7 mt/ha which contributes 14% of the total world production of vegetables (Sahni, 2017).

1.2 Vegetables production in West Bengal

West Bengal has overtaken Uttar Pradesh and emerged as the top State in vegetable production in 2018-19, according to the data of Agricultural Ministry. West Bengal produced 29.55 million tonnes (mt) of vegetables last year (2018-19) against 27.70 mt in the year before. Vegetable production in UP, which held the first position earlier, came down to 27.71 mt in 2018-19 from 28.32 mt the previous year. West Bengal accounted for 15.9 per cent of the country's total vegetable production in 2018-19 while UP produced 14.9 per cent. Madhya Pradesh (9.6 per cent), Bihar (9 per cent) and Gujarat (6.8 per cent) were the other major vegetable producers.
West Bengal, U.P. and M.P. are the leader vegetables producer contributing nearly 40% of the total production of in the country. In West Bengal Vegetables contribute 3.2% of the agricultural Gross Domestic Product during 2015-16. The average productivity of vegetables production in West Bengal is 18.42 mt/ha. So far 40 kinds of vegetables are being cultivated in West Bengal. In case of brinjal, cabbage and cauliflower West Bengal is the leading state.

1.3 Review of the Study of literature

We know that profitability of a crop depends on yield, price of the product, cost of inputs and as well, farmers' management capacity. Any variation in any of the above factors obviously changes the profitability. A good number of studies (Ahmad, 2003; Akhter, 2011; Chowdhury, 2011; Hassan, 2005; Islam, 2000; Sultana, 2005; Naher, 1998) were also being conducted which are related to costs and returns of different vegetables including tomato, cauliflower and cabbage. Parvin (2008) found alternate rice and vegetables production were profitable from the viewpoint of marginal, small, medium and large farmers. Naher (2005) observed that produce vegetable and exporting it to other countries is more profitable than other crops. Hossain (1997)found that cucumber growers received the highest per hectare gross return, net return above full costs and cash costs and cabbage growers obtained the lowest per hectare gross return, net return above full costs and cash cost. Haque (2001) observed that in most of the vegetables production the MVP of human labour was greater than one and it was also significant implying that it was a very crucial input and there prevails a great chance to generate employment.

1.4 Importance of this study

The importance of vegetable can be realized from two stand points such as, economic point of view and nutritional point of view. It also creates a great opportunity of employment for the large number of unemployed women of West Bengal.The government of west Bengal has given emphasis on vegetable production in the year-round to meet the nutritional and caloric need for the growing population and for increasing employment opportunities and income of farmers. Prior to giving emphasis on the production of winter vegetables, it requires relevant and adequate information on different aspects of production at farm level. For this reason, the present study makes an attempt to analyze profitability of summer and winter season vegetables. The study would identify the major factors that affect the yield of these vegetables. Therefore, the individual farmer would be benefited from this study for effective operation and management of their farms.

2. Data set and Methodology

2.1 Data set

A unique set of data have been collected directly from the vegetable growing farmers of one block, namely Khargapur – 2, of Paschim Medinipur District during February – March, 2020. Two villages, Gokulpur and Borhkola have been randomly selected. A total of 100 (Hundred) respondents (small and marginal farmers) are selected randomly and purposively from the two villages. All the selected households of vegetable growers have been interviewed personally with a structured questionnaire containing relevant information. The data from the questionnaire have been compiled for analysis.

Gopkulpur is the name of the village, which is located at a distance of about 5 k.m. from Kharagpur town and Borhkola village is located at a distance of about 4 k.m. from Kharagpur town. Most important is that all household's mainly depends on agriculture.

2.2 Methodology

On the basis of intensity of cultivation, two seasons – summer and winter - have been taken for study. The important summer vegetables are Guard, Okra, bitter guard, Patol, green vegetables etc. The winter vegetables are Cabbage, Cauliflower, Tomato, Brinjal, Potato, Onion etc in the study area. Each of the information has been documented for analyzed and make them meaningful. MS WORD and MS EXCEL were used for input process and analyzed data from sample survey.

In this study, simple profit equation was used for calculating profitability of the said vegetables. The profit function is as follows:

$\Pi=\Sigma P_{1i}Q_{1i}$ -TC

Where, P_{1i}= Price of main product

Q_{1i}= Quantity of main products

TC= Total Cost

Simple statistical techniques as well as Cobb-Douglas production function were used to process and analyze the data to achieve the goals of the study.

- Descriptive statistics like mean, standard deviation, co efficient of variation are used here to access the social and economic condition of the producers.
- Various concepts used in the study are as follows:
  a) Gross Return or Total Return = Multiplying total production with farm gate price.
  b) Variable Cost or Paid Out Costs or Cost A1 = The sum of all costs incurred in seed, fertilizer & manures, plant protection chemical, hired labour, irrigation charge, farm machinery charge, interest on working capital (negligible), etc. (Commission from Agricultural Costs and Prices (CACP), Govt. of India (Dhandayal, 2002).

c) Return over variable cost = Deducting variable costs from total return.

d) Per bigha net return was determined by subtracting per hectare total cost (variable cost and fixed cost) of production from per hectare total return.

Profitability Analysis: All the cost, benefits and related data have been collected and estimate with respect to the reference year prices. Financial viability of investment was assessed in terms of financial rate of return by using discounted cash flow method.

Financial evaluation measures like Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate Of Return (IRR) were worked out to study the winter vegetables Production.

- Net Present worth (NPW) or Net Present Value (NPV): NPV of any project is the difference between the discounted cash benefit and the discounted cost of the project. The discount rate represents the present value of the future cost or benefits.

$$\text{Net present value (NPV)} = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} - \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

Where, Bt= Benefit in each year, Ct= cost in each year, n= number of year,

r= discount rate. With this method we can estimate whether the net value of the project discounted over its anticipated life, will be positive or negative. This investment is profitable if NPV≥0.

- Benefit-Cost Ratio (BCR): when we compare two or more project with different cost, the BCR method gives a correct choice. Benefit- Cost ratio is a ration between Discounted Cash Benefit and the discounted cost of the project. If the BCR is greater than one, the project worthy of selection. If we compare two or more project, the project under consideration can be arranged according to the BCR.

$$\text{Benefit-cost ratio (BCR)} = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} \Big/ \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

Factors influencing vegetables production:

It seems to be important to answer the question like: what are the determinants of output and their extent of influence on output. Which inputs are significant in explaining variation in output? In order to ascertain the contribution of relevant inputs in street food production, the simple regression analysis of OLS type has been carried out.

$Y = f(X_1, X_2, X_3 X_4, X_5, X_6, X_7)$

Where Y= Total output, X_1 =Labour cost, X_2 =fertilizer cost, X_3 =seed cost, X_4 =irrigation cost, X_5=pesticides cost X_6=Rent of land, X_7=other costs for production.

3. Objectives

The broad objectives of these studies are to estimate a comparative study of the cost, return and profitability of winter vegetables and summer vegetables production in the study area.

The specific objectives of the study are:

1. To study the present status of vegetables cultivation in the existing socio-economic constraints of the farmers.
2. To determine the cost of production, relative share of various inputs in total cost and to assess the benefit cost ratio of different vegetables to analyze the financial efficiency of the farms.
3. To determine the most important factors which influence the vegetables production in the study area.
4. To identify constraints of vegetables cultivation and put suggestions thereof.

4. Result and Discussion

In the study area regarding occupational structure of the households it is found that 72% of the total sample households are engaged in cultivation. 12% of the sample households are agricultural labour and remaining 16% are engaged in others occupation (shopkeeper, Govt. service etc.). The result reveals that maximum households are engaged in cultivation in terms of primary occupation. Regarding educational status of household members, it is reveals that 18.91% members of households are illiterate, 36.32% members are primary educated, 20.39% people are madhyamik pass, 18.91% members are H.S pass and only 3.98% are under graduate. So above 50 percent (55.23%) of total population under study area either illiterate or primary educated. In the study area maximum family is nuclear family with average four family members.

The workers (mainly cultivators and agricultural labourers) suffer from various work related health hazards such as pains in different part of the body (hand, wrist, shoulder, neck, eye, head, etc) due to long hours of working in the particular position. Above 80% mentioned that they get ill due to excessive hard work, lack of proper nutritious diet, lack of knowledge about health care etc. workers also suffer from different health hazards as the use pesticides and chemicals.

Table-1 represents the average costs of different vegetable production of two seasons in the sample village. In order to determine the cost of purchased inputs, prevailing market price was used and for that of home supplied inputs the opportunity cost considered. The bank rate of 8% per annum was used to determine the opportunity cost of operating capital. From Table-1 it is important that the variable cost constitutes the significant major contribution of total cost for all seasons of vegetable production. Out of total variable cost, labour cost of both winter and summer vegetables is the major cost component (near about 31%). Fertilizer cost is the 2nd highest cost component among different cost components in both the seasons. In winter season it is slightly higher (28.53%) than the summer season. Among fixed cost components rent of land has the major contribution (10%-11%) for all season's vegetable production. Therefore among all types of costs Labour cost, fertilizer cost, rent of land and seed costs are the most important cost components.

Table:-1 Average cost (Rs./Acre of land) of winter and summer Vegetable Production in Sample village

Sr. no.	Cost Components	Average Cost (Rs. / Acre)		
		Winter vegetables	Summer Vegetables	Total Cost (two seasons)
	A-Variable Costs			
1.	Labour (hired + family labour)	22153.45 (31.88)	19942.84 (31.61)	42096.29
2.	Seeds	5049.70 (7.27)	4165.50 (6.60)	9215.2
3.	Fertilizer	19825.50 (28.53)	16540.65 (26.22)	36366.15
4.	Pesticides	4054.85 (5.84)	3782.43 (5.99)	7837.28
5.	Irrigation	2673.50 (3.85)	4005.80 (6.35)	6679.3
6.	Miscellaneous	4825.25 (6.94)	4100.50 (6.50)	8925.75
A.	**Total Variable Cost**(1+2+3+4+5)	58582.25 (84.31)	52537.72 (83.27)	111119.97
	B-fixed Costs			
6.	Rent of land	7000 (10.08)	7000 (11.09)	14000
7.	Interest of Capital	2400 (3.45)	2156.70 (3.42)	4556.7
8.	Depreciation	1500 (2.16)	1400 (2.22)	2900
B.	**Total fixed costs** (6+7+8)	10900 (15.69)	10556.70 (16.73)	21456.7
	Total Cost (A+B)	69482.25 (100)	63094.42 (100)	132576.67

Source: Village Survey, 2020

Table-2 represents the different economic indicators of vegetables production of two seasons. Per acre average revenue for winter vegetables is Rs. 123890 which is slightly higher than the revenue from summer vegetables (Rs. 118564). In winter season there is a different variation of the vegetables but the main problem is that market price of winter vegetable is more unstable than the market price of summer vegetables. Benefit-Cost ratio (B-C ratio) for winter season reads at 1.78 compare to 1.88 for summer season. The most important observation from this area is that in the last three years the B-C ratio has been decreased mainly due to the following two reasons:

a) The fly ash which is coming from surrounding industrial unit reduces the productivity of the land.
b) The inter-market (and intra-market) price variation for different vegetables in both the seasons is far from uniformity. The percentage change of price lies between 42.41 and 21.54 in winter and summer seasons respectively.

The coefficients of multiple regressions, R^2 were 0.72, 0.76 and 0.78 in case of winter vegetables, summer vegetables and all seasons variable respectively. These indicated that 72%, 76% and 78% of the variation of output winter seasons, summer seasons and all seasons were explained by the explanatory variables included in the model. The F-values of the equation were significant at one percent probability level which indicated the good fit of the models.

Table:-2 Average cost and revenue (Rs./Acre of land) of winter and summer Vegetable Production in Sample village

Sr. no.	Cost / Revenue Components	Average Cost /Revenue (Rs. / Acre)		
		Winter vegetables	Summer Vegetables	Total Cost (two seasons)
1.	Total Cost	69482.25 (100)	63094.42 (100)	132576.67
2.	Total Revenue	123890.00	118564.00	242454.00
3.	Net Benefit	54407.75	55469.58	109877.33
4.	Benefit-Cost Ratio	1.78	1.88	1.83

Source: Village Survey, 2020

It is observed from the Table-3 that the regression coefficient of human labour cost was positive sign and significant at 1% level of significant for winter season (0.6858) summer season (0.5682) and for all seasons (0.9061). The regression coefficient of seed cost was positive sign and significant at 1% and 5% level of significant for winter season (0.9091) summer season (0.6249) and for all seasons (0.8265). There also a significant positive relationship for fertilizer cost and pesticides cost. For irrigation cost there is significant positive relationship for winter season but for summer and all seasons there is significant negative relationship. Therefore from the above analysis we can say that there is a positive relation between value of total revenue and inputs of production (mainly labour employment, seeds, fertilizer and pesticides) for all types of vegetable production. In some times there is negative relation for irrigation input and rent of land.

Table 3:- Estimated values of coefficients of factors affecting vegetables production

Sr. no.	Cost Components	Estimated coefficients		
		Winter vegetables	Summer Vegetables	Two season vegetables
1.	Constant	2867.76(1192.15)	3788.35(998.81)	3655.47(2906.23)
2.	Labour (hired + family labour)	0.6858 (0.0857)*	0.5682(0.1239)*	0.9061(1.279)*
3.	Fertilizer	0.3628 (0.0949) **	0.5670(0.1325) ***	0.4260(1.02) **
4.	Seeds	0.9091(0.3031) *	0.6249(0.4410) * *	0.8265(1.279) *
5.	Irrigation	0.7524(0.1903) **	-0.0900(0.3845) ***	-1.483(1.962) **
6.	Pesticides	0.838(0.3020) **	0.5039(0.3130) **	1.890(1.041) **
7.	Rent of land	-0.074(0.084)	-0.30(0.135)	-0.091(0.033)
8.	Other costs	0.0408(0.0331)	0.0904(1.274) ***	0.0765(1.041) **

Note: * Significant at 1 percent level, ** Significant at 5 percent level, *** Significant at 10 percent level.
The value in the ( ) represents standard error.

To identify the major constraints on the expansion of vegetable production in study area, all constraints are classified into four groups' namely economic, technological, marketing and environmental constraints. Among all types of constraints, uncertainty about the Price of Vegetables of marketing constraints ranks first (90% respondents). In this year farmers faced huge loss due to low price of the winter vegetables. Shortage of human labour (rank-2) is the 2nd most important constraints because the unorganized labour in this area are moving to the surrounding industrial sector. Fly ash from surrounding industries (rank-3) reduces the quality of the vegetables as well as reduces the productivity. Lack of proper transport system (rank-4), low price of

vegetables (rank-5), exploitation by market middleman (rank-6), low family income of households (rank-7), high input costs (rank-8) etc. are the most important constraints faced by farmers in the study area.

Table- 4: Major constraints for vegetables cultivation

Types of Constraints	Constraints	Percentage of respond farmers
Economic Constraints	High Input costs	72 (8)
	Shortage of human labour	85 (2)
	Low price of vegetables	80 (5)
	Low family income of households	74 (7)
Technological Constraints	Lack of Irrigation facilities	37 (15)
	Incidence of insects pests	56 (11)
	Poor quality of seeds	42 (13)
	Lack of application of modern technology	53 (12)
Marketing Constraints	Poor marketing system	65 (10)
	Lack of proper transport system	83 (4)
	High transportation costs	69 (9)
	Exploitation by market middleman	78 (6)
	Uncertainty about the Price of Vegetables	90 (1)
Environmental Constraints	Ply ash from surrounding industries	84 (3)
	Unexpected Climatic conditions	40 (14)

Source: Village Survey, 2020. The value in the ( ) represents rank.

5. Conclusion

In the study area maximum households are engaged in cultivation in terms of primary occupation. They get ill due to excessive hard work, lack of proper nutritious diet, lack of knowledge about health care etc. workers also suffer from different health hazards as the use pesticides and chemicals. At present there is shortage of agricultural labour because the young generation is working in the surroundings industrial sector. Among all types of costs Labour cost, fertilizer cost, rent of land and seed costs are the most important cost components in both the seasons. Benefit-Cost ratio (B-C ratio) for winter season reads at 1.78 compare to 1.88 for summer season. The most important observation from this area is that in the last three years the B-C ratio has been decreased. There is a positive relation between value of total revenue and inputs of production (mainly labour employment, seeds, fertilizer and pesticides) for all types of vegetable production. In some times there is negative relation for irrigation input and rent of land. Among all types of constraints, uncertainty about the Price of Vegetables, shortage of human labour, fly ash from surrounding industries are the most important problems faced by farmers. Thus if government fixes price for vegetables to reduce the uncertainty, it is only the efficient production system which can increase productive efficiency on the one hand and also supply vegetables to the consumers with better quality at the least possible price. It is real fact that at present labour shortage is the most important problems of the agricultural sector in all over West Bengal. Modern technology in the agricultural sector can be applied to solve the labour shortage but it is constrained by low family income. Either Government support or cooperative system is the expected solution in this regards. These findings have important implications to be considered in designing agricultural policies and programs to improve farmer-to-market linkages.

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