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Cabbage production in East Khasi Hills district of Meghalaya: A feasibility analysis

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ABSTRACT

The present study was designed to assess the economies of cabbage production in East Khasi Hills district of Meghalaya. As the cabbage crop is grown in two seasons namely *zaid* and winter, therefore primary data were collected for both the seasons. A sample of 80 cabbage growers was selected by multi-stage random sampling technique. The study revealed that the production of cabbage in both *zaid* and winter season were found to be profitable but the profit margin of winter season was higher to that of *zaid* season. The estimates of Cobb-Douglas production function indicated that per hectare gross returns were significantly influenced by cost of seeds, fertilizers and insecticides. Therefore, significant variable inputs must be taken care by the cabbage growers as well as researcher for enhancing the productivity of cabbage. Intervention of small machinery must be tapped to reduce the cost of production of cabbage in the study area.

Key words : Cabbage, Cobb-Douglas, feasibility analysis, winter, *zaid*

INTRODUCTION

India's Agriculture and horticultural sectors has registered an impressive growth during the past few decades. Horticulture sector has established its credibility in improving the income of the farmer by generating employment and increasing foreign exchange through the increased productivity. The present scenario of horticultural crops becomes very encouraging as it moves from the traditional approach and to the commercial scale. India has witnessed a shift in the area from agriculture to horticulture in recent years. It has boosted the socio-economic conditions of many farmers. India is the second leading producer of the vegetables and fruits. Presently, horticultural crops occupies about 13.6 million hectares of the gross cropped area. This sector contributes 18.20 per cent of gross value added product of India's agricultural output (Gupta et al., 2017). India ranks second position in both creage and production of Cabbage in the world. The area shows positive trend from 5593 thousand hectares with the production of 58532 thousand metric ton (MT) in the year 1991-1992 to 10259 thousand ha with the production of 184394 thousand MT in the year 2017-18. The productivity of vegetable has been increased from 101.2 million MT in the year 1991-92 to 184.40 million MT in the year 2017-18. Percentage share of vegetables in total horticultural crops is increased from 58.7 per cent in 2013-14 to 59.2 per cent in 2017-18. Uttar Pradesh has the highest production of horticultural crops in India contributing 392.48 lakh MT followed by West Bengal with 324.20 lakh MT (GoI, 2018).

In North Eastern India the area under the cabbage is 5649 thousand ha with the production of 1,027.42 MT. The average productivity of vegetables in North Eastern Hill region is far below the national average productivity and contributes 8.15 per cent to production from 9.05 per cent

(GoI, 2018). Amongst the North Eastern states in India, Meghalaya has favourable agro climatic conditions for growing vegetables throughout the year which helps the farmers to get premium price during off-seasons from neighbouring states. The returns and the revenue from the vegetables are higher than the cereals and pulses. More ever these vegetables can be grown in gentle slopes or homesteads GoM (2018). Recently the government of Meghalaya has introduced vegetable development scheme led by the Directorate of Horticulture with the association of Agriculture and Farmers Welfare Department which aims to promote vegetable production in Meghalaya. Amongst the vegetable crops, cabbage is contributing highest area and production after potato in Meghalaya. Consumption of cabbage keep the bones healthy it reduces the risk of cancer and aids in reducing the blood pressure (Ware, 2017). The area under cabbage in Meghalaya is 1943 ha; the production is 42.67 thousand MT with a yield of 21964 kg ha^{-1}. Among the different district of Meghalaya East Khasi Hills district is the major producer occupying 54.70% area and 68.70% production. Since, scanty research information is available on cabbage in Meghalaya, there is a need to study the economies of cabbage production in the state for constructive policy decision. The present paper is an overview of its economic feasibility in the state of Meghalaya.

MATERIALS AND METHODS

The study was conducted in two blocks *viz.*, Mawrykneng and Mawkynrew of East Khasi Hills district of Meghalaya due to their higher area and production. Two villages namely; Umphyrnoi and Sohryngkhemg from Mawrykneng block and three villages namely; Thangsning, Tynroit and Rapleng were selected from Mawkynrew block. A sample of 80 cabbage growers (Fig. 1) adopting proportionate random sampling in each selected village were selected. Primary data of two seasons *viz.*, *zaid* and winter were collected on seeds, fertilizers, organic manures, insecticides, pesticides including clod crushing, nursery bed and main field preparation, intercultural operations, harvesting and labour used in cabbage cultivation.

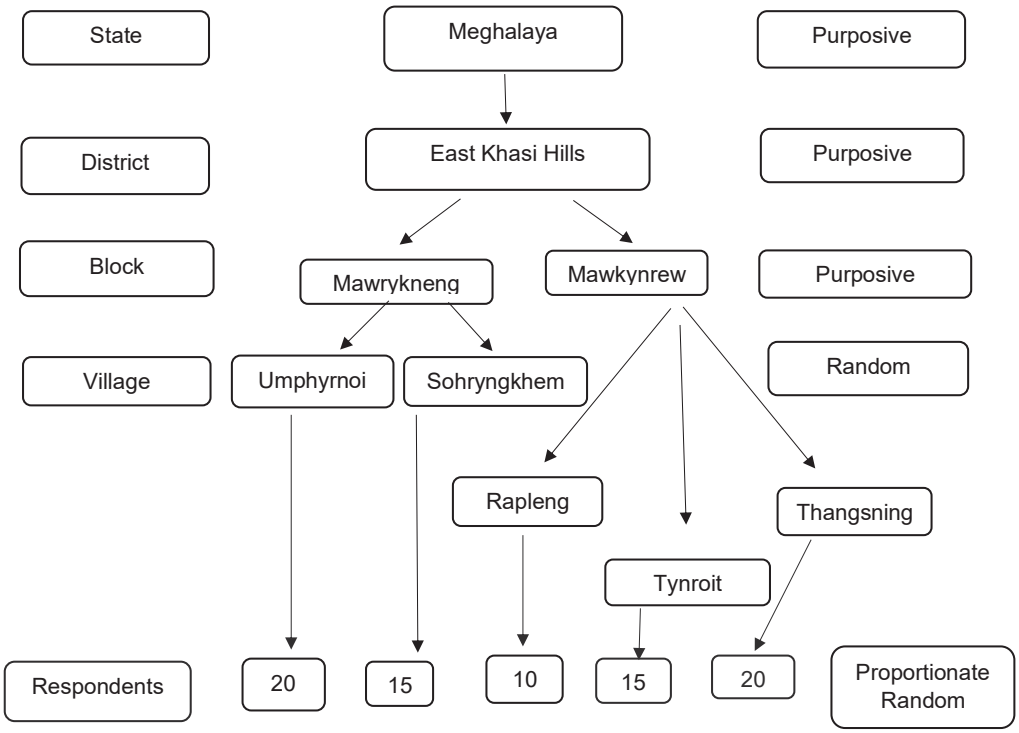

Fig. 1. Schematic representation of sampling plan

Analytical tools

Costs analysis

Cost concepts proposed by Special Expert Committee on (GoI, 1979) was used to calculate Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1 and Cost C_2.

Cost A_1 includes

i) Value of hired human labor, animal labor (owned),

ii) Charges on hired farm machinery,

iii) Value of seed owned and purchased,

iv) Value of manures, value of fertilizers,

v) Value on plant protection chemicals,

vi) Depreciation on implements and farm buildingscesses and other taxes

vii) Repair and maintenance of farm machinery and farm implements and farm buildings,

viii) Irrigation charges,

ix) Land revenue,

x) Interest on working capital and miscellaneous expenses.

Cost A_2: Cost A_1 + rent paid for leased in land

Cost B_1: Cost A_1 + interest on value of owned fixed capital assets (excluding land)

Cost B_2: Cost B_1 + rental value of owned land (minus land revenue)

Cost C_1: Cost B_1 + imputed value of family labour

Cost C_2: Cost B_2 + imputed value of family labour

B. Return analysis

Gross farm income (GFI) = Value of main product (quantity × Price)

Net return including family labor = GFI − Total cost including family labor

Net return excluding family labor = GFI − Total cost excluding family labor

Farm business income = GFI – Cost A_2

Family level income = GFI − Cost B_2

Net farm income = GFI – Cost C_2

Farm investment income = Farm business income - imputed value of family labour

Cobb-Douglas production function

Cobb-Douglas production function model was chosen to estimate the effect of key variables on gross returns of cabbage production. The double log form of production proved to be superior alternative on theoretical and econometric grounds as given under.

$$Yi= \alpha X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5}$$

By taking log in both sides, the Cobb-Douglas production function was transformed into the following logarithmic form because it could be solved by ordinary least square method.

$$\text{Ln } Yi= \text{In } \alpha+\beta_1 \text{In } X_1+\beta_2 \text{ In } X_2+ \beta_3 \text{ In } X_3+ \beta_4 \text{ In } X_4+ \beta_5 \text{ In } X_5$$

Where;

Y= Gross returns (₹ ha^{-1});

In α= Constant or a intercept of the function;

X_1= Seed cost per ha;

X_2= Organic fertilizers Cost per ha;

X_3 = Cost of fertilizers;

X_4= Insecticides cost per ha;

X_5= Labour cost per ha; B_1, β_2, β_3 *etc* are Co-efficient of respective variables;

In= Natural logarithm; e= Base of the natural logarithm;

Ui= Error term and i= 1,2,3…..n.

Economic viability

Benefit cost ratio (B-C Ratio)

This ratio indicates the rate of return per rupee invested in cabbage enterprises. It is worked out by dividing the discounted net cash flow by cost of cultivation.

BCR= {Gross present value of income ÷ Gross present value of cost}

Operating ratio

The operating ratio is firms operating expenses as a percentage of revenue. The smaller the ratio, the greater the firm's ability to generate profits.

RESULTS AND DISCUSSION

Cost of cabbage cultivation in *Zaid* season

The total cost A_1 was estimated to be of ₹27821.52 per ha. Cost A_2 was depicted as same as cost A_1 since no respondents found to have lease in land. Similarly, the cost B_1 was estimated to be of ₹28153.93 per ha. The respondents under research were giving their land for rent which costs ₹4500 and consequently the cost B_2 was estimated of ₹32653.93 per ha. The imputed value of family labour has been estimated of ₹19475.07. The cost C_1 was worked out to be of ₹47629 and cost C_2 to be of ₹52129. Per hectare Cost A_1 of cabbage cultivation in winter season was found to be of ₹26274.95. The Cost $B_1$was worked out to be of ₹26607.37 per hectare. The cost B_2 was found to be of ₹31107.37. Cost C_1 was worked out to be of ₹43334.42 and cost C_2 was found to be ₹47834.42 per hectare. The cost A_1 was found to be more in *Zaid* season (₹27821.52 ha^{-1}) than winter season (₹26274.95 ha^{-1}). The reason might be the labour has charged more in *zaid* season than in winter season. Consequently, the Cost C_1 and C_2 were higher in *zaid* than the winter season. Hence, the comparative cost analysis for cultivation of cabbage in *zaid* and winter season provided an overview from which researcher can think of for intervene as per season (Table 1).

Table 1. Comparative cost of cabbage cultivation in *zaid* and winter season

Sl. no.	Particulars	Season (₹ ha^{-1})	
		Zaid (₹ ha^{-1})	Winter (₹ ha^{-1})
i	Hired labour	21792.84 (41.80)	18723.42 (39.14)
ii	Cost of the seeds	1166.66 (2.23)	2070.82 (4.32)
iii	Cost of Fertilizers	905.60 (1.73)	901.21 (1.88)
iv	Organic fertilizers	609.20 (1.16)	1188.55 (2.48)
v	Plant protection	1255.50 (2.40)	1365.8 (2.86)
vi	Interest of working capital @ 4.50	1157.80 (2.22)	1091.24 (2.28)
vii	Depreciation	933.91 (1.79)	933.912 (1.95)
viii	Cost A_1 (i to vii)	27821.52 (53.37)	26274.95 (54.93)
ix	Rent payed for the leased in land	-	-
x	Cost A_2 (viii+ix)	27821.52 (53.37)	26274.95 (54.93)
xi	Interest on the owned fixed capital assets excluding land @ 8.45%	332.41 (0.63)	332.4156 (0.69)
xii	Cost B_1 (x+xi)	28153.93 (54.00)	26607.37 (55.62)

xiii	Rental value of owned land	4500.00 (8.63)	4500 (9.41)
xiv	Cost B_2 (xii+xiii)	32653.93 (62.64)	31107.37 (65.03)
xv	Imputed value of family labour	19475.07 (37.35)	16727.05 (34.97)
xvi	Cost C_1 (xii+ xv)	47629.00 (99.99)	43334.42 (90.59)
xvii	Cost C_2 (xiv+xv)	52129.00 (100)	47834.42 (100)

Note: Figures in Parentheses are percentages in total to Cost C_2.

Returns from cabbage cultivation

Yield, total gross farm income, farm business income and family labour income of cabbage during winter has been observed to be higher than *zaid* crop. The net return including family labour was also found to be higher in winter compared to *zaid* season. If we see the net return excluding family labour it was higher in winter season than *zaid*. Hence, it is apparent from the analysis that there was huge investment on labour for cultivation of cabbage. Therefore, intervention of mechanization was a need of hour on the basis of season (Table 2).

Table 2. Comparative returns from cabbage cultivation in *zaid* and winter season

Particulars	Season	
	Zaid (₹ ha^{-1})	Winter (₹ ha^{-1})
Productivity (q ha^{-1})	58.33	68.00
Gross returns	84578.50	88400.00
Net return including family labour	51924.57	57292.63
Net return excluding family labour	32449.50	40565.58
FBI	56756.98	62125.05
Family labour income	51928.57	51928.57
Net farm income	32449.50	40565.68
Farm investment Income	37281.92	45398.00

Benefit cost and business operating ratio

The B:C ratio of cabbage cultivation during *zaid* and winter found to be of 1.60 and 1.84, respectively. It indicated that cabbage cultivation in winter is more profitable compared to *zaid*. The operating ratio of cabbage production in *zaid* and winter found to be of 54 per cent and 47 per cent, respectively indicating; the cultivation of cabbage economically profitable during both the seasons.

Factors ascertaining cabbage production

The magnitude of co-efficient of regression for seed cost was found to be of 0.01 with the positive sign and it was significant at 5 per cent of level of significance. It indicates that 1 per cent increase in the seed cost lead to increase in gross returns by 0.01 per cent. In the concerned research area most of the respondents were using the seeds less than the optimum usage recommended by government so in this case if respondents can purchase more quantity of seeds, more will be the production which will lead to higher gross return. Co-efficient of regression for fertilizer has shown a positive sign with 0.25 which was contributing

significantly at 1 per cent. It indicates that 1 per cent increase in fertilizer cost will lead to 0.25 per cent increase in gross returns. Majority of the respondents in the study area were using less than the required level of fertilizers. Since cabbage is a heavy fertilizer consuming crop, if the respondent will apply more fertilizer to cabbage then both the production and gross returns will increase (Table 3). The co-efficient of regression was found to be 0.02 which was statically significant at 1 per cent level. It indicates that 1 per cent increase in insecticides costs leads to increase in gross returns by 0.02 per cent. Similar findings were given by Somajpoti et al. (2016). The crop was prone to attack of insects and sucking pests which resulted in crop damage and gross returns. The value of co-efficient of multiple determinations (R^2) was 0.60; which indicates that 60 per cent of variation in gross returns of cabbage was due to explanatory variables included in the model and remaining of other factors which were not taken into model.

Table 3. Estimated Cobb-Douglas production function of cabbage production

Explanatory variables	Co-efficient	Standard error	P-value
Intercept	6.89	2.52	0.00
Seed costs	0.01**	0.11	0.03
Organic fertilizers	0.79	1.36	0.24
Fertilizer costs	0.25***	0.141	0.00
Insecticides	0.02**	0.1	0.04
Labour	-0.03	0.09	0.69

**Indicates p<0.05 and ***indicated p<0.01 respectively.

CONCLUSION

Cabbage crop has been observed to be highly beneficial in the state of Meghalaya. The significant input variables need to take care by the farmers which are playing vital role in enhancing the yield of cabbage. The season wise analysis has given clear way forward in which the winter season must be popularized to produce cabbage. The agricultural engineering department of the state must come forward to develop small size of machinery to reduce human labour use which will reduce in cost of cabbage production.

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