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Impact of Demonstration on Organic Cultivation of Cabbage (*Brassica oleracea var.* capitata) in Baksa District of Assam

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ABSTRACT

Cabbage is one of the important *rabi* season crop in Baksa district. The climatic conditions of the region are very much suitable for its growth and development. But, the practices of using inorganic fertilizers without any standard doses are rising at an alarming rate among the farmers in the district which is bringing a great threat to the soil health as well as to the crop. Under such circumstances, Krishi Vigyan Kendra, Baksa conducted frontline demonstration programme on organic cultivation of cabbage during the year 2018-19 and 2019-20 covering an area of 0.8 ha with 6 numbers of farmers. The study came out with very encouraging results and revealed that the organic package which is demonstrated obtained a higher yield (186.4 q/ha); head weight (1250 g); canopy diameter (42.51 cm) and head size (13.75 cm) than the farmers' practice which only managed to obtain yield 170 q/ha; head weight 900 g; canopy diameter 38.21 cm and head size 13.28 cm. In addition, the gross return was also found higher in the technology (Rs.278100.00 in 2018-19 and Rs.281190.00 in 2019-20) than the farmers' practice (Rs.202872.00 in 2018-19 and Rs.205116.00 in 2019-20) with a net B:C ratio of 2.30 and 1.77, respectively. Finally, from the study it was concluded that the farmers of Baksa can go for the organic package demonstrated in place of their existing practice to obtain higher yields and returns in terms of money.

Keywords: Organic cultivation, Cabbage, Vermicompost, *Azotobacter*, Rock phosphate

VEGETABLES are an integral part of a healthy daily diet. Fresh vegetables are very much needed to our body and that too when pandemic situation is prevailing in the country it is badly desired. They contain varieties of micronutrients useful for physical and mental function (Kaplan *et al.,* 2007). Such an important crop in today's discussion is Cabbage. It is one of the most common cool season vegetable crops grown in the *rabi* season in almost all the parts of the country. It belongs to the family Crucifereae and is believed to have originated in the Western Europe and it was the first cole crop to be cultivated (Chauhan, 1986).

A total of 1049 ha of area is covered under Cabbage cultivation with a production of 22818 tonnes in the Baksa district (Directorate of Economics and Statistics, Assam, 2015). It is mainly grown as an annual vegetable for its dense leaved and compact heads. The optimum temperature for its growth and development ranges from 18°C to 20°C. It can be grown on a wide range of soils but it performs well on loamy soils with good moisture percentage, rich in organic matter and proper drainage facilities. The ideal soil pH ranges from 5.5 to 6.5 and soils with pH above 6.5 tends the leaves to become dark and leaf margins die back. It is used as fresh salad or either consumed as cooked vegetable or other processed products. The marketable head is a very good source of vitamin C, some B vitamins, potassium and calcium (Hasan & Solaiman, 2012 and Tiwari *et. al.,* 2003). Cabbage have been shown to protect against lung cancer, breast cancer and chemical influenced cancers due to the glucosinolates present in them (Traka *et al.,* 2010).

Baksa is one of the districts situated at the lower Brahmaputra valley zone in Assam. The average annual rainfall of the district is 2097 mm with a temperature of 10 - 35°C. Thus, cabbage grows very well in this region due to its favourable cool and humid

climate. The farmers here usually follow non judicious use of inorganic fertilizers and thus brings disastrous to the crop, soil and to the ecosystem as well. Earlier reports mentioned that excessive use of nitrogenous fertilizers produces coarse and loose heads resulting in low keeping quality (Ojetayo *et al.,* 2011). High uses of synthetic fertilizer inputs may lead to damage to crops and unexpected harmful effects of environment (Adesemoye & Kloepper, 2008; Kirchmann & Thorvaldsson, 2000 and Letourneau, 1996). Under such situation it has become a very high matter of concern to promote organic cultivation for the farmers' to bring them away from the domain of chemical fertilizers and pesticides by the use of organic inputs like Vermicompost, *Azotobacter*, Rock phosphate etc.

Vermicomposting is a potential source of available nutrients and it helps in maintaining soil fertility and enhancing productivity (Sunasee, 2001). *Azotobacter* can fix atmospheric nitrogen helping plants in better grain production. Besides, it also produces certain growth hormones (Shende *et al.,* 1986 and Jadhav & Patil, 1985). Moreover, reports also suggested that treating seeds with phosphate solubilizing micro-organisms can result in higher yields (Bai *et al.,* 2020).

Therefore, the present investigation was carried out to study the effect of organic inputs like Vermicompost, *Azotobacter*, Rock phosphate and *PSB* on growth and yield of Cabbage in Baksa district.

Material and Methods

The present investigation was conducted by Krishi Vigyan Kendra, Baksa at farmers' field during the period 2018-19 and 2019-20 under the Frontline demonstration (FLD) programme to disseminate and popularize the organic package of Cabbage cultivation (Assam Agricultural University, 2019) covering an area of 0.8 ha with 06 nos. of farmers. The villages selected for the study were Borbalisiha, Uttarpara, Bunbari. The soil selected under the treatments was a sandy loam soil with proper drainage facilities. The land was duly ploughed and harrowed to obtain a fine tilth. The seed was sown in the nursery bed in the month of mid September and after 35 days, transplanting was completed in all the treatment plots. The management practices of the technology demonstrated and the farmers' practice are elucidated in Table 1.

Some of the parameters are taken into the study to determine the final yield of the technology demonstration plot against the famers' practice *viz.,* Head size, head weight and canopy diameter and economic parameters like Gross cost, Gross return, Net return and B:C ratio. Moreover to find the gap analysis some exercise have been worked out to calculate certain parameters like technology gap, extension gap and technology index by using the formulae as given below (Samui *et al.,* 2000).

Technology gap=Potential yield-Demonstration yield

Extension gap=Demonstration yield- Farmers yield

$$\text{Technology gap index} = \frac{\text{Potential yield-Demonstration yield}}{\text{Potential yield}} \times 100$$

Results and Discussion

Growth Parameters

The data obtained in the study are presented in Table 2. From the study it has been obtained that the higher value for head size was found in case of the improved organic package (13.75 cm) whereas, in case of the farmers' practices it was 13.28 cm. This might be due to the reason of sufficient supply of heavy nutrients during the crop growth through organic fertilizers. Earlier, similar works were also reported by Bharadwaj *et al.,* 2000; Samawat *et. al.,* 2001; Jayathilake *et al.,* 2002; Prabhakaran & Pitchai, 2002 and Tripathy *et al.,* 2004. In addition, improved plant growth by *Azotobacter* sp. and PSB may be attributed to growth hormone production, improving root efficiency and combined nitrogen and phosphorus availability (Vessey, 2003). From the observation, it has also come into notice that the improved practice has the higher head weight (1250 g) and the farmers' practice has the lower one (900 g). This could be probably due to the application of organic manures which helped in improving microbial activities leading to better availability and uptake of nutrients in soils by

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TABLE 1

Management practices of the technology demonstrated and farmers' practice

Particulars	Technology demonstrated	Farmers' practice
Time of Sowing	Mid october	Oct-November
Variety	BC-76	Non descript seeds
Spacing	5 m × 5 m	No specific spacing followed
Fertilizer dose	FYM @ 5t/ha + Vermicompost @ 1t/ha. Moreover, soil application with Rock phosphate @ 313 kg/ha	Non judicious use of fertilizers
Irrigations	2 Life saving irrigations	Rainfed
Plant protection	Neem based insecticides	Do not use any chemicals or botanicals

the plants as compared to the sole application (Reza *et al.,* 2016) of fertilizers without maintain any standard fertilizer doses. Likely the previous two parameters, the improved practice with the organic inputs resulted in higher canopy diameter (42.51 cm) than the farmers' practice (38.21 cm). Ali and Kashem (2018) also reported increased spreading of the canopy with the increase in Vermicompost application. Moreover, Canellas *et al.,* 2002 reported that the plant growth is related to humus content excreted by earthworm which contains humic acid and this finally helps in the plant growth and development. The crop took a total of 81.5 days to harvesting stage in the technology demonstrated plot on the other hand it took 91.3 days in the practice followed by the farmers. Similar results are also reported by Islam *et al.,* 2018.

TABLE 2

Effect of organic inputs in the technology plot and farmers' practice

Treatments	Parameters (Year wise)											
	Head size (cm)			Head weight (g)			Canopy diameter (cm)			Maturity		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean
Technology	14.7	13.96	13.75	1316.66	1383.33	1250	43.75	46.27	42.51	80	83	81.5
Farmers' practice	12.82	13.17	13.28	1066.66	1193.33	900	36.77	39.65	38.21	90.2	92.4	91.3

TABLE 3

Analysis of technology gap, extension gap and technology index

Year	Area (Ha)	No. of farmers	Yield (q/ha)			% increase over control	Tech. Gap (q/ha)	Extension gap (q/ha)	Tech. Index (%)
			Potential (q/ha)	Demo (q/ha)	Farmers' practice (q/ha)				
2018-19	0.4	3	217.5	185.4	169.06	9.66	32.1	16.34	14.75
2019-20	0.4	3	217.5	187.46	170.93	9.67	30.1	16.53	13.81

TABLE 4
Effect of organic inputs in Economics

Treatments	Gross cost (Rs.)		Gross return (Rs.)		Net return (Rs.)		B:C ratio	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Technology	121000.00	121000.00	278100.00	281190.00	157100.00	160190.00	2.29	2.32
Farmers' practice	115000.00	115000.00	202872.00	205116.00	87872.00	90116.00	1.76	1.78

Gap Analysis

The yield gap were analysed in the study (Table 3) and the results revealed that the yield obtained was 185.4 q/ha to 187.46 q/ha during the year 2018-19 and 2019-20, respectively in the technology demonstration plot. In case of the farmers' practice it limited 169.06 q/ha to 170.93 q/ha. The technology gap observed may be due to the varying soil and nutrient status of the soil and weather conditions (Mitra and Samajdar, 2010). The extension gap was found to be 16.34 and 16.53 q/ha which indicates more efforts are to be done to educate and need awareness about the concept and benefits of the organic cultivation among the farming community of the district. Lastly, the technology index in the two years of study ranges 13.81 to 14.75 which mean the technology is a feasible technology and can be easily accepted by the farmers because lesser the value of technology index, more feasible is the technology (Jeengar *et al.,* 2006).

Economics

From the Table 4, it is clearly evident that the higher return was obtained by the improved cultivation practice in both the years using the organic sources of nutrients (Rs.278100.00 in 2018-19 and Rs.281190.00 in 2019-20) than the farmers' practice (Rs.202872.00 in 2018-19 and Rs.205116.00 in 2019-20). This is actually due to the higher yield and better market price received for the organically cultivated produce than the product produced by the farmers' practice. As a result, net return and B:C ratio are also found to be higher (Table 4) in case of the technology demonstration than the farmers' practice.

Finally, it can be concluded that the application of Vermicompost @ 5 t/ha + Rock Phosphate @ 373 kg/ha and *Azotobacter* and PSB @ 7 g each per 100 g of seeds as seed treatment can be opt against the practice followed by the farmers of Baksa district which is no any scientific management practices rather only non-judicious use of fertilizers in terms of getting higher yields and maximum benefits or returns. Moreover, it is noteworthy to be mentioned that cultivation practices using natural or organic sources of nutrients maintains the soil health and nutrient status. It do not allows the soil to loose its fertility which is very much important in today's world whereas repeated use of excess inorganic fertilizers brings various hazards and threats to the soil health. Therefore, organic cultivation of cabbage will be the better option for the farmers in place of inorganic one to maintain sustainability and better productivity in the region.

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