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Preliminary study on yam cultivation at Jashore: A case study

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A B S T R A C T

A preliminary study was conducted to estimate cost and return analysis on yam cultivation at Gaidghat of Bagharpara upazila of Jashore from February to March 2021. The average yam cultivation area was 0.12 ha in the study area. Different types of yam were cultivated in the study area, which had excellent local names, such as LalJhupi, KaloJhupi, Gorai, Lalteer, Altapat, Munshi, etc. Yam seed was shown from April to May and harvested from December to March. Most of the farmers planted yam seeds in rows where plant to plant distance was 1.5-2.5 feet and line to line distance was 2-3 feet. Average number of plants per hectare was 17023 nos., and the seed required 851 kg ha^{-1}. The total cost of yam production was Tk. 1,23,060 ha^{-1}, where the variable cost was Tk. 69,579 ha^{-1} (56.54%) and fixed cost were Tk. 53,481 ha^{-1} (43.46%). Yield of yam tuber was 44.98 ton ha^{-1}, and seed yam was 2.05 ton ha^{-1}. Gross return was Tk. 1,75,097 ha^{-1}, gross margin was Tk. 1,05,518 ha^{-1} and the net return was Tk. 52,037 ha^{-1}. The benefit cost ratio was 2.52, which means it's a profitable crop. Some disease organisms like fungi, viruses, and mites affect yam.

Keywords: Cost and return, Profitability, Yam

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Introduction

Yam (*Dioscorea* spp.) is one of the tuber crops grown for their edible tubers. Yam was grown in a warm region, and some species were cultivated as staple food crops in the tropical region (Chaudhary *et al*., 2014; Okongor *et al*., 2021). Yam was consumed as starchy vegetables, boiled, and mashed into a starchy paste and someone used in a curry. Yam plants had thick and bark-like skin tubers. It's fleshed had different colors, such as white to yellow, pink or purple, and varies in taste from sweet to bitter to tasteless. Round, oval, elongated, flattened to irregular aerial tuber shape, greyed orange skin colored with yellow, yellow-orange to greyed orange tuber was found in yam in Bangladesh (Islam *et al*., 2012). Yam (*Dioscorea* spp.) is a neglected tuber crop in Bangladesh. However, it is the fourth most important tuber root crop in the world after potato, cassava and sweet potato (Islam *et al*., 2012). It is a starchy vegetable and high potassium-rich food. It can easily grow in the home garden and need little care. This crop can be cultivated side of the roads, homestead gardens, houses, and jungle. No extra land was required for yam cultivation like other root and tuber crops such as potato, cassava, and sweet potato. Different minority people generally cultivate yam under shade in hills and forests in Bangladesh (Jahan *et al*., 2020). However, nowadays, it was cultivated in some plain land areas as a field crop and gains profit. Different types of recipes made from yam are uncommon nowadays. However, it is grown in hill areas, and some selected plain land areas are also cultivated yam. Bangladesh Agricultural Research Institute (BARI) has developed two yam varieties, BARI yam-1 and BARI yam-2, but it did not spread on the farmers' fields. Farmers cultivated different types, sizes, and colors of yam locally. Due to a lack of adequate information on farmers' level of yam production, researchers faced difficulties formulating the design of production technology improvement and the cost and return calculation of yam cultivation. Therefore, the present study was conducted on the socio-economic study as well as an estimate of the cost and return of yam cultivation and measures the constraints of yam cultivation.

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Materials and Methods

The study was conducted at Gaidghat of Bagharpara upazila of Jashore from February to March 2021 for the preliminary survey on yam cultivation. For the present study, 20 sample farmers were selected purposively and surveyed with a prepared questionnaire. The collected data were edited, tabulated and analyzed to fulfill the objectives of the study. Descriptive statistics such as Sum, ratio, average etc. were calculated as per requirement.

The equation for cost and profitability analysis is as follows:

Total cost (TC) = Total variable cost (TVC) + Total fixed cost (TFC)

Gross return (GR) = ∑(YiPi + yjpj)

Where, Yi = Yield of yam tuber ($Kgha^{-1}$)
Pi= Price of yam tuber ($Tkkg^{-1}$)
yj= Yield of yam seed ($Kgha^{-1}$)
pj= Price of yam seed ($Tkkg^{-1}$)

Gross margin = Gross return (GR) - Total variable cost (TVC)

Net return = Gross return (GR) - Total cost (TC)

Results and Discussion

Socio-economic characteristics

Most of the farmers who cultivated yam were young, and their age range was 32 years to 68 years. Among the farmers, about seventy-five percent were young aged, which means 31 to 50 years of age group (Fig. 1). Rest of the farmers, about twenty-five percent were above 51 years age group. The average family size was 5.5 in the study area, nearer to the national average (Table 1). Among the family member, thirty-seven percent was children, followed by thirty-two percent male member, and the rest of thirty-one percent was female member (Fig.1). As the household head, male farmer worked in a crop land, but female also engaged in agricultural activities in some cases. A study showed that male farmers were more efficient than female farmers (Tanko and Alidu, 2017) in yam cultivation, but female members also worked in yam field. Most of the farmers' main occupation was agriculture and they were involved in farming different seasonal crops. The average farming experience was 7 years, which ranges from 2-11 years. Some farmers were experienced, and some learned and cultivated yam and other vegetables. The entire farmer was literate and about thirty percent had mass education knowledge, meaning they could sign their name. About forty percent of the farmer had gone to primary school, followed by fifteen percent to secondary and fifteen percent to higher secondary (Fig.1). Average yam cultivable land was 0.53 ha.

In contrast, yam cultivated area was 0.12 ha in the study area. Among the cultivated land of a farmer, yam cultivated area was twenty-three percent of his total cultivated land. This cultivated land for yam was medium to high, and the farmer cultivated other vegetables as an intercrop with yam in the same fields simultaneously.

Table 1. Socio-economic characteristics of yam farmer.

Particular	Mean value/ Percentage	Range
Average farmer age (years)	46	32-68
Average family member (No.)	5.5	4-9
Main occupation-Agriculture	100	
Yam farming experience (years)	7	2-11
Own land (ha)	0.53	0.09-2.00
Yam cultivated land (ha)	0.12	0.04-0.24

Source: Field survey, 2021

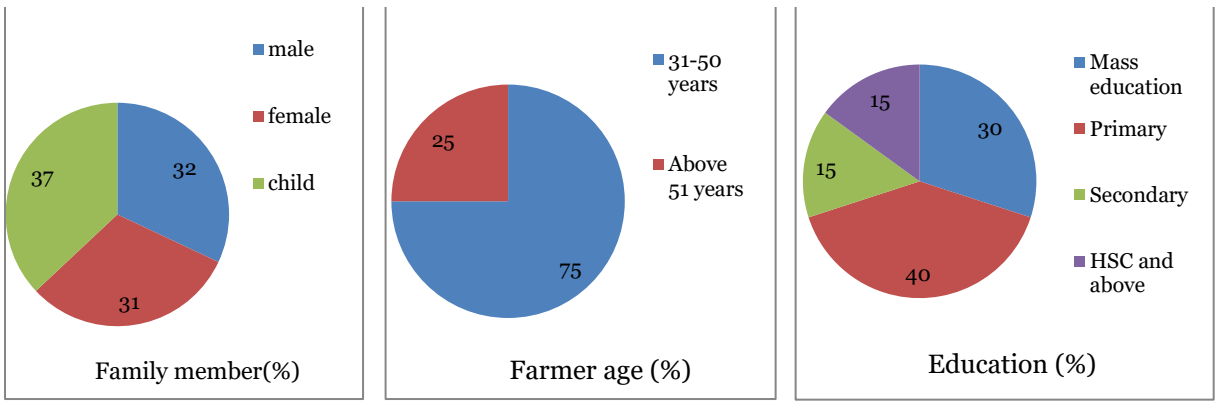

Fig.1. Percentage of family member, farmer age and education of the respondent farmer.

Agronomic traits

Most farmers planted yam seeds in rows where plant to plant distance was 1.5-2.5 feet and line to line distance was 2-3 feet. After well-prepared land with a power tiller and tractor with a deep harrow farmer digs a deep hole. This hole is kept with organic and inorganic fertilizer, sowing yam

seed properly. Yam seed was sowed from April to May and harvested from December to March. About fifty-five percent of farmers planted the seed in April, and the rest, about forty-five percent, in May (Fig. 2). About seventy percent of farmers kept their seed for sowing next season. It gets an edible portion of yam (edible tuber), some yam seed and bulbils from whole yam plants. Yam seeds get from some parts of the yam, called yam seeds, and some are from its fruits, called bulbils. Studies showed that whole tubers seed grow faster and yield more than minisetts (cut) tubers (Aighewi *et al.*, 2020). The farmer kept both of these for the next season's cultivation. Some farmers, especially those who cultivate new, buy yam seeds from other farmers. About forty-five percent of the farmer harvested yam in December to get a higher price (Fig. 2). Among other farmers, twenty-five percent of farmer harvest in January, twenty percent in February and the rest ten percent in March. Farmers harvested yam at different times to get higher prices at other times. If they are harvested simultaneously, market demand falls, and prices become lower. So that they harvested yam at different months, again yam did not store at storage farmer sold yam potatoes after harvest as well as possible time. Whereas potato was stored for a long time (Hajong *et al.*, 2014) to get a high price, yam did not store by the farmer. However, yam can also be stored, traded, and consumed during the dry and off-season for food security in Africa (Neina, 2021).

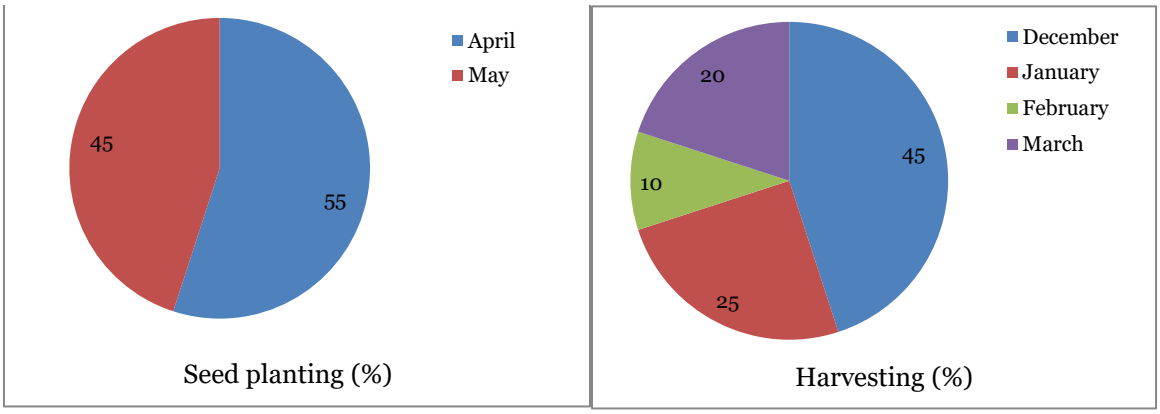

Fig. 2.Percentage of seed planting and harvesting of yam by months.

Input used pattern

After well-prepared land with a power tiller and tractor with a deep harrow farmer digs a deep hole. This hole is kept with organic and inorganic fertilizer, sowing yam seed properly. Yam seed was sowed in April to May and harvested from December to March. It gets an edible portion of yam (edible tuber), some yam seed, and bulbils from whole yam plants. Yam seed gets from some parts of yam, which are called yam seed, and some are from its fruits, which are called bulbils. The farmer kept both of these for the next season's cultivation. Some farmers, especially those who cultivated new ones, bought seeds from another farmer. Average number of plants per hectare was 17023 nos. Bulbils become the next season's seed, and these seeds become yam tuber. Average size of the yam was 2.30 kg, which ranges from 0.50 kg to 7.00 kg in the study area. Average seed required was 851 kg ha^{-1} (Table 2). Average labor requires 208 man-days per hectare. Labor as hired and family labor was important for yam cultivation, considered human capital (Osei-Adu *et al.*, 2016). Most of the activities, such as land preparation, sowing of seed, weeding, fertilizer application, pesticide spray, irrigation, harvesting, transporting, marketing etc. were done by the farmer solely along with the family members. Farmers used organic and inorganic fertilizers to get higher yields, though the amount was reasonable, and the entire farmer did not apply the same amount of fertilizer. Farmers apply urea, TSP/DAP, MoP, Zipsum, Boron and Zinc, which amount was 166 kg ha^{-1}, 158 kg ha^{-1}, 82 kg ha^{-1}, 27 kg ha^{-1}, 4 kg ha^{-1} and 4 kg ha^{-1}, respectively. Farmers build mancha with bamboo and sutli to keep yam and grow smoothly. This mancha is used for cultivating different vegetables simultaneously, such as cucumber, bitter gourd, pointed gourd, ridge gourd, etc., along with yam, which minimizes their production cost. Yam cultivation requires less input than potato (Haque *et al.*, 2012), panikachu, and elephant foot yam production (Haque *et al.*, 2013; Hajong *et al.*, 2015; Rahman and Hajong, 2022).

Table 2. Input used pattern of Yam cultivation.

Inputs	Amount	Inputs (Fertilizer)	Amount
Seed (kg ha^{-1})	851	Urea (kg ha^{-1})	166
Labor (No.)	208	TSP (kg ha^{-1})	158
Manure (kg ha^{-1})	735	MoP (kg ha^{-1})	82
Bamboo (No.)	89	Zipsum (kg ha^{-1})	27
Seed (kg ha^{-1})	851	Boron (kg ha^{-1})	4
		Zinc (kg ha^{-1})	4

Source: Field survey, 2021

Cost of production of yam cultivation

Production cost was the cost of different activities in farming, such as land preparation, seed or seedlings, labor, organic and inorganic fertilizer, crop protection material, irrigation, land use etc. There were two types of costing in production: variable and fixed. Variable cost directly involves costing and required cash amount for mitigating the cost of production. The total cost of yam production was Tk. 1,23,060 ha^{-1}, where the variable cost was Tk. 69,579 ha^{-1} (56.54%), and the fixed cost was Tk. 53,481 ha^{-1} (43.46%) (Table 3). Among the variable cost, the highest cost was incurred labor cost Tk.15934 ha^{-1} (12.95%), followed by the seed cost Tk. 14,052 ha^{-1} (711.42%), the mancha preparation cost Tk. 10614 ha^{-1} (8.63%), chemical fertilizer Tk. 10,113 ha^{-1} (8.22%), pesticide Tk. 4742 ha^{-1} (3.85%), and so on. In yam cultivation, labor, seed, and other inputs significantly affect yam production (Christopher *et al.*, 2021). For land preparation, mechanical power such as power tiller and some cases tractor was used. The land was ploughing with deep harrow smoothly for yam cultivation. Seed cost was huge, and most of the production cost involved buying seeds, but most farmers kept their seeds for the next season's cultivation. In this costing, seed cost was calculated tentatively as there required a huge amount of seed. Seed size affects the tuber size, where a bigger seed size gets a giant yam tuber. The yam field is rarely attacked by disease organisms (viruses and fungi), mites and some insects. So, farmers spray different insecticides, fungicides, and miticides such as Furadan, Nativo, Omite, etc., which incur some costs. Mancha was necessary for yam cultivation, and this mancha was used for other vegetable crops along with yam cultivation to minimize cost.

Table 3. Production cost of yam production (Tk. ha^{-1}).

Cost and return	Unit amount (Tk. ha^{-1})	Percentage of cost
Variable cost		
Land preparation cost	6835	5.55
Seed cost	14052	11.42
Hired labor	15934	12.95
Fertilizer	10113	8.22
Organic manure	2205	1.79
Irrigation	2086	1.70
Pesticide cost	4742	3.85
Mancha preparation cost	10614	8.63
Interest on operating capital	2996	2.43
Total variable cost	69579	56.54
Fixed cost		
Family labor	31041	25.22
Land use cost	22440	18.23
Total fixed cost	53481	43.46
Total cost	123060	100.00

Source: Author's calculation

Profitability of yam cultivation

From yam plants, it gets yam tuber, the main edible part of yam, yam seed and bulbils, which are also seeds. The yield of yam tuber was 44.98 ton ha^{-1}, and seed yam was 2.05 ton ha^{-1}. The farm gate price of yam was considered Tk. 29kg^{-1}. Gross return was Tk. 1,75,097 ha^{-1}, gross margin was Tk. 1,05,518 ha^{-1} and net return was Tk. 52,037 ha^{-1} (Table 4). Yam cultivation was less costly than aroids (Hajong *et al.*, 2015). In the study area, land use cost means the lease value of land was huge, so it affected the production cost, especially fixed cost, which lessened net return, though yam cultivation was profitable. Benefit-cost was 2.52, which means it is a profitable crop. Yam cultivation was also profitable in countries like Nigeria, where it was a viable and profitable enterprise (Verter and Becvarova, 2015; Ariyo *et al.*, 2020).

Table 4. Per hectare profitability of yam cultivation.

Particulars	Unit value
Yam yield (Ton ha^{-1})	44.98
Gross return (Tk.)	175097
Gross margin(Tk. ha^{-1})	105518
Net return	52037
BCR (Variable cost basis)	2.52
BCR (total cost basis)	1.42

Source: Author's calculation

Constraints and opportunities

Yam was cultivated in a selected area where land was medium to high. Yam cultivation had meagre constraints. Some farmers opined that yam affected by some disease organisms such as some fungal attacks and viruses but not ample besides these mites were hampered its growth. Crop yield and quality of yam decrease due to the attack of different plant pathogens (virus) at yam cultivation (Luo *et al*., 2022). Yam cultivation required less nourishment, and the fertilizer used was a meager amount. In yam cultivation, mancha building required bamboo and other material, which farmer seam a problem that it increased production costs though farmers shared this mancha with other crops and used it intensively. Yam had great demand in local and far away markets. Therefore, farmers did not face marketing problems and sold yam tuber at the local market.

Conclusion

Yam was a profitable tuber crop, and its demand and use increased day by day. Yam was a neglected crop, but its cultivation was increasing day by day. However, it required a long time for cultivation, progressive farmers cultivated relay and mixed crops with yam. In the study area, different types of yam were cultivated with excellent local names, such as LalJhupi, KaloJhupi, Gorai, Lalteer, Altapat, Munshi, etc. In a yam field, other crops, such as cucumber, bitter gourd, pointed gourd, etc. were cultivated along with yam and shared the mancha, which minimized farmer costing and farmer getting profit same time in row.

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