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Evaluation and promotion of orange-fleshed sweetpotato to alleviate Vitamin A deficiency in Orissa and Eastern Uttar Pradesh of India

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Abstract. Sweetpotato is the most important crop next to cereals in Orissa and plays an important role in the agrarian economy of the state. A ready and cheap source of beta-carotene is the orange fleshed sweetpotato, which contains high amounts of beta-carotene, largely responsible for the orange color of the flesh. Vitamin A deficiency can be prevented in children when there is regular intake of 100g of orange fleshed sweetpotatoes everyday. The International Potato center (CIP) had introduced the orange fleshed sweetpotato germplasm CIP 440074 along with other materials like IB-90-10-20, CIP 440127 and CIP-SWA-3 in the Gajapathi, Ganjam districts of Orissa and Gorakhpur district of eastern Uttar Pradesh(UP). CIP-440074 recorded highest yields at all the three locations both in terms of market and fresh root yields. The yield of local varieties at all the three places, when compared with the CIP cultivars was significantly low. Apart from CIP-440074, the cultivar CIP-440127 recorded the second maximum yield at all the three places both in the case of market and fresh root yields. CIP 440074 is very popular in the eastern UP and is ready to be released as a variety in this region because of its high yield and orange color of flesh. High risk of Vitamin A deficiency in the above regions should be reduced by wide cultivation of the orange fleshed sweetpotatoes. The above varieties performed well and should be promoted.

Introduction

Sweetpotato is an important crop in South Asia. Sweetpotato production in the region is about 1.6 million tons on 0.2 million hectares. India accounts for 68% of the total production followed by 27% in Bangladesh and about 5% in Sri Lanka. Sweetpotato is the most important root crop in Bihar and Orissa covering 17,900 ha and 47,900 ha with a production of 170,700 ton and 364,900 ton respectively. It is also an important root crop in Uttar Pradesh covering 30,600 ha with a production of 285,900 ton. It can be grown in poor soils but also performs well in a fertile environment, far exceeding yields of cereal crops. Sweetpotato can be grown with limited land, labour and capital. Early maturing sweetpotato varieties provide higher edible energy per unit area and unit of time than all other major food staples. The tender leaves of sweetpotato vines can be eaten as a vegetable. However, a major use of the leaves, is for animal feeds, particularly for dairy cattle and goats.

Dietary vitamin A deficiency is the world's most common cause of childhood blindness. The world Health Organization (WHO) estimated that as many as 228 million children worldwide are affected subclinically at a severe or moderate level by vitamin A deficiency. About 3 million of these children have some form of vitamin A related eye

disease, ranging from night blindness to irreversible partial or total blindness. Every year, at least 500,000 children become partially or totally blind as a result of this deficiency. Vitamin A deficiency (VAD) causes an estimated 30,000 to 40,000 children in India to go blind each year. Prevalence of vitamin A deficiency rates vary greatly among the states and ranges from 2.2% in Andhra Pradesh to 9.0% in Bihar. Prevalence of VAD is a significant public health problem in India.

A ready and cheap source of beta-carotene is the orange-fleshed sweetpotato, which contains high amounts of beta- carotene (Simonne *et al.*, 1993; Takahata *et al.*, 1993). A regular intake of 100g per day of orange-fleshed sweetpotato roots provides the recommended daily amount of vitamin A for children.

Materials and Methods

Batches of sweetpotato germplasm were introduced in the districts of Ganjam, Gajapathi in Orissa and Gorakhpur in Eastern Uttar Pradesh. Accessions were also acquired from farmers' fields in the above three districts. The corresponding soil types in the districts are given in Table 1. All the materials were screened at the CIP Regional office farm in New Delhi for over two seasons (Table 2). Seven selection based on fresh root yield were made from these trials.

Evaluation trials. Multi-locational trials at three districts in different agro-ecologies were conducted over two seasons in progressive farmers' fields. Seven selections were grown along with the local variety in the three districts. Based on the results of the multi-locational trials, four selections were made on the basis of fresh root yield. The four selections were evaluated in farmers' fields in the three districts.

Results and Discussion

The highest fresh root yields from the multi-locational trials were recorded in the three districts (Table 3). The four cultivars selected were CIP- 440127, IB-90-10-20, CIP- 440074, CIP-SWA-3. The highest root yields were obtained from Ganjam and Gorakhpur districts. CIP-440074 recorded highest yields at all the

Table 1: Districts and Agro-ecologies of the evaluation trials.

Name of the districts	State	Soil type
Ganjam	Orissa	Sandy-loam soils
Gajapathi	Orissa	Red Sandy-loam soils
Gorakhpur	Uttar Pradesh	River bed loamy soils

Table 2: Performance of the seven local cultivars at the CIP Regional office, New Delhi.

Cultivar	Market root yield (t/ha)	Fresh root yield (t/ha)
CIP-440127	20.7	24.8
IB-90-10-20	17.5	22.9
CIP-440074	22.4	30.1
CIP-SWA-7	16.8	21.2
CIP-SWA-3	19.1	22.4
CIP-SWA-1	12.2	18.2
IB-97-12-7	18.9	21.7
Mean	18.22	23.04
CV	17.86	16.04

Table 3: Performance of 4 cultivars in relation to local variety in various districts.

District/cultivar	Market root yield (t/ha)	Fresh root yield (t/ha)
Ganjam		
CIP-440127	21.2	27.8
IB-90-10-20	16.5	22.3
CIP-440074	26.8	32.3
CIP-SWA-3	21.2	28.4
Local	12.1	17.1
Gajapathi		
CIP-440127	23.4	28.2
IB-90-10-20	20.9	23.2
CIP-440074	24.8	31.0
CIP-SWA-3	19.1	23.2
Local	14.4	16.4
Gorakhpur		
CIP-440127	19.1	30.8
IB-90-10-20	21.4	29.2
CIP-440074	28.3	37.7
CIP-SWA-3	22.1	27.2
Local	16.4	19.1
Mean	20.51	26.26
C V	21.64	22.69

three places both in terms of market and fresh root yields. The maximum fresh root yield was recorded for CIP-440074 at 37.7 t/ha in the Gorakhpur area. The yield of local varieties when compared with the CIP cultivars was significantly low. Apart from CIP-440074, the cultivar CIP-440127 recorded the second maximum yield at all the three places both in the case of market and fresh root yields. IB-90-10-20 recorded high at Gorakhpur area both in terms of market and fresh root yields when compared in Ganjam and Gajapathi districts. CIP-SWA-3 also recorded maximum market and fresh root yields at Gorakhpur district when compared with the local variety. The local varieties yields at the three places were on par with each other ranging from 12.1 t/ha to 19.1 t/ha. The variation in terms of yield was not much significant among the CIP cultivars. CIP- 440074 is more preferred by farmers in Ganjam, Gajapathi and Gorakhpur districts because of high yield, carotene and the moderate starch content.

Vitamin A deficiency in Orissa Orissa is the largest sweetpotato growing state in India (Table 4). In Orissa, 60% of the population lives below the poverty line and 53% is malnourished. Overall prevalence of Vitamin A deficiency is 0.2% in the country but in Orissa vitamin A deficiency occurs in approximately 0.9 % of the population (Rajalakshmi, 2001). Orange fleshed sweetpotatoes were a potential food substitute to the tribesmen living in the state of Orissa.

Vitamin A deficiency in Gorakhpur (Uttar Pradesh) India. It is estimated that the prevalence of vitamin A deficiency at

Table 4: Area, production and productivity* of sweetpotato in leading states in India.

State	Area (x 1000 ha)	Production (x 1000 mt)	Productivity (t/ha)
Orissa	43.9	361.2	8.2
Bihar	9.9	135.2	13.7
Uttar Pradesh	25.6	302.1	11.8
Assam	8.9	31.0	3.5
Karnataka	3.1	23.3	7.5
Kerala	1.1	11.9	10.8
Tamil Nadu	1.9	32.2	16.9
India	114 (total)	1007 (total)	8.8 (average)

* Source: Indian Horticultural Data base – 2001(National Horticulture Board- Gurgaon, India)

Gorakhpur is 10.97% (Sharma, 1985) and it was most prevalent among children of 3-5 years of age. Gupta (1987) estimated the prevalence of vitamin A deficiency in different child age groups at Gorakhpur, based on hospitalized children (Table 5). Night blindness, conjuctival xerosis, Bitot's spot and active corneal involvement were found in 5.5 %, 15.74 %, 4.72 % and 14.9% of children respectively. Kansal (1997) studied the prevalence of vitamin A deficiency among rural and urban population at Gorakhpur. Overall prevalence of vitamin A deficiency was 6.8 % in children under 5 years of age and it was more prevalent in rural areas (9.3%) than urban areas (3.1%). CIP 440074, which is orange-fleshed, was found to be promising in terms of yield in the Gorakhpur area.

Implications

Farmers use local cultivars, which have poor yields and hence less economic benefits to the resource poor farmers. Introduction of exotic lines with high β-carotene and relatively high dry matter content should improve the economic status of the people in this region in addition to alleviating the vitamin A deficiency. Production of orange fleshed sweetpotatoes should be promoted and integrated with a processing industry ease processing and also to produce high quality sweetpotato products.

Table 5: Distribution of different age groups suffering from vitamin A deficiency at Gorakhpur.

Age group	Children suffering from vitamin A deficiency
2 months-1 year	10%
1-2 years	43.3%
2-3 years	45.8%
3-4 years	61.9%
4-5 years	53.8%
5-6 years	55.3%
Average	40.9%

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