

Crop diversification with Broccoli (*Brassica oleracea* var *italica* L.) and Summer Squash (*Cucurbita pepo* L.) in Dakshin Dinajpur District of West Bengal

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Abstract—The present investigation was aimed to diversify summer squash and broccoli along with other existing winter vegetables mainly cabbage and cauliflower (main season) in Dakshin Dinajpur District of West Bengal. The study was conducted at two villages of Dakshin Dinajpur district based on two year data, collected from 30 numbers of progressive farmers. The results indicated that broccoli and summer squash grown successfully and performed economically better as compared to cabbage and cauliflower. The yield of summer squash (21.85 t/ha) and broccoli (16.54 t/h) was less as compared to cabbage (24.23 t/ha), cauliflower (21.64 t/ha) but maximum cost benefit ratio was recorded by summer squash (3.47) followed by broccoli (2.88), cabbage (2.24) and cauliflower (2.17). It also found that summer squash was taken lowest growing time (55 days) as compared to Broccoli (70 days), cabbage (82 days) and cauliflower (74 days). Because of the short growing time, summer squash can be grown at several different planting dates during the cool growing season. In case of cole crops broccoli produced maximum B:C ratio with more demand and higher price. As the crops were new to the farmers hence proper scientific cultivation practices was not known by them so yield can also be improved by adopting scientific cultivation practices. Thus based on above findings it may be concluded that summer squash and broccoli can be cultivated commercially in the villages of Dakshin Dinajpur District.

1. INTRODUCTION

In India more than 70 percent people are engaged in Agriculture over an area 320 million acres out of this very few (1-2 percent) are involved in vegetable cultivation. In our country different vegetables are grown throughout the year but production is not in sufficient as compared to requirement as per population. India is the second largest producer of vegetables in the world next only to China and the

area under cultivation of vegetables about 10.1062 million hectares and produced around 168.6 million tonnes in 2016-17 which accounts for nearly 14.0 percent of country's share in the world total production (Annon. 2017). West Bengal tops with a 16% share of total vegetable production of country in 2017 (Kumar and Kumari 2017). Dakshin Dinajpur district of West Bengal produces 35020 tonnes vegetable from 2001 hectares of land (Anon. 2013-14). The important vegetables cultivated in this district are tomato, brinjal, chilli, okra, cabbage, cauliflower, coriander, amaranthus, palak, pointed gourd, bitter gourd, pumpkin, bottle gourd, broad bean, pea, onion etc. Generally progressive farmers are involved in vegetable cultivation and get more benefitted than field crops and the numbers of this progressive farmer increase very rapidly. Cultivation of group of vegetables is more profitable than a particular vegetable due to demand of multiple vegetables in a particular season in market. Multiple cropping systems offer special advantages and reduce the probability of low income for small and marginal farmers (Kumar and Negi 2015). Multiple vegetable can be grown in different plot of a particular land or as intercropping, multitier cropping, mixed cropping etc. with multiple vegetables. Intercropping cereals with a multiple of crops, and including legumes in these systems is most common and researched due to the synergistic effects, with the objective of diversifying food production and household cash incomes (Rao and Mathuva 2000; Kimaro *et al.* 2009). Summer squash and broccoli are two economically important, rich in nutrition and good in taste which may be grown in Dakshin Dinajpur District. Summer squash is the only cucurbitaceous crops which need low temperature as arises in winter season and broccoli's needs climatic condition as like cabbage or cauliflower. In present condition farmers are not get expected profit as the same vegetables are cultivated by more number of farmers. In this situation more suppliers of some particular vegetables leads to less demand and minimize the prize rate and less profit. Production of vegetable is seasonal and most perishable in nature so large production of a particular vegetable leads to post harvest losses also. Diversification of summer squash and broccoli may increase the choice of option to select multiple crops which may improve the farmers' profit.

Therefore, keep in mind the above situation the present studies is conducted with following specific objectives

- 1) To study the performance of summer squash and broccoli along with other existing crops.
- 2) To analyze the cost of cultivation and return of summer squash and broccoli.
- 3) To identify the constraints in production and marketing of summer squash and broccoli.

2. MATERIALS AND METHOD

A unique set of data have been directly collected from two adapted villages of Dakshin Dinajpur Krishi Vigyan Kendra, namely Panchagram village of

Gangarampur block and Sehas village of Tapan block of Dakshin Dinajpur District. Data were collected from 30 numbers of progressive farmers of each village for the two year (2015-16 and 2016-17). Relevant information from all the selected households of vegetable growers has been interviewed personally with a structured questionnaire. The data from the questionnaire have been compiled for analysis. Mainly tabular form of analyses has been used. Besides, simple mathematical tools like average, percentage, etc. have been estimated for interpretation of data. Along with summer squash (variety Don-17) and broccoli (variety Green Magic), cabbage (variety Pan 1162) and cauliflower (variety Kadambini) were selected for easy comparison during the main winter season (November planting). Farmers were mostly trained with good agricultural practices and followed recommended fertilizer doses for all selected crops. 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 Cost or Total Cost = The sum of all costs incurred in seed, fertilizer and 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) Net Return over variable cost = Subtracting variable costs from total return.

d) Benefit-Cost ratio = Total return divided by variable cost.

Information from different sources like internet, journal, book, printed materials, Govt. Department etc. have also been consulted to verify and further justification of the data as obtained from primary sources i.e. from farmers.

Limitations of the Data : Due to some constraints in time, weather fluctuation, fund, personnel and management, size of sample is small. Data have been selected only for two year and all farmers were like to cultivate traditionally. Climatic and other environmental and managerial data are not collected and incorporated, which may lack accurate conclusion in respect of production, productivity and profitability. And, thus, it leaves a scope for future research.

3. RESULT AND DISCUSSION

Days to harvesting : The result indicates that among the four crops summer squash required minimum time period (55 days) followed by broccoli (70 days) to complete life cycle (Table-1). Due to short duration in nature these crops can give early return and with proper time arrangement these crops can be cultivated in several planting dates at a particular growing season and make it available for a long period. Richardson K. V. (2016) also reported that because of the short growing time, summer squash can be grown at several different planting dates during the cool growing season.

Table-1

Crops	Days to harvesting	Yield (t/ha)	Gross return (Rs./ha)	Gross cost (Rs./ha)	BCR
Summer squash	55	21.85	327750	94451	3.47
Broccoli	70	16.54	248100	86145	2.88
Cabbage	82	24.23	169610	75718	2.24
Cauliflower	74	21.64	173120	79778	2.17

Yield and Profitability : The calculated data showed that maximum yield was obtained by cabbage (24.23 t/ha) followed by summer squash (21.85 t/ha) and minimum yield was recorded in Broccoli (16.54 t/ha) though Giri *et al* (2013) recorded that maximum curd production of broccoli reaching at 14.47 t/ ha in western Chitwan, Nepal. As the seed price for both crops were high therefore gross cost for both the crops become higher than cabbage and cauliflower. Gross return for both the crops was recorded higher than others as higher market demand and less availability. The result showed that summer squash produced maximum cost benefit ratio (3.47) followed by broccoli (2.88) which indicates good profitability in both the crops than other two. Cultural practices and cost of cultivation of broccoli is more or less same as cabbage or cauliflower and produced higher BC ratio, so it may suggest to the practicing farmer to cultivate broccoli along with cabbage and cauliflower which will give more return as compare to other cole crops. Higher cost benefit ratio also indicates that higher market value which directly co-related with market demand. Hence it showed that both the crops have a market demand and if there will be large scale production marketing problem may not be a great problem.

4. CONCLUSION

In this study summer squash and broccoli was a new crops to the farmers and aimed was to find out the performance, profitability and constrain of both of them for commercial cultivation. Depend upon results it may be summarized that both the crops can be cultivated commercially in the village level which will be profitable. In present condition both the crop have a good market demand and it may also be increased by increasing awareness among the people about nutritional value of both the crops. As the summer squash and broccoli were new crops to the farmers so some lacking in case of cultural practices may cause the lower yield so yield can also be improved by adopting scientific cultivation practices and has a scope for feature research.

Thus based on above findings it may be concluded that summer squash and broccoli can be cultivated commercially in the villages of Dakshin Dinajpur District.

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