Evaluation of biofortified sweet potato varieties for their growth, yield and economic performance under Assam condition

Abstract

An on-farm trial under Krishi Vigyan Kendra, Baksa was undertaken to evaluate the performance of two biofortified sweet potato varieties (Bhu Sona and Bhu Krishna) against a check variety Dergaon Red. The trial was conducted in eight different locations of Baksa and Dhubri district of Assam following scientific cultivation practices. Assessing the novel varieties for performance and economic return were taken as primary objectives while designing the experiment.Randomised Block Design was used to lay out the design and statistical analysis of the growth and yield characters shows significant differences between the three varieties.The variety Bhu Sona exhibited the highest vine length(214 cm), tuber length(18.6 cm), tuber weight(152.3 g), and average yield(16.7 tonnes/ha). In some significant yield characteristics like marketable tuber yield per plant and tuber yield per plant, the two biofortified varieties were at par with each other. And with respect to days taken for harvesting from planting, Bhu Sona and Dergaon Red were at par with each other with 109.3 days. The economic analysis reflected a maximum gross income of Rs. 253500 per hectare in Bhu Sona which was 26.8% more than the check variety. The variety Bhu Krishna also exhibited a 14% increase in gross return from the check variety. The trial indicated that the cultivation of varieties Bhu Sona and Bhu Krishna is feasible under Assam conditions contributing higher economic return to the farmers.

Keywords: Biofortified, sweet potato, Bhu Sona, Bhu Krishna, Dergaon Red

1. Introduction

Sweet potato or Sakarkand (*Ipomea batata* L.) is one of the rich tuberous crop with herbaceous and prostrate growth habit grown around the world(Nandhini *et al.*, 2021). Although perennial in nature, it is grown as an annual through vegetative propagation. The crop is cultivated across the countries located in the tropical, sub-tropical and warmer temperate regions and among them the Asia is the world's largest producing region. Ranked as fifth most important food crop in developing countries after rice, wheat, maize and cassava, sweet potato is a good source of Vitamin A, B1, B2, C and E, essential minerals like zinc and calcium and antioxidant properties. It is also rich source of dietary fibre and contains high pectin content. The low glycemic index of sweet potato also makes it favourable

for consumers with diabetic conditions (Sanap*et al.*, 2023). The crop can be grown in diverse climatic conditions and degraded or marginal land conditions with minimum input for which it is often referred to as 'Famine relief crop' and 'Poor Man's Energy food' (Jata*et al.*, 2011).

Assam has a high potential for expanding the cultivation area of sweet potato which is around 9.4 thousand hectares of sweet potato cultivation with an average production of about 36.2 thousand tonnes per year (Jha and Deka). The state suffers heavily from annual floods which also hits the agricultural economy. In such situation, sweet potato may be a suitable crop to reduce the distress of the farmers after the flood. Moreover, consumption of sweet potato in Assam is also linked with traditional customs since pre colonial times and it is one of the important tuber vegetable consumed by the people of the region (Saikia, 2013). There is a great scope for value addition of sweet potato for which it has also demand in different industries like flour, ethanol etc. The vines are also great source of round-the year green fodder. Hence, there exist a demand and a market for sweet potato.

The introduction of novel varieties with proper scientific cultivation practices among the growers of traditional varieties may help in increasing productivity and economic return. The biofortified varieties Bhu Sona and Bhu Krishna with high beta-carotene and anthocyanin content can help to fetch premier prices from the farmers. However, testing of novel varieties for new climatic conditions is needed since temperature, daylight and precipitation have significant effect on the productivity of the crop (Chakraborty et al., 2017). Hence, the on farm trial was designed with the objective of assessing the performance of the varieties in terms of yield and economics.

2. **Materials and method**

An On-Farm Trial was conducted to assess the performance of two biofortified varieties- Bhu Sona and Bhu Krishna against a check variety - Dergaon Red at eight different locations of Baksa district and Dhubri district of Assam under Krishi Vigyan Kendra, Baksa and Krishi Vigyan Kendra, Dhubri. Bhu Sona and Bhu Krishna were developed by ICAR-Central Tuber Crops Research Institute as biofortified varieties with a potential yield of 18-20 tonnes/ha and were released during the year 2017. The crops were grown following the standard package of practices recommended by Assam Agricultural University.

The treatments viz. T1- Bhu Sona, T2- Bhu Krishna, and T3- Dergaon Red were laid in randomized block design and the eight locations (four locations each in Baksa district and Dhubri district) were used as replications. The varieties were raised in different plots during May-June for the generation of cuttings which were planted in the main field duringSeptember and were ready for harvest after 105-115 days. Vine turning or lifting was carried out60 days after planting to prevent adventitious root development and to achieve better production from the main root. Different parameters related to vegetative growth and yield were recorded from the eight locations to calculate the mean value. Statistical analysis of the recorded data was done to test the significance of the treatments using ANOVA as suggested by Panse and Sukhatme (1985).

3. **Results and discussion**

3.1. Morphological characters

Significant morphological differences were observed among the three treatments. Critical characters like leaf type, vine colour and tuber skin and flesh colour were recorded and furnished in Table 1. for distinguishing the morphological characters.

3.2. **Vegetative characters**

Vegetative characters play a significant role in influencing the yield of sweet potato (Pazos et al., 2021) and recorded data of some important parameters are furnished in Table 2.Vine length is one of the major growth character which was recorded at the time of harvest. Significant difference among the treatments was observed and Bhu Sona exhibited the highest vine length (214 cm). The variation in this character might be due to the different genetic makeup of the varieties (Rahman *et al*., 2015). The internodal length also significantly varied among the treatments which may be due to variation in the vine length of the varieties. Bhu Sona recorded the highestintermodallength (3.73) whereas Bhu Krishna and Dergaon Red was at par with each other. This character is also highly influenced by varietal genetic stock (Egbe *et al.*, 2012). In case of days taken to harvest, Bhu Sona and Dergaon Red both took minimum days (109.3 days) to harvest. Apart from genetic makeup, this character might have been influenced by the vine length, and number of leaves which helped in rapid production of tubers. The results obtained are concurrent with the findings of Pavithra *et al*., (2022), Rahman *et al*., (2015) and Tirkey *et al*., (2011).Table 2. Performance of sweet potato varieties on vegetative characters.

3.3. **Yield characters**

The important yield attributing characters like tubers per plant, tuber length, and tuber weight have shown significant variation among the treatments (Table 3.). The highest number of tubers per plant was recorded in Bhu Krishna(7.1) and the lowest in Dergaon Red(4.8). The variation in number of tubers per plant is due to the genetic variation among the varieties (Uwah *et al.*, 2013). A higher number of tubers per plant effectively enhances the total yield(Rahman *etal*., 2015). Hence, Bhu Sona might have exhibited the highest tuber yield per plant (0.865 kg/plant) and tuber length (18.6 cm) which is also an influential character for economic return. The highest fresh tuber weight was found in Bhu Sona (152.3 g) followed by Dergaon Red (144.3 g). The results implicated that fresh tuber weight increased with higher tuber length. In the case of marketable tubers per plant, Bhu Sona(3.5) and Bhu Krishna(3.7) were at par with each other. The average yield per hectare was recorded highest in Bhu Sona(16.7 tonnes/ha) which is at par with Deragaon Red(16.5 tonnes/ ha). Good quality tubers, tuber per plant and tuber yield per plant in Bhu Sona might have attributed to the highest average yield. The results recorded from these parameters areconcurrent with the findings of Kar et al., (2022), Allolli*et al*., (2012) and Bharathi *et al*., (2005)

3.4. Economic analysis

The highest return was recorded from Bhu Sona (Table 4.) which might be due to high average yield. Moreover, the biofortified varieties fetched higher prices in the market in comparison to Dergaon Red which has also resulted in variation in the economic return. The gross return from Bhu Sona was recorded 26.8% more than the gross return from Dergaon Red. The cost of cultivation from the second year may decrease due to the availability of planting material from the first year mother plant stock**.**

4. Conclusion

Sweet potato, being a demanding crop mainly in the tribal areas has the potential to play a key role in uplifting the economy of the rural mass. The bio-fortified varieties may fetch a premium price in the market. The initiatives taken by KVKs to create awareness about the importance of biofortification may have a positive impact on added market value. According to the results of the analysis, Bhu Sona recorded superior vegetative and yield characters. Bhu Krishna was also at par with Bhu Sona in respect to some important characteristics. The gross and net return from Bhu Sona was also the highest along with a high BC ratio. The organo-

leptic evaluation showed better consumer acceptance of the variety Bhu Sona. Hence, these varieties have exhibited promising performance in terms of vegetative, yield, and economic returns.

Table 1. Morphological characters of sweet potato varieties

Treatments	Vine colour	Leaf type	Petiole pigmentation	Tuber skin colour	Tuber flesh colour
Bhu Sona	Green	Cordate with moderate lobe (Fig. 1)	Reddish	Orange yellow	Orange (Fig. 1)
Bhu Krishna	Purple	Cordate with moderate lobe (Fig 2.)	Purple	Purple	Purple (Fig. 2)
Dergaon Red	Green	Cordate with slight lobe (Fig. 3)	Purple	Reddish purple	White (Fig. 3)

Table 2. Performance of sweet potato varieties on vegetative characters

Treatments	Vine length (cm)	Internodal length (cm)	Days to harvest
Bhu Sona (T1)	214	3.73	109.3
Bhu Krishna (T2)	190.6	3.2	117.3
Dergaon Red (T3)	186.33	3.1	109.3
SEd	2.27	0.202	3.13
C.D (0.05)	5.152	0.46	7.108

Table 3. Performance of sweet potato varieties on yield characters

Treat-ments	Tubers per plant	Tuber length (cm)	Fresh Tuber weight (g)	Tuber yield per plant (kg/plant)	Marketa-ble tuber per plant	Average yield (tonnes/ha)
Bhu Sona (T1)	6.1	18.6	152.3	0.865	3.5	16.7
Bhu Krishna (T2)	7.1	14.5	124.3	0.861	3.7	16.2
Dergaon Red (T3)	4.8	17.6	144.3	0.748	2.9	16.5
SEd	0.350	0.339	3.2	0.030	0.251	0.11
C.D (0.05)	0.794	0.769	7.286	0.068	0.570	0.250

Table 4. Economic performance of sweet potato varieties

Particulars	Gross cost(Rs./ha)	Gross re-turn(Rs./ha)	Net re-turn(Rs./ha)	B:C ratio
T1	94500	253500	159000	2.68
T2	94500	227360	132860	2.4
T3	73300	159920	86620	2.18

Fig 1. Bhu Sona

Fig 2. Bhu Krishna

Fig 3. Dergaon Red

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