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Performance of biofortified cauliflower varieties Valentena and Carotena under Sonitpur district of Assam

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Abstract

Cauliflower is extensively grown in Assam from July onwards in three different seasons including early, mid and late season crop. Farmers are cultivating various hybrid (F1) cultivars including biofortified varieties to increase the yield and income. Every year, several hybrids are being imported in Assam and there needs a varietal trial before being recommend at farmer's field. Thus a field experiment was carried out by Krishi Vigyan Kendra, Sonitpur to study the performance of two biofortified cauliflower hybrids under agro-climatic condition of Sonitpur district of Assam, during the year 2022-23 and 2023-24 covering two numbers of villages namely Amolapam and Berajan in four locations. Two biofortified cauliflower hybrids namely Valentena and Carotena and one white cauliflower hybrid White star (check) were studied for growth and yield attributing characters. The experiment was laid out using randomized block design with four numbers of replications. The results revealed that among the two biofortified cauliflower hybrids, Valentena performs better in terms of growth and yield attributes as compared to Carotena and White cauliflower hybrid White Star. Maximum plant height (86.26 cm), number of leaves per plant (24.56), leaf length (67.77 cm), leaf breadth (32.84 cm) were recorded in cauliflower hybrid Valentena which was followed by cauliflower hybrid White star (79.91 cm, 21.62, 64.15 cm and 24.56 cm) and Carotena (74.32 cm, 14.41, 62.23 cm, 23.31 cm) respectively. In relation to yield parameters and economics of production also, maximum values were recorded in hybrid Valentena in terms of fresh weight of plant (2.25 kg), average curd weight (1.85 kg), total curd yield per hectare (144.26 q/ha), gross return (Rs. 2, 16,660.00), Net return (Rs. 1, 47,370.00) and B: C ratio (3.12) followed by White Star (1.89 kg, Rs. 187500.00, Rs. 123179.00 and 2.91) and Carotena (1.65 kg, Rs. 174990.00, Rs. 107510.00 and 2.59) respectively. The performance of biofortified cauliflower hybrids Valentena and Carotena was convincing to the farmers of the locality and increasing its possibility of horizontal expansion in the district as a nutritionally rich crop.

Keywords: Biofortified cauliflower hybrids, Valentena, Carotena, white star, cauliflower cultivation

Introduction

Cauliflower (*Brassica oleracea* var botrytis L.) belongs to the family *Brassicaceae* is an important cole crop in the world originated in Mediterranean region (Giri, 2020) ^[1, 8]. The crop first introduced to India in 1822 from England during the period of East India Company. In India two separate groups of cauliflower are commonly grown i.e. Indian or Tropical type and European or Temperate type known as Snowball type. The cauliflower sector is accounted for over 75% of world production by Chinese and Indian cauliflower (Mulderji, 2016) ^[22]. More than 20 million tonnes of cauliflower is produced annually worldwide and China and India are among the leading countries. China produces half of the world's total production of cauliflower while India's share is around 32.5%. In India, the area under cauliflower was 459 thousand hectares with a production of 8800 thousand tonnes and productivity of 19.17 tonnes/ha (FAO, 2023) ^[15]. Individually cauliflower accounts for 5.06% of vegetable production of the country. West Bengal is the leading cauliflower producing state (1863 MT) in India and Assam occupies 7th position in cauliflower production (449.25 MT) among the leading states. India being the second largest populating country of the world, the biggest challenges are inadequate food supply, hunger and malnourishment.

According to UNICEF, one in three malnourished children in the world is Indian (Singh *et al.*, 2019) ^[21]. Micronutrient deficiency leads to global problem of malnourishment of the population due to inadequate availability of vitamins particularly vitamin C, vitamin D and vitamin E and other micronutrients such as iron, zinc, calcium, iodine, folic acid, etc. Vegetables are rich sources of vitamins and minerals. According to ICMR, an adult should consume 300 gm of vegetable capita⁻¹ day⁻¹ to meet the requirements of vitamins and minerals. So to overcome the problem of malnutrition with ever increasing population and limited land holding, biofortification is an economical approach of nutrient fortification into food crops providing more nutritious food to a large population by availing a few land resources. Biofortification differs from conventional fortification in that biofortification aims to increase nutrient levels in crops during plant growth rather than through manual means during processing of the crops.

The economical and edible part of cauliflower is immature curd and is rich source of several vitamins, minerals and fiber (Poudel *et al.*, 2017) ^[19]. Cauliflower serves medicinal value as it helps to prevent chronic cancer and cardiovascular diseases (Ara *et al.*, 2009) ^[20] and is consumed as raw, cooked vegetable, curry and is the best ingredients in noodles, burgers and sandwich preparation (Sajad, 2017; Kushwah *et al.*, 2023) ^[17, 18]. Besides, cauliflower contain 92.7 % water and the food value per 100 g of edible portion is as follows: energy 31 calories, protein 2.4 g, calcium 22 mg, vitamin A 40 IU, ascorbic acid 70 mg, thiamine 0.2 mg, riboflavin 0.1 mg and niacin 0.75 mg. Biofortification works have been practiced in most of the horticultural crops including cauliflower. Two of the Syngenta developed biofortified hybrid gaining popularity among the farmers in recent years are Valentena (purple coloured cauliflower) and Carotena (yellow coloured cauliflower). Valentena is rich in anthocyanin while Carotena in carotenoid content besides containing other essential vitamins and minerals. However, continuous research and evaluation studies should be done to provide better variety choosing options for the farmers during the season (Chapagain *et al.*, 2011) ^[16]. In this context, Krishi Vigyan Kendra Sonitpur conducted On Farm Testing programmes on these two biofortified cauliflower varieties during rabi season to evaluate the performance in yield and yield attributing characters along with economics of production in Sonitpur district of Assam.

Materials and Methods

The study was carried out in farmers' field at four (04) numbers of locations of Sonitpur district to evaluate the performance of biofortified cauliflower varieties in the region during Rabi season of 2012-23 and 2023-24. Two biofortified cauliflower Syngenta hybrids Valentena and Carotena along with a popular white cauliflower Syngenta variety White Star grown by the farmers as check were selected for the study. The farming situation was irrigated and the soil texture was sandy loam. The treatments involved in this study were T₁: Valentena, T₂: Carotena and T₃: White Star. The trial was laid out in a randomized complete block design and 02 (two) number of villages with four locations used as replications. Before conducting the experiment, the farmers were well imparted with trainings on scientific cultivation practices of biofortified cauliflower varieties along with their nutritional benefits. Regular

monitoring and frequent field visits were conducted to provide instant solution to the problems reported from the study plot.

Observations on parameters like plant height, number of leaves per plant, leaf length and breadth, fresh weight of plant, average curd weight, total curd yield per hectare, gross return, net return and B:C ratio were recorded.

Results and Discussion

Among the three cauliflower hybrids under study, Valentena recorded the maximum values in growth, yield as well as the highest benefit cost ratio comparative to other hybrids.

Growth Parameters

From the data presented in Table 1 it is clearly evident that amongst all the three (03) hybrids of cauliflower, maximum plant height was recorded in Valentena (86.26 cm) followed by White Star (79.91 cm) and Carotena (74.32 cm). The variation in plant height in hybrids may be due to the effects of inherent genetic difference of the hybrids and environmental factors (Giri, 2020; Giri *et al.*, 2020) ^[1, 8]. Similar results were reported by (Santhosha *et al.*, 2014; Jindal & Thakur, 2004; Chittora and Singh, 2015; Giri *et al.*, 2023; Shrestha, 2022) ^[11, 10, 13, 9, 3, 12]. Premalakshmi *et al.* 2017 stated that plant height is an important trait which determines growth and vigour of the plants. The maximum number of leaves was recorded in Valentena (24.56) whereas, the least number of leaves was found in Carotena (21.62). The average value for leaf length and breadth of cauliflower hybrids revealed that Valentena produced largest leaf length (67.77 cm) and breadth (32.84 cm) followed by White Star (64.15 cm and 24.56 cm) and Carotena (62.23 cm and 23.31 cm). This might be due to the superior genetic constituent of variety Valentena hybrid and suitability of agro-metrological condition of Sonitpur district. The close findings of this research are observed by Singh *et al.* (2011) ^[6], Singh *et al.* (2013a) ^[4], Singh *et al.* (2013b) ^[5] and Sharma *et al.* (2018) ^[2].

Table 1: Performance evaluation of cauliflower varieties for growth parameters (pooled data)

Treatment	Plant height (cm)	Number of leaves	Leaf length (cm)	Leaf breadth (cm)
T ₁	86.26	24.56	67.77	32.84
T ₂	74.32	21.62	62.23	23.31
T ₃	79.91	14.41	64.15	24.56

Table 2: Performance evaluation of cauliflower varieties for fruit and yield parameters (pooled data)

Treatments	Fresh weight of plant (kg)	Curd weight (kg)	Curd yield ha ⁻¹ (q/ha)
T ₁	2.35	1.85	144.26
T ₂	1.65	0.94	116.74
T ₃	1.89	1.21	125.46

Table 3: Economics of cauliflower hybrid varieties (pooled data)

Treatments	Gross Income (Rs)	Cost of cultivation (Rs)	Net return (Rs)	B:C ratio (Rs)
T ₁	216660.00	69290.00	147370.00	3.12
T ₂	174990.00	67480.00	107510.00	2.59
T ₃	187500.00	64321.00	123179.00	2.91

Fruit and yield parameters

Fruit and yield parameters were recorded at the time of harvesting of the crop. From Table 2, it is evident that in case of fresh weight of plant, highest recorded data was found in Valentena (2.23 kg) followed by White Star (1.89 kg) and Carotena (1.65 kg). Curd weight is a prime factor which has a positive impact directly on the overall crop yield. Pertaining to the data, maximum average curd weight was recorded in hybrid Valentena (1.85 kg) followed by White Star (1.21 kg) and Carotena (0.94 kg). Total curd yield per hectare was found maximum in Valentena (144.26 q/ha) followed by White Star (125.46 q/ha) and Carotena (116.74 q/ha). The yield variation among the cultivars was influenced by the genetic characteristics and environmental factors and similar findings were reported by (Sharma *et al.*, 2018; Giri *et al.*, 2020; Shrestha, 2022) [7, 1, 8, 3, 22]. Highest yield performance by Valentena was due to its consistence higher plant height, leaf number, leaf length, leaf breadth and net biomass accumulation in terms of fresh weight of plant. Higher biomass accumulation by the plant was always beneficial for yield performance since, the vegetative part had a major contribution on photosynthesis and carbohydrate synthesis (Basnet *et al.*, 2023; 2017) [24, 23].

Economics

Data pertaining to economics (Table 3) indicated that cultivation of Valentena (T₁) gave higher net returns of Rs. 1,47,370.00.00 per ha as compared to varieties Carotena (T₂) and White Star (T₃) which are found to have net returns of Rs. 107510.00 and Rs. 123179.00 respectively. Similarly, Valentena (T₁) was recorded with highest benefit cost ratio of 3.12 in comparison to T₂ (2.59) and T₃ (2.91) respectively.

Conclusion

The experiment revealed that the cultivar Valentena showed the consistent and prominent vegetative characteristics and yield related characteristics as compared to other two hybrid cultivars. Hence, biofortified cauliflower hybrid Valentena could be promoted for cultivation in Sonitpur district for maximum return with good health.

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