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# Status, performance and impact of sweet potato cultivation on farming communities of Odisha, India

**Prakash P[a*], Prabhat Kishore[b], Jaganathan D[a], Sheela Immanuel[a] and Sivakumar P.S[a]**

[a]*ICAR- Central Tuber Crops Research Institute, Thiruvananthapuram- 695 017, India*
[b]*ICAR- National Institute of Agricultural Economics and Policy Research, New Delhi -110012, India*
***Author for correspondence:prakashiari@yahoo.com***

**Abstract**

This paper has examined the spatio-temporal changes in area, production and yield of sweet potato in India and its impact on economics of sweet potato cultivation in selected districts of Odisha. Compound annual growth rate, farm business analyses and Garrett's ranking technique were used to assess the growth rate, cost and returns and constraints faced by the farmers. The cost and returns analysis indicated that the labour cost accounted for 42 per cent of the total cost of production and the sweet potato production is profitable. Yield had a greater impact on improving profitability. The constraints in the sweet potato cultivation were non-availability of quality planting materials, lack of storage, lack of appropriate price and high marketing cost among producers. These constraints may be addressed by the timely and adequate supply of vines, creating awareness about improving cultivation practices and reforming the market system of farm produce in Odisha which provides better avenues for increasing farmers' income.

**Key words:** Sweet potato, Compound annual growth rate, Farm business analysis, Garrett's ranking technique

## Introduction

Sweet potato ranked seventh most important food crop of the world after wheat, rice, maize, potato, barely and cassava (ASHS, 2007; Jan low *et al*, 2015; CIP, 2017). Globally sweet potato is cultivated in 117 countries in an area of 8.62 million ha producing 105.19 million tons with a yield of 12.20 t $ha^{-1}$ (FAO, 2016). Africa is the world largest sweet potato growing region and majority of the sweet potato production about 95 per cent comes from developing countries, of which China having the maximum share of 67.09 per cent (FAO, 2016). In India, it is cultivated in almost all the states but major contribution comes from four states namely Odisha, Kerala, West Bengal and Uttar Pradesh. Odisha is the largest producer of sweet potato in India. The area under sweet potato cultivation in India is 0.13 million ha with a production of 1.47 million tonnes (FAO, 2016). Sweet potato are traditionally considered to be hardy crops and it is a rich source of carbohydrates, vitamins and minerals for the poor farmers in many developing countries and also it can produce more edible energy per ha per day than wheat, rice or cassava (Jan low *et al*, 2015; CIP, 2017) . In present times it is becoming the focus for research due to its versatility and adaptability to variation in climatic conditions. Sweet potato is one of the main crops as majority of farmers consider it as major source of food mainly for human consumption and having substantial role by ensuring food security and increasing the income of farmers (Prakash *et al*, 2016; Prakash *et*

*al*, 2017). However sweet potato was traditionally grown as a food crop after cereals in major sweet potato growing districts in Odisha as it gives more returns with less inputs (Gains project, 2013). The present paper has studied the status and performance of sweet potato in India and the impact on economics of sweet potato cultivation with the following objectives (i) To study the spatio-temporal changes in area, production and yield of sweet potato in India; (ii) To estimate the costs and returns of sweet potato cultivation in Odisha; and (iii) To identify the constraints encountered by the farmers and to suggest strategies to improve the sweet potato farming communities in Odisha.

## Data and Methodology

This study is structured based on primary and secondary data. Primary data was collected from the farmers growing sweet potato in Odisha state. Quantitative and qualitative data were collected from sweet potato growing farmers in selected districts in Odisha namely Koraput, Ganjam, Kalahandi and Kandhamal. The secondary data on area, production and yield of sweet potato were collected from diverse sources viz., Faostat and Indiastat and Department of economics and statistics. The well-structured questionnaire was used to collect the data. A census of households was conducted to enumerate the sweet potato producers, the area and its production, price and inputs etc. Thus 310 sweet potatoes producers were interviewed. The compound annual growth rate was used to analyse the trend in area, production and yield of sweet potato by taking semi log exponential functional form. The model used was Log $y_t$ = $a+b^t$**;** Where, $y_t$=area/production/yield of sweet potato, a=constant, t=time variable in year (1,2,3,…n) and b=regression coefficient that shows the rate of change for targeted variables. Various cost concepts and farm income measures were used to analyse the impact on economics of sweet potato cultivation. The constraints faced by the farmers were analysed using Garrett's ranking technique. The formula for converting ranks into percent is given by: Percent position=$100*(R_{ij}-0.5)/N_j$; Where, $R_{ij}$= Rank given for $i^{th}$ factor by $j^{th}$ individual; $N_j$=number of factors ranked by $j^{th}$ individual. For each factor, the scores of individual respondents were added together and divided by the total number of the respondents for whom the scores were added. These scores for all the factors were arranged in descending order, ranks were given and the most important factors were identified (Subhadra *et al*, 2009).

## Results and Discussion

### Area, production and productivity of sweet potato growing countries in the world

Table 1 shows the area, production and productivity of major sweet potato growing countries in the world. Sweet potato is grown in an area of 8623.97 thousand ha producing 105190.5 thousand tonnes with a yield of 12.20 t $ha^{-1}$ (FAO, 2016). It is grown in 117 countries in the world. African continent occupies first position contributing 48.56 per cent of sweet potato area with production share of 20.27 per cent in total worlds' sweet potato production. Even though sweet potato area is more in Africa, its production is low due to low yield (5.09 t $ha^{-1}$) which is lower than the world average.

**Table 1. Area, Production and Productivity of sweet potato in major growing countries (2016)**

| Continent | Country | Area (000 ha) | % of total | Production ( 000 tons) | % of total | Productivity (tons $ha^{-1}$) |
|---|---|---|---|---|---|---|
| **World** | **Total world** | **8623.97** | **100** | **105190.5** | **100** | **12.20** |
| **Asia** | **Total Asia** | **3913.67** | **45.38** | **78595.55** | **74.72** | **20.08** |
| | China, mainland | 3281.52 | 38.05 | 70570.94 | 67.09 | 21.51 |
| | Indonesia | 137.06 | 1.59 | 2270.62 | 2.16 | 16.57 |
| | **India** | **130.00** | **1.51** | **1472.00** | **1.40** | **11.32** |
| | Vietnam | 120.64 | 1.40 | 1269.30 | 1.21 | 10.52 |
| | Philippines | 84.75 | 0.98 | 529.47 | 0.50 | 6.25 |
| **Africa** | **Total Africa** | **4187.77** | **48.56** | **21316.86** | **20.27** | **5.09** |
| | Nigeria | 1546.56 | 17.93 | 3916.69 | 3.72 | 2.53 |
| | United Republic of Tanzania | 759.54 | 8.81 | 3822.87 | 3.63 | 5.03 |
| | Uganda | 482.24 | 5.59 | 2126.99 | 2.02 | 4.41 |
| | Angola | 186.01 | 2.16 | 1830.91 | 1.74 | 9.84 |
| | Madagascar | 137.51 | 1.59 | 1113.18 | 1.06 | 8.10 |
| | Ethiopia | 130.00 | 1.51 | 1939.76 | 1.84 | 14.92 |
| | Rwanda | 135.58 | 1.57 | 919.12 | 0.87 | 6.78 |
| | Burundi | 127.65 | 1.48 | 726.05 | 0.69 | 5.69 |
| | Ghana | 76.59 | 0.89 | 143.11 | 0.14 | 1.87 |
| **America** | **Total America** | **362.13** | **4.20** | **4319.81** | **4.11** | **11.93** |
| | Haiti | 116.87 | 1.36 | 650.35 | 0.62 | 5.56 |
| | United States of America | 66.09 | 0.77 | 1430.90 | 1.36 | 21.65 |
| | Brazil | 47.57 | 0.55 | 669.45 | 0.64 | 14.07 |
| | Cuba | 54.51 | 0.63 | 594.38 | 0.57 | 10.90 |
| **Europe** | **Total Europe** | **2.63** | **0.03** | **52.18** | **0.05** | **19.83** |
| | Portugal | 1.05 | 0.01 | 22.90 | 0.02 | 21.80 |
| | Spain | 0.79 | 0.01 | 13.52 | 0.01 | 17.04 |
| **Oceania** | **Total Oceania** | **157.77** | **1.83** | **906.10** | **0.86** | **5.74** |
| | Papua New Guinea | 135.94 | 1.58 | 700.17 | 0.67 | 5.15 |

Source: Authors calculations based on FAOSTAT (FAO, 2016)

Asian continent is the second largest in terms of area (45.38 per cent) and first in terms of production (74.72 per cent) of sweet potato with a yield of 20.08 t $ha^{-1}$. American countries

has 4.20 per cent of area producing 4.11 per cent (third rank) of the world production. China, mainland is having the largest area under sweet potato (38.05 per cent) among all the sweet potato growing countries in the world with an annual output of 67.09 per cent. Nigeria occupies second position in sweet potato area producing 3.72 per cent of the world production. United Republic of Tanzania occupies the third position in terms of area and production in the world. China, Indonesia, India and Vietnam are the major countries growing sweet potato in Asia. Sweet potato is grown in an area of 130 thousand ha producing 1472 thousand tonnes with a productivity of 11.32 t $ha^{-1}$ in India (Table 1).

**Temporal changes in area, production and productivity of sweet potato in India**

Trend in area, production and productivity of sweet potato in India from 1981/82 to 2016/17 were given in table 2. It may be seen from table 2 that sweet potato area it has come down to 107 thousand ha from 213.33 thousand ha from 1981/02 to 2001/01. It increased from 2001/02 onwards. Production of sweet potato also followed the same trend as that of area. Annual growth of -0.87 per cent in production of sweet potato in India has been mainly due to decrease in production acreage (-1.88 per cent annually on average). However note that productivity of sweet potato has been consistently increased from 7.03 tons/ha in 1981/82 to 11.76 tons per ha in 2016/17 (1.02 per cent annually on average).

Table 2: Trend in area, production and productivity of sweet potato in India, 1979/80-2016/17

| Year (TE) | Area ('000 ha) | Production ('000 metric tons) | Productivity (metric tons/ha) |
|---|---|---|---|
| 1981/82 | 213.33 | 1503.60 | 7.03 |
| 1991/92 | 149.00 | 1219.00 | 8.20 |
| 2001/02 | 107.00 | 928.00 | 8.63 |
| 2016/17 | 122.33 | 1440.00 | 11.76 |
| CAGR(1979/80-2016/17) | -1.88 | -0.87 | 1.02 |

Source: Authors calculation based on Ministry of Agriculture and Farmers Welfare, Govt. of India (various reports)
Notes: CAGR=compound annual growth rate; TE=triennium ending

Though sweet potato is grown in 117 countries, India ranks third in Asia and 10$^{th}$ in the world for area and third in Asia and 7$^{th}$ in the world for the production of sweet potato tubers. However, India accounts for just 1.51 % of area. Although sweet potato is cultivated in India in almost all the states, major production comes from Odisha (23 per cent) followed by Kerala (19 per cent), west Bengal (15 per cent) and Uttar Pradesh (14 per cent). The state wise area and production details of sweet potato in India during the year 2016-17 are given in table 3.

Table 3: State wise in area, production and productivity of sweet potato in India, 2016-17

| States/UTs | Area ('000 ha) | Production ('000 metric tons) | Productivity (metric tons/ha) | % share of area | % share of production |
|---|---|---|---|---|---|
| Assam | 10.21 | 55.93 | 5.5 | 7.57 | 3.41 |
| Bihar | 0.91 | 8.48 | 9.3 | 0.67 | 0.52 |
| Chhattisgarh | 5.57 | 200.03 | 35.9 | 4.13 | 12.21 |
| Karnataka | 2.54 | 36.02 | 14.2 | 1.88 | 2.20 |
| Madhya Pradesh | 4.2 | 50.57 | 12.0 | 3.11 | 3.09 |
| Meghalaya | 4.65 | 17.85 | 3.8 | 3.45 | 1.09 |
| Odisha | 40.8 | 384.51 | 9.4 | 30.25 | 23.46 |
| Uttar Pradesh | 17.18 | 227.25 | 13.2 | 12.74 | 13.87 |
| West Bengal | 22.7 | 240.62 | 10.6 | 16.83 | 14.68 |
| Kerala | 19.23 | 318.05 | 16.5 | 14.26 | 19.41 |
| Other states | 6.9 | 99.54 | 14.4 | 5.12 | 6.07 |
| India | 134.88 | 1638.84 | 12.2 | 100.00 | 100.00 |

Source: Authors calculation based on NHB, Horticultural statistics at a glance, 2017

**Compound annual growth rate (%) of sweet potato growing states in India**

Table 4 presents the compound annual growth rate (%) for sweet potato growing states in India. The time series data on area, production and yield of sweet potato crops from 1950 to 2014 were categorized into seven phases based on the values of coefficients of determination of the exponential trend lines. The reference period was divided into seven phase namely Phase I (1950-1959), Phase II (1960-1969), Phase III (1970-1979), Phase IV (1980-1989), Phase V (2000-2009), Phase VI (2010-2014) and Phase VII (2000-2014). Further Table 3 shows that the data revealed positive significant compound annual growth rate (%) for area, while production and yield had positive and negative growth rate respectively but not significant during the first phase. Area under sweet potato registered a significant positive compound annual growth rate during the second phase while production had a positive value but significant may be due to positive growth rate in yield but not significant. The CGAR % for the third phase was 1.32,-0.89 and -2.22 respectively but statistically it is not significant. The negative CGAR % of sweet potato area was statistically significant during fourth and sixth phase and during fifth phase it was not significant indicating that sweet potato area in India is decline stage. Corresponding figure for production were -2.87, -0.29 and 1.87 respectively. Positive and significant growth was observed in the yield of sweet potato during fourth and sixth phases while it was not statistically significant during fifth phase. In the period seventh phase yield of sweet potato were positive and significant and non-significant growth in production in spite of the decline in the area of sweet potato at -1.33 per cent per annum.

Table 4: Compound annual growth rate (%) for sweet potato in India

| States | 1950/59 | 1960/69 | 1970/79 | 1980/89 | 2000/09 | 2010/14 | 2000/14 |
|---|---|---|---|---|---|---|---|
| **Area** | | | | | | | |
| Assam | 13.13*** | 1.37ns | 1.82** | -2.07*** | -0.21ns | -11.21** | -1.10* |
| Bihar | 1.81ns | 13.14*** | 0.72ns | -10.82*** | -34.74*** | 30.56*** | -18.6*** |
| Chhattisgarh | - | - | - | - | 6.16** | -1.11ns | 1.55ns |
| Karnataka | -8.25*** | 6.23*** | -1.88ns | -5.05*** | -2.39* | -1.59ns | -2.70*** |
| Madhya Pradesh | 2.32* | 3.83*** | -0.25ns | -3.67*** | -3.70ns | -7.26 | -5.29*** |
| Meghalaya | - | - | - | 1.54* | 1.87*** | -31.53 | -1.91* |
| Odisha | 6.15*** | 10.38*** | 7.86*** | 1.07** | 2.63*** | -0.27ns | 0.16ns |
| Uttar Pradesh | 4.44** | 2.45* | -1.16ns | -5.00*** | -2.29** | 0.17ns | -2.35*** |
| West Bengal | -21.32*** | - | - | - | -11.67* | -0.87ns | -8.66*** |
| All India | 2.37** | 6.59*** | 1.32ns | -4.21*** | -0.82ns | -1.54*** | -1.33*** |
| **Production** | | | | | | | |
| Assam | 8.51*** | 2.02ns | 3.26*** | -2.27*** | 0.51ns | -3.01ns | 1.53** |
| Bihar | -0.06ns | 17.59** | -2.12ns | -7.0*** | -33.75*** | -1.57ns | -17.85*** |
| Chhattisgarh | - | - | - | - | -0.27ns | 2.50** | 0.56ns |
| Karnataka | 21.9 ns | 7.89*** | -1.88ns | -4.10ns | 3.61ns | 1.80ns | 0.97ns |
| Madhya Pradesh | 1.91* | 2.67* | -2.57* | -4.19*** | -5.87*** | 2.42*** | 2.49ns |
| Meghalaya | - | - | 5.18*** | 0.95ns | 0.42ns | -2.57 | -2.87*** |
| Odisha | -4.22ns | 34.04*** | 7.33*** | 1.55** | 4.20*** | -2.78*** | 2.03*** |
| Uttar Pradesh | 9.64* | 5.55*** | -4.82*** | -4.64*** | -1.29ns | 7.13* | -0.12ns |
| West Bengal | -2.68*** | 0.26* | - | - | 4.36*** | 0.51* | 2.71*** |
| All India | 1.88ns | 8.09*** | -0.89ns | -2.87*** | -0.29ns | 1.87ns | 0.31ns |
| **Productivity** | | | | | | | |
| Assam | -4.06*** | 0.53* | 1.41*** | -0.13ns | 0.61ns | 9.00*** | 2.67*** |
| Bihar | -1.67ns | 3.89ns | -2.81** | 4.32*** | 4.62*** | -30.03*** | -0.92ns |
| Chhattisgarh | - | - | - | - | -6.06* | 3.70*** | -0.90ns |
| Karnataka | -12.78*** | 16.95ns | 0.01ns | 0.98*** | 6.13** | 2.48** | 3.75*** |
| Madhya Pradesh | -0.46ns | -1.17ns | -2.32ns | -0.48ns | -2.74ns | 37.17*** | 8.27*** |
| Meghalaya | - | - | 5.33*** | -0.69ns | -0.28ns | 1.15ns | -0.24ns |
| Odisha | -9.7*** | 21.2*** | -0.52ns | 0.48ns | 1.62*** | -2.55* | 1.84*** |
| Uttar Pradesh | 5.01ns | 3.05*** | -3.67*** | 0.38ns | 1.04** | 6.89ns | 2.27*** |
| West Bengal | 23.60*** | 0.26* | - | - | 5.68*** | 0.67*** | 3.60*** |
| All India | -0.41ns | 1.39ns | -2.22*** | 1.48*** | 0.49ns | 3.45** | 1.66*** |

Source: Authors calculations based on secondary data

Note: *** -Significant at 1%, **-Significant at 5%, *-Significant at 10% and ns-Non-significant

## Status of sweet potato export in the country

The country wise export of sweet potato during 2011-12 to 2016-17 from India are given in Table 5. Sweet potato is mostly consumed as snacks in boiled or baked form and also used for vegetables. About 80 per cent was sold through retail markets in India during 2011-16 and rest exported to other countries. In 2015-16, the total market size of sweet potato for direct consumption was estimated as Rs.36.4 billion, with a compound Annual Growth Rate (CAGR) of 13.7 per cent during 2011-16 (Passport, Euro monitor International, May 2017). About 56 per cent of sweet potato was exported to United Arab Emirates followed by Nepal (29 per cent) and Maldives (13 per cent) mostly as fresh tubers.

Table 5: Country wise export of sweet potato during 2011-12 to 2016-17 from India

| Country | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | % share in 2014-2015 |
|---|---|---|---|---|---|---|---|
| | qty. in tons | qty. in tons | qty. in tons | qty. in tons | qty.in tons | qty.in tons | |
| UAE | 828 | 536 | 276 | 344.16 | 293.5 | 246.46 | 56.72 |
| Nepal | 19 | 54 | 149 | 8.4 | 87.86 | 126.94 | 29.21 |
| Maldives | 91 | 20 | 45 | 43.95 | 120.05 | 58.5 | 13.46 |
| Bahrain | 4 | 18 | 6 | 5.55 | 4.07 | 0.12 | 0.02 |
| Other country | 68 | 5 | 25 | 24.97 | 3.05 | 2.86 | 0.65 |
| Total | 1010 | 632 | 502 | 427.03 | 508.53 | 434.48 | 100 |

Source: Authors calculations based on apeda.gov.in

## Socio economic characteristics of sweet potato farmers' households

Table 6 reports the socio-economic charactertics of sweet potato farmers. The results showed that 55.34 per cent of the respondents were between the age of 31-50 years, 9.71 per cent of them were between 21-30 years while 11 per cent were above 61 years. This observation indicated that most of the famers were in middle aged group and very few young farmers were involved in sweet potato farming. A total of 48.06 per cent of the respondents had 6-10 members per household, 47.10 per cent had 1-5 members while 4.84 per cent had 11-15 members and above. Education qualification showed that majority (42.58 %) had primary education, 29.03 per cent had no formal education while 1.04 percent attained higher education. This implies that most of the respondents had low education in the study areas. Majority (95.81%) of them engaged had farming as their primary occupation and had no other source of income apart from farming, 2.26 per cent farmers were engaged as wage labour while very few people were engaged in other activity. Farmers in the study area were generally marginal and small famers which accounts 81.25 per cent with a farm size of not more than 2 ha, 16.15 per cent of the respondents had farm size between 2-4 ha while 1.29 per cent of the farmers had between 4-10 ha. About 99 per cent of the sweet potato farmers were marginal farmers with a farm holding of 1 ha.

Table 6: Distribution of sample households based on age, household size, education, occupation and farm size (%)

| **Characteristics** | **Frequency** | **Percentage** |
|---|---|---|
| **Age of the household head (years)** | | |
| 21-30 | 30 | 9.71 |
| 31-40 | 87 | 28.16 |
| 41-50 | 84 | 27.18 |
| 51-60 | 74 | 23.95 |
| Above 61 | 34 | 11.00 |
| **Household size (number)** | | |

| | | |
|---|---|---|
| 1-5 | 146 | 47.10 |
| 6-10 | 149 | 48.06 |
| 11-15 | 13 | 4.19 |
| Above 16 | 2 | 0.65 |
| **Education level (years)** | | |
| No formal education | 90 | 29.03 |
| Primary | 132 | 42.58 |
| Upper primary | 42 | 13.55 |
| Secondary | 37 | 11.94 |
| Upper secondary | 3 | 0.97 |
| Higher education | 6 | 1.94 |
| **Primary occupation (%)** | | |
| Farming | 297 | 95.81 |
| Wage labour | 7 | 2.26 |
| Salary worker | 3 | 0.97 |
| Self-employment | 1 | 0.32 |
| Traders | 2 | 0.65 |
| **Size of operational land (ha)** | | |
| Marginal (up to 1) | 164 | 52.90 |
| Small (1-2) | 91 | 29.35 |
| Semi-medium (2-4) | 51 | 16.45 |
| Medium (4-10) | 4 | 1.29 |
| **Area under sweet potato cultivation (ha)** | | |
| Marginal (up to 1) | 232 | 99.15 |
| Small (1-2) | 2 | 0.85 |

Source: Authors calculations based on primary survey (2016)

## Cost and returns in sweet potato cultivation

Table 7 presents the cost and returns for sweet potato cultivation in Odisha. Sweet potato is cultivated in Odisha during Kharif and Rabi season and majority by tribal's as rain fed crops. Local varieties were predominately cultivated by the farmers in the study area. On an average, the sweet potato area allocated by farmers was 0.30 hectare. However the recommended fertilizers were not adopted by the farmers. The estimated average yield of sweet potato was 7.9 tons $ha^{-1}$ which was less the national average. (FAO, 2016). On an average farmer were selling sweet potato tubers at the rate of Rs.975 /quintal. It was also estimated that the gross cost of Rs.21995 was incurred for cultivation of sweet potato in one ha. Labour cost was estimated to be Rs.9257 while material cost was Rs.4088. Operational cost for cultivating one ha of sweet potato was Rs.13796. The cost of production of sweet potato was estimated to be Rs. 687 per quintal of tubers. Gross income of Rs.77025 and a net income of Rs.55029 were obtained from one hectare of sweet potato cultivation. Farm business income was estimated to be Rs.63228. Family labour income and farm investment income were estimated to be Rs.57071 and Rs.61186 respectively. Benefit cost ratio (BCR) was found to be 3.50:1.

Table 7: Cost and farm income measures for sweet potato cultivation in Odisha (Rs.ha$^{-1}$)

| Particulars | Rs. | % to total |
|---|---|---|
| **Labour costs** | | |
| Land preparation | 3230.12 | 14.69 |
| Transplanting | 2652.70 | 12.06 |
| Intercultural operation | 928.56 | 4.22 |
| Harvesting | 2446.26 | 11.12 |
| **Gross labour costs** | **9257.64** | **42.09** |
| **Material Costs** | | |
| Planting material | 1295.36 | 5.89 |
| Manures | 1007.52 | 4.58 |
| Fertilizers | 1391.36 | 6.33 |
| PP chemicals | 394.72 | 1.79 |
| **Gross material cost** | **4088.96** | **18.59** |
| Land revenue | 12.76 | 0.06 |
| Interest on working capital | 157.00 | 0.71 |
| Depreciation | 279.83 | 1.27 |
| **Cost A1** | **13796.19** | **62.72** |
| Rent paid for leased in land | 0.00 | 0.00 |
| **Cost A2** | **13796.19** | **62.72** |
| Rental value of owned land | 6000.00 | 27.28 |
| Interest on owned fixed capital | 157.00 | 0.71 |
| **Cost B** | **19953.18** | **90.71** |
| Imputed value of family labour | 2042.42 | 9.29 |
| **Cost C** | **21995.60** | **100.00** |
| Cost of production | 687.36 | |
| **Farm income measures** | | |
| Yield (Quintal) | 79.00 | |
| Price /quintal of tubers | 975.00 | |
| Gross Income | 77025.00 | |
| Net income | 55029.40 | |
| **Benefit-Cost ratio** | **3.50** | |
| Farm business income | 63228.81 | |
| Family labour income | 57071.82 | |
| Farm investment income | 61186.40 | |

Source: Authors calculations based on primary survey (2016)

## Constraints in sweet potato cultivation

Results from the Table 8 indicate the major constraints faced by the farmers during production and marketing of sweet potato in Odisha. The response of sweet potato farmers was ranked using Garrets ranking technique. The major problem faced by the sweet potato farmers was lack of quality planting materials. The second biggest constraints the farmers reported was lack of storage facilities and majority of the farmers do not opt for storage due to lack of awareness about the storage technique and hence the products were sold immediately. This led to the exploitation of farmers by marketing agents. The farmers reported that that they faced yield loss due to pest and diseases mainly sweet potato weevil.

Besides, unforeseen weather due to erratic rainfall also had affected the production. Many of the farmers also reported about shortage of labour during the peak months of planting and harvesting of sweet potato. Table 6 further shows that the marketing constraints faced by sweet potato farmers. Farmers reported low price for the produce which is affecting the profit. Many of the farmers indicated about the non availability of processing units for value added products, high marketing cost, long distance to the market and limited market information as major constraints.

Table 8: Constraints faced by sweet potato growers in Odisha

| Constraints | Mean Score | Rank |
|---|---|---|
| **Production** | | |
| 1. Lack of quality planting materials | 53.90 | I |
| 2. Lack of storage facilities | 51.25 | II |
| 3. Prevalence of pest and diseases | 44.75 | III |
| 4. Weather aberrations | 30.85 | IV |
| 5. Labour shortage | 34.28 | V |
| **Marketing** | | |
| 1. Low price for the produce | 55.75 | I |
| 2. Lack of access to processing units | 51.80 | II |
| 3. High marketing cost | 48.23 | III |
| 4. Long distance to the market | 38.20 | IV |
| 5. Limited market information | 35.02 | V |

Source: Authors calculations based on primary survey (2016)

## Conclusion and Policy Implications

Sweet potato area in India has been showing a declining trend due to shifting of area to other crops which are remunerative and less exploitation due to durability and market support. Productivity showed an increased trend in all periods as various research institutes focussed on this crop due to its climate resilience. Even though sweet potato plays a very important role for ensuring food security and increasing the income of farmers in Odisha. Sweet potato cultivating farmers in Odisha is highly constrained by availability of quality planting materials for their fields Therefore, it is suggested to ensure timely and adequate supply of quality vines to the farmers. Apart from, adequate training is to be imparted to the sweet potato farmers for creating awareness about improved cultivation techniques and its importance in the present scenario of climate change. Production of sweet potato requires few inputs and the returns are comparatively high which can be very attractive to the resource constraint farmers. To promote sweet potato production in the study area, value added products need to be developed which provides better avenues for increasing farmers' income

in Odisha. Further all these need to be supported with proper institutional mechanism to make it sustainable in the near future.

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