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Economics of cultivation of sweet potato in different growing media under grow bag condition

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Abstract
The present investigation was carried out under premises (lobby) of Department of Vegetable Science at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, Indira Gandhi Krishi Vishwavidyalaya Raipur (C.G.) during the summer season of 2022. The experiment was laid out in Completely Randomized Design with nine treatment and three replications. All grow bags were placed in the 240.57 m^2 area that was the total area covered for this experiment. T_8 recorded the highest per square meter cost of cultivation at Rs. 102.6, while T_9 recorded the lowest at Rs. 38.20. Treatment T_5 produced the highest Net Profit per square meter, which was Rs. 116.48, while treatment T_2 produced the lowest Net Return, which was Rs. 18.4. Treatment T_5 recorded the highest gross profit per square meter at Rs. 180.48. Consequently, T_5 was used to achieve the highest Gross Income and Net Income (Black soil: paddy husk: sand: vermicompost 1:1:1:1). The significantly highest B:C ratio 1.82 was recorded under treatment T_5, and the lowest B:C ratio 0.24 was recorded under treatment T_2.

Keywords: *Ipomoea batatus*, net return, benefit-cost ratio, cost of cultivation

Introduction
Sweet potato (*Ipomoea batatus* L.) commonly known as Sakarkand. It originated from Tropical America belongs to family Convolvulaceae. It is a hexaploid species with chromosome number 2n=6x=90. It is an important tuber crop in tropical and sub- tropical countries like Africa, China and India. Sweet potato ranked sixth most important food crop of the world after Wheat, Rice, Maize, Potato and Cassava (Hejjegar *et al*., 2018). Africa is the world's largest sweet potato-growing region, and about 95% of the crop is produced there, with China accounting for the largest share with 67.09%. (FAO, 2016). Nearly all of the states in India cultivate it, but Odisha, Kerala, West Bengal, and Uttar Pradesh make up the majority of the contributors. India's largest sweet potato producer is Odisha. Sweet potato plays an important role as food and nutrition security. It is a source of income for many communities in the developing countries. The sweet potato contains phytochemicals with various pharmaceutical activities including anticancer (Karna *et al.*, 2011) [4], anti-diabetic (Kusano and Ab, 2000) [6], antioxidant (Teow *et al*., 2007) [10], anti-inflammatory properties. It can help reducing nutritional problems and can be especially recommended for diabetics (Krochmal-marczak *et al.* 2014) [5]. In India, the area cultivated under sweet potato is 118 thousand hectare and production is 1,206 thousand MT (Ministry of Agriculture and farmers welfare 2021.) Chhattisgarh covered an area of 4.510 hectare with production of 49.410 tons with low productivity of 10.95 t/ha. In Rajnandgaon district of Chhattisgarh cultivated area of sweet potato is 0.033 hectare with production of 0.304 MT (Directorate of Horticulture and Farm Forestry C.G. 2021). It is a rich source of Carbohydrate, minerals and fibers as well as good source of vitamin A, B and C. It can produce more edible energy per hectare per day than wheat, rice and cassava (Jan low *et al*, 2015) [3]. Growing media like coco peat, paddy husk, vermi- compost, sand, paddy hay having direct effect on tuber growth, yield and quality of tuber and higher income is obtained from higher tuber yield. Capital inputs had the least effect on reducing profit and yield had the greatest impact on boosting profitability. Sweet potato production was affected by planting materials, fertilizer, labour costs, plant protection, etc.

Materials and Methods
The experiment was conducted under premises (lobby) of Department of Vegetable Science at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, Indira Gandhi Krishi Vishwavidyalaya Raipur (C.G.) during the summer season of 2022.

The experiment was laid out in Completely Randomized Design with nine treatment and three replications. Under this experiment black soil and vermicompost are common in all the treatments and other growing media *viz*; Cocopeat, Saw dust, Paddy husk, Red soil, Cut paddy hay, Sand had taken in experiment with the ratio of 1:1:1:1. The economics of sweet potato crop production were determined using prevailing sweet potato prices as well as the inputs used. Current pricing for various inputs were used to determine the cost of growing sweet potato tubers. On the basis of market pricing, the production of sweet potato tubers was converted to gross profit (Rs/ m^2). The B: C ratio was calculated with the help of following formula:

A. Cost of cultivation (Rs./m2)

The expenditure incurred for pre and post-harvest treatments were worked out and expressed as rupees per square meter per year.

B. Gross returns (Rs/m2)

Based on the marketable tuber yield obtained at the end of the storage period, the gross return was worked out and expressed as rupees per square meter per year.

C. Net returns (Rs/m2)

A net return was obtained by subtracting the cost of Cultivation from gross returns.

Net Return (Rs/m2) = Gross income (Rs/m2) - Cost of cultivation (Rs/m2)

D. Benefit: Cost Ratio (B: C Ratio)

The benefit: cost ratio was worked out by using formula

$$\text{Benefit: Cost ratio} = \frac{\text{Net returns}}{\text{Cost of cultivation}}$$

Results and Discussion

The findings of the investigation are presented below in Table 1, along with an appropriate discussion. The total tuber yield varied from 0.18 kg/plant (T_9) and 0.37 kg/plant (T_5). The treatment (T_5) with the highest observed tuber yield was 0.376 kg/plant. Total tuber yield increased as a result of the combination of media's beneficial effects on plants. The addition of rice husk provides plants with nutrients and increases the soil's porosity and Cation Exchange Capacity, allowing the tuber to expand properly. Additionally, sand enhances the aeration of the rhizosphere, increases the media's capacity to hold water, and creates pores for better tuber growth. Table 2 shows the various growing media combinations that were used in this investigation and found to have a significant impact on gross income, net return, and benefit cost ratio. All treatments have similar costs for material inputs, such as planting supplies, fertilizer, grow bags, insecticides, and labour, but there are differences in cultivation costs between treatments that are primarily caused by price differences between different growing media.

The highest per square meter cost of cultivation was noted in T_8 at Rs. 102.6, followed by T_7 at Rs. 102.28, and the lowest cost was noted in T_9 at Rs. 38.20. Treatment T_5 produced the highest Net Profit/m^2, which was Rs. 116.48, while treatment T_2 produced the lowest Net Return, which was Rs. 18.4. The highest gross profit per square meter was Rs. 180.48 for treatment T5. Consequently, T_5 obtained the highest gross and net income. The significantly maximum B:C ratio 1.82 was recorded under the treatment T_5 and the minimum B: C ratio 0.24 was recorded under the treatment T_2. Thus, the maximum gross return, net return and benefit cost ratio was recorded under the treatment T_5 (Black soil: Paddy husk: Sand: Vermicompost 1:1:1:1). This was mainly due to lower input cost and higher tuber yield. This result can be confirmed for three times in a year hence it was multiplied by three in this outcome of benefit- cost ratio The present investigation confirmed the finding of Panwar and Wani (2014) [8].

Table 1: The data related to total tuber yield per plant are presented

Notation	Treatments	Total tuber yield (Kg/plant)
T_1	Black soil: Sawdust: Sand: Vermicompost (1:1:1:1)	0.204
T_2	Black soil: Sawdust: Red soil: Vermicompost (1:1:1:1)	0.197
T_3	Black soil: cut paddy hay: Sand: Vermicompost (1:1:1:1)	0.246
T_4	Black soil: cut paddy hay: Red soil: Vermicompost (1:1:1:1)	0.235
T_5	Black soil: Paddy husk: Sand: Vermicompost (1:1:1:1)	0.376
T_6	Black soil: Paddy husk: Red soil: Vermicompost (1:1:1:1)	0.302
T_7	Black soil: Cocopeat: Sand: Vermicompost (1:1:1:1)	0.358
T_8	Black soil: Cocopeat: Red soil: Vermicompost (1:1:1:1)	0.295
T_9	Control	0.18

Table 2: Economics of different treatments and benefit cost ratio are presented

	Treatment	Cost of Cultivation (Rs/m^2)	Yield (kg/m^2/yr)	Gross return (Rs/m^2)	Net return (Rs/m^2)	B:C ratio
T_1	Black soil: Sawdust: Sand: Vermicompost (1:1:1:1)	75.4	2.44	98.02	22.54	0.29
T_2	Black soil: Saw dust: Red soil: Vermicompost (1:1:1:1)	76.28	2.36	94.56	18.4	0.24
T_3	Black soil: Cut paddy hay: Sand: Vermicompost (1:1:1:1)	64.28	2.95	118.05	53.89	0.83
T_4	Black soil: Cut paddy hay: Red soil: Vermicompost (1:1:1:1)	64.92	2.82	112.90	48.08	0.74
T_5	Black soil: Paddy husk: Sand: Vermicompost (1:1:1:1)	64.12	4.51	180.48	116.48	1.82
T_6	Black soil: Paddy husk: Red soil: Vermicompost (1:1:1:1)	64.28	3.63	144.98	80.82	1.25
T_7	Black soil: Cocopeat: Sand: Vermicompost (1:1:1:1)	102.28	4.3	171.84	69.68	0.68
T_8	Black soil: Cocopeat: Red soil: Vermicompost (1:1:1:1)	102.6	3.54	141.41	38.58	0.37
T_9	Black soil	38.20	2.16	86.50	48.41	1.24

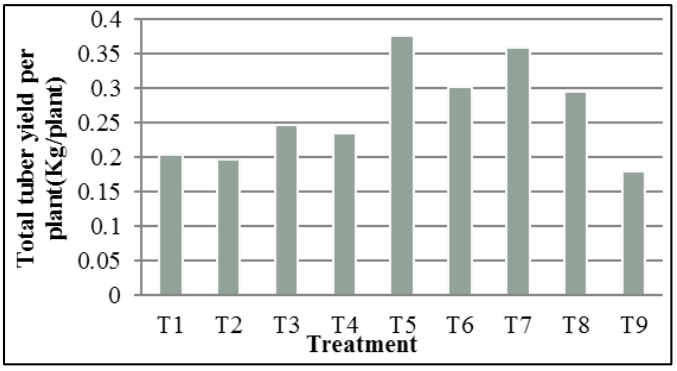

Fig 1: Total tuber yield per plant (Kg/Plant)

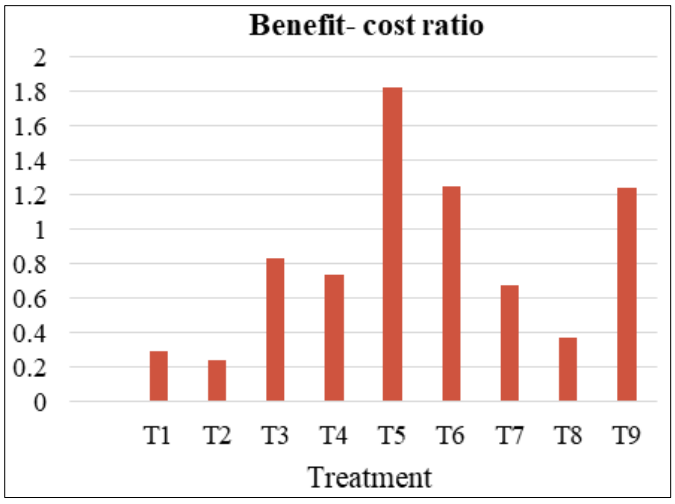

Fig 2: Benefit Cost ratio

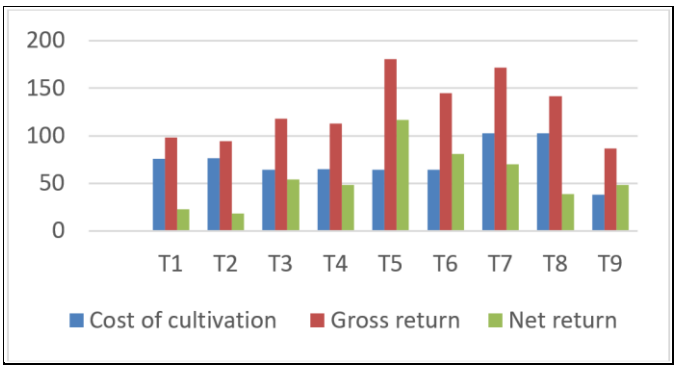

Fig 3: Cost of cultivation, Gross return and Net return

Conclusion

According to the current study, the various growing media combinations significantly affect gross income, net income and benefit cost ratio. The highest gross income (Rs. 180.48) and highest net income (Rs. 116.48) were obtained in treatment T_5 (Black soil: Paddy husk: Sand: Vermicompost 1:1:1:1), and the highest B:C ratio (1.82) was recorded in treatment T_5 (Black soil: Paddy husk: Sand: Vermicompost 1:1:1:1). This was primarily caused by increased tuber yield and lower input costs.

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