A study of the profitability of oyster mushroom cultivation in Kampala metropolitan area, Uganda

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Abstract

The study was conducted in Kampala Metropolitan area Uganda, during October 2016. It focused on analyzing costs involved in mushroom production, estimating profits, conducting a Benefit Cost Ratio (BCR) and Break Even Point (BEP), identifying the constraints of mushroom farming from the perspective of farmers as well as the possible solutions to the constraints as a basis of boosting mushroom production in Uganda. 52 respondents were interviewed face to face through use of questionnaires. The study revealed average net profit of 2,385.31 US dollars per farm in a period of three months, BCR of 4.08 and BEP of 106.41 Kgs. The study revealed that mushroom production is a profitable enterprise. The problems faced by farmers were ranked from the most pressing problem to the least pressing problem in this order; Low market prices per kilogram of mushroom, scarcity of cotton during some seasons, poor quality mushroom spawn supplied to farmers by breeders, inadequate extension and advisory services, unfavorable (high) temperatures, less capital to expand their businesses, termites, snails, fungus and infections, perishability nature of mushroom and difficulty in obtaining water were the most observed problems. The suggested solutions were organizing farmers into groups or cooperatives in order to negotiate for better markets locally and abroad together with the help of government, promoting input producers like cotton farmers and spawn breeders to produce high quality mushroom spawn in adequate quantity and on time, re-equipping local extension workers with knowledge regarding mushroom production, providing water all over the country to ensure adequate production of mushroom during hot seasons and researchers to carry out more research to find out other suitable inputs other than relying on only cotton.

Keywords: Profitability. Production. Costs

1. Introduction

The climate of Uganda is mildly tropical and temperatures range from 17 - 30^{o}C with the northern regions generally warmer and drier than the southern regions. Generally Kampala

in the central region is a bit warmer during the day and cooler at night and it has a slightly milder climate due to its location near Lake Victoria.

Traditionally, people pick mushrooms in forests, grasslands and woodlands including around termite mounds where conditions favour their growth. Mushrooms are still considered a delicacy because of their scarcity and unique flavor (Malakar, 2016). Commercial introduction of mushrooms in Uganda started in 1989 following the government introduction of Oyster mushrooms from Egypt to National Agriculture Research Laboratories (NARL) Kawanda (Kyobutungi, 2014).

There are few farmers involved in its cultivation and the actual number of mushroom growers in Uganda is not known since no reliable census has been undertaken (Malakar, 2016). All Ugandans, except the nomadic pastoralists, appreciate mushrooms as a food delicacy and some tribes even use them as medicine and as fertility enhancers. There is a thriving market for local edible wild mushrooms, especially along motorways (Nshemereirwe, 2004). The uniqueness of mushroom growing is, that it can be done with low capital investment, it requires minimal space and it is a home based activity that is environmentally friendly (MTRC, 2009).

Farmers in Uganda have increasingly taken up growing mushrooms in order to meet increasing demand as more consumers discover their nutritive and medicinal values, which include easy digestibility and an excellent source of protein, vitamins and minerals. Oyster mushrooms are the most commonly grown mushroom species due to the relative ease of cultivation (Malakar, 2016).

In Uganda the perception of mushroom growing as a profitable enterprise is commonplace, as mushroom production requires an initial low capital investment, small land requirement, and requires no input of fertilizers and is therefore considered environmentally friendly. Mushrooms can be grown indoors in a simple enclosed structure and potential mushroom growth substrates in Uganda include all major crop residues of cereals and legumes, corncobs, tree leaves, sawdust, coffee hulls, banana leaves, sugar cane bagasse, cotton waste, cotton seed hulls, brewers waste, papyrus reeds and elephant grass however the most used substrate is cotton seed hulls.

Although, the government is sensitizing people especially in the peri-urban areas to involve in mushroom production to boost household income and create employment opportunities to fight poverty, there is no study which has been done to find out the profitability of mushroom cultivation in Kampala Metropolitan area and Uganda in general.

Frempong (2000) argued that generally, farmers especially illiterate ones only consider as important, the actual amount of additional income they expect to receive and ignore the measures of project worth and hence end up engaging themselves in unprofitable ventures (as cited by Gittinger, 1982). With the active promotion of mushroom cultivation, therefore, there is the need to find out whether the investment is worthwhile to ensure that the individual farmers reap enough profit for consumption and re-investment. This study provides information to various stakeholders especially farmers or potential investors whether investing in mushroom cultivation is profitable and also provides information to the government as a basis for proper allocation of resources in improving people's standards of living through agriculture. The major objectives of the study were: to analyze the costs involved in mushroom production, to identify the constraints to mushroom production from the perspective of farmers and to analyze the trends in mushroom production in the world.

In developed countries such as Europe and America advanced technologies are used which are at a high level of mechanization and automation in the production of mushrooms. Mushroom farming is an important source of livelihood for some countries (Sing, 2011). The major types of mushrooms grown all over the world were estimated to be Agaricus 30%, Pleurotus 27%, Lentinula17%, Auricularia 6%, Flammulina 5% and other species 15% (Royse, 2014). Mushrooms provide important nutrients, including selenium, potassium, riboflavin, niacin, vitamin D, proteins, and fiber. All together with a long history as food source, mushrooms are important for their healing capacities and properties in traditional medicine. It has beneficial effects for health and treatment of some diseases. Many nutraceutical properties are described in mushrooms, such as prevention or treatment of Parkinson, Alzheimer, hypertension, and high risk of stroke. They are also utilized to reduce the likelihood of cancer invasion and metastasis due to antitumor attributes (Valverde et al, 2015). Increased cultivation and consumption of mushroom can therefore help raise the nutritional status of Ugandans by providing an extra source of protein, valuable minerals and vitamins especially to children, pregnant women, and people infected with HIV/AIDS and all other categories of people as well as improving household income especially in the peri-urban areas with small pieces of land. Mushroom industry is providing full or part time employment to rural and urban poor and marginal people in many developing countries (Ferchak and Croucher, 2001).

The world production of mushroom has increased over time, FAO in 2007 estimated world mushroom production at about 2.18 to 3.41 million tons over period of ten years

between 1997-2007, this was due to an increase of about 56% world mushroom production during that period. Generally, mushroom sector has experienced rapid growth all over the world. World mushroom production increased from 495,127 tons in 1961 to 10,378,163 tons in 2014 (FAO, 2015). Since 1978, mushroom production has increased by more than thirty (30) folds (Sharma et al, 2018). The top ten world major mushroom producing countries include China which occupies the greatest proportion worldwide 73.6%, Italy occupies 5.8%, United States of America occupies 4.2%, Netherlands produces 3%, Poland produces 2.4%, Spain produces 1.4%, France produces 1%, Iran produces 0.8%, Canada produces 1%, the United Kingdom produces 0.9% and other countries in the world produces 5.9% of the world total mushroom produced in the world. The global market for mushrooms was valued at over $35.08 billion in 2015. It is projected to grow at a commercial annual growth rate (CAGR) of more than 9.2% from 2016 to reach above $59.48 billion by 2021. Europe dominated the market in 2015 occupying 35%. Asia pacific is expected to show the highest growth in the mushroom market owing to escalating demand from the food industry (Zionmarketresearch.com, 2017).

Table 1: The top ten world major mushroom producing countries in selected years (Tons)

Countries	2000	2005	2007	2010	2013	2014	%
China	2,400,000	3,400,000	4,060,000	4,826,000	7,076,842	7,634,959	73.6
Italy	72,492	88,361	85,911	650,000	792,000	600,114	5.8
USA	464,071	467,055	432,890	432,399	406,198	432,100	4.2
Netherlands	265,000	245,000	240,000	266,000	323,000	310,000	3.0
Poland	113,479	160,000	180,000	230,000	220,000	254,224	2.4
Spain	63,254	137,764	131,974	133,000	149,700	149,854	1.4
France	203,811	138,541	162,450	119,346	104,621	108,540	1.0
Iran	16,000	27,908	28,000	74,000	87,675	80,239	0.8
Canada	80,241	80,071	73,260	72,930	81,788	102,526	1.0
UK	89,900	74,000	71,500	69,300	79,500	94,857	0.9
Other Countries	437,540	480,846	524,991	525,689	614,684	610,750	5.9
Total	**4,205,788**	**5,299,546**	**5,990,976**	**7,398,664**	**9,762,375**	**10,378,163**	**100**

Source: FAO, 2015.

2. Literature Review

There are several studies all over the world that have been conducted to establish the profitability of mushroom in respective countries and all of them have reported positive results as shown below:

Frempong Alex (2000), conducted a study in Greater Accra region of Ghana to analyse the profitability of mushrooms were all costs involved in mushroom production of 35 respondents who were randomly selected, were analysed and various tools such as BCA, NPV and IRR which concluded that mushroom production had a BCA of 1.35, NPV of Ghana Cedis 62,900 and IRR of 48.24%.

Thakare et al. (2006), in the study titled Economics of mushroom production in Chhatisgarh Plain where 64 mushroom growers from three districts of Raipur, Durg and Bilaspur in Malaysia were randomly selected and participated in the study. The study aimed at analyzing the cost of production, returns of oyster mushroom, to examine the level of participation of men and women in mushroom production and training programmes as well as the problems faced by growers in mushroom production. The study found out that fixed costs accounted for 33.58% and variable costs were 66.42% of the total costs of production, the average net returns per kilogram were Rs.24.04, the input –output ratio was found to be high on large farms compared to other growers, there was high participation of men compared to women in training programmes and production of mushroom, less production due to lack of technical knowledge, unavailability of spawn and different suitable varieties of mushrooms were the major challenges in mushroom production.

Godara et al. (2008) conducted a case study between 2008-09 titled Economics of Mushroom Production in Sonepat district of Haryana aimed at evaluating the cost of production of mushroom on different categories of farms and to analyse returns, benefit-cost ratio, break-even point (BEP) of mushroom production on different categories of farms and the policy implications for improving mushroom production. This study indicated an average net returns of 88,587.76 per farm, average cost benefit ratio of 1.46 and average break-even point output of 1,188.57 kgs which was highest over total fixed and total variable costs and it was established that mushroom production is a profitable venture and the economies of scale operated for large farms.

Singh et al. (2010), conducted a study of Cost-Benefit Analysis and Marketing of Mushroom in Haryana India as part of PhD thesis in the year 2003-04, it also analysed the problems facing the mushroom sector and solutions to the challenges to boost the sector. The study revealed that the average initial total cost of investment was Rs 155,187 per mushroom farm. since mushroom production is capital intensive, financial assistance through institutional agencies at cheaper interest rate would be the desirable entity, mushroom being a highly perishable crop and prone to high temperature, marketing infrastructures such as cold storage facilities are of immense importance. Similarly, suitable arrangements are needed by the canning/processing units for the management of surplus mushroom.

Barmon et al. (2012), conducted a study in 2011 to estimate BCR and household income of mushroom production and also to explore the problems of producing mushroom and its marketing channels in Bangladesh, thirty respondents were involved, the study found out that mushroom production was profitable with average net profit of 395.72 US dollars per farm and BCR of 1.55 within a production period of 3 months.

3. Materials and Methods

The study area covered Kampala metropolitan. It is an area about 100 kilometres from the city centre. It covers the four divisions of Kampala including Kawempe, Makindye, Lubaga, Nakawa and Kampala central. It also covers some parts of Wakiso like Kawanda, Entebbe, etc, some parts of Mukono and Mpigi like Maya. It was selected because most of the farmers live in this area, Kampala has the major market for mushroom and people have limited pieces of land. The selected farmers were based on their participation in mushroom production. The primary data were obtained through cross sectional research design where face to face interviews were conducted using questionnaires administered to 52 farmers and secondary data was also used. To calculating costs, the opportunity cost for owner inputs and actual price paid by the farmers for purchased inputs were considered. Mushroom farmers were categorized into three groups basing on the number of gardens (bags) they cultivate i.e 50-500, 501-1000 and 1001+ gardens. The average fixed costs were calculated basing on three month basis by dividing the value of a fixed item into its estimated economic life. The estimated economic life for a semi-permanent housing structure was 1 year, metallic drum (barrel) was 2 years, weighing scale was 3 years, knapsack sprayer or watering can was 2

years and tarpaulin was 2 years. All the average costs were considered on a 3 months basis, because one production period for commercial mushroom farmers takes 3 months.

3.1. Data analysis and presentation

Several approaches are used in this report to determine the major objective of this study. The costs involved in mushroom production are analyzed using SPSS 20 ranging from demographic data to the problems faced by farmers in mushroom production. Benefit Cost Ratio (BCR) is calculated by obtaining the average value from the total number of respondents involved in the study depending on their level of production and an overall average has been also obtained. BCR is obtained by dividing the total discounted benefits/revenue by total discounted costs involved in an enterprise.

$$\textbf{Benefit Cost Ratio} = \frac{\text{Total Revenue}}{\text{Total Costs}} \quad \text{(i)}$$

A BCR greater than 1 means the benefits outweigh the costs and the investment should be considered. If the ratio is less than 1, the costs outweigh the benefits. If the BCR is equal to 1, the benefits equal the costs.

The second and third technique was to find out the gross and net profit of mushroom enterprise which was calculated as shown below;

$$\textbf{Gross Profit} = \textbf{Total income} - \textbf{Total Variable Costs} \quad \textbf{(ii)}$$

$$\textbf{Net Profit} = \textbf{Gross profit} - \textbf{Total Fixed Costs} \quad \textbf{(iii)}$$

Break Even Point Analysis

This is the point at which its sales exactly cover its expenses. The breakeven point is equal to the total fixed costs divided by the difference between the unit price and variable costs. Note that in this formula, fixed costs are stated as a total of all overhead for the firm, whereas Price and Variable Costs are stated as per unit costs — the price for each product unit sold (Singh et al. 2010).

$$\textbf{BEP} = \frac{TFC}{(ASP - AVC)} \quad \textbf{(iv)}$$

Where, BEP=Break Even Point, TFC = Total Fixed Costs, ASP = Average Sale Price of mushroom ($/kg), and AVC = Average Variable Cost ($/kg).

4. Results and Discusion

This section includes research findings using descriptive statistics ranging from demographic data to cost analysis.

4.1. The social economic characteristics of respondents

Age

The 52 mushroom farmers who were interviewed, 42.3% belonged to the age group between 31 and 40, 36.5% of the respondents belonged to age group between 20 and 30, 13.5% and 7.7% of the respondents belonged to the age groups between 41-50 and 51 and above respectively. This implies that majority of the mushroom producers are mature adults between 31-40 followed by youth between 20-30. Mushroom production is also important to those people in the retirement age as shown in table 2 below.

Table 2: Age groups of respondents

Age groups	Frequency	Percent
20-30	19	36.5
31-40	22	42.3
41-50	7	13.5
51 and above	4	7.7
Total	52	100.0

Sex and marital status of the respondents.

The sex composition of respondents according to respondents was dominated by women 55.8% and men 44.2%. The survey comprised of 78.8% married respondents, 15.4% single and 5.8% widowed respondents as shown in tables 3 and 4 below. It indicated that mushroom production is important for economic empowerment of women.

Table 3: Sex of respondents

Sex	Frequency	Percent
Female	29	55.8
Male	23	44.2
Total	52	100.0

Table 4: Marital status of respondents

Marital status	Frequency	Percent
Married	41	78.8
Widowed	3	5.8
Single	8	15.4
Total	52	100.0

Level of education

Majority of the respondents were diploma and degree holders 55.8%, 25% of the respondents were secondary school leavers, 15.4% and 3.8% respondents were high school leavers and primary levers respectively as shown in table 5 below. Farmers had varying experience in mushroom production, a farmer with the longest experience had spent 21 years and the minimum was 1 year and on average each farmer had experience of approximately 3 years. The study reveals that educated people have actively involved in mushroom production.

Table 5: Level of education of respondents

Level of education	Frequency	Percent
Primary	2	3.8
Secondary	13	25.0
High School	8	15.4
Diploma and Degree	29	55.8
Total	52	100.0

Membership to farmer groups, associations or cooperatives.

The survey revealed that most of the mushroom growers 73.1% don't belong to any farmer group, association or cooperatives. Only 15.4% of respondents belong to farmer groups or association and 11.5% of respondents belong to cooperatives as summarized in table 6 below. This implies low development of cooperatives in mushroom sector and agriculture generally.

Table 6: Membership to any organization

Membership	Frequency	Percent
Cooperative	6	11.5
Farmer group/association	8	15.4
None	38	73.1
Total	52	100

Access to extension or advisory services

The research revealed that 90.4% of farmers receive extension and advisory services mainly from their fellow farmers, followed by 84.6% of farmers who receive extension and advisory services from researchers and breeders, 13.5% and 11.5% farmers receive their extension services from cooperatives, radio and television programs as well farmer group meetings respectively.

Table 7: Access to extension services

Source of extension service	Number of respondents	Percentage
Cooperative	7	13.5
Researchers/Breeders	44	84.6
Farmer group meetings	6	11.5
Radio and Television	7	13.5
Magazines and Newspapers	4	7.7
Fellow farmers and others	47	90.4

4.2. Economic analysis of mushroom production.

The cost items in the mushroom farming included different types of fixed, variable and opportunity costs. On the return side, gross return included revenue from sales of fresh mushrooms.

Fixed Costs

These include costs whose economic life is more than one year and they included housing, weighing balance, drum, tarpaulin and knapsack sprayer or watering can.

Variable costs

Variable cost share is the largest amount in the total cost of mushroom farming since they vary with the level of output. They include mushroom spawn, cotton, gauze or string, polythene bags, water costs, firewood, packaging materials, the cost of training, rice bran, agriculture lime, labour costs both hired and family labour in mushroom production. They were subjected to an interest rate of 1.5% per annum.

Labor costs

Labor cost included family labor and hired labor costs. The family labor cost was calculated on the principle of opportunity cost. The hired labor cost was calculated on the basis of the labor employed at the local market price. Labor cost is one of the main cost items in agriculture and it is also true in mushroom farming. In case of small and medium farm owners, family members provide their labor and hire out a person to help them during preparation of the mushroom gardens and he is paid depending on work done. However, for large farms, not only owner and family members but also hire labor on the farm that are paid on monthly basis.

4.3. Total cost of mushroom production

The average costs involved in mushroom production are summarized in the table below.

Table 8: Analysis of costs and returns of mushroom production US dollars

Cost Items	Categories			
	50-500	501-1000	1001+	Average
Variable Costs (US $)	34	11	7	-
- Mushroom spawn	96.79	171.18	1,065.91	242.99
- Cotton	42.17	99.37	73.99	147.15
- Water costs	19.46	27.17	58.67	26.37
- Firewood	9.18	17.36	37.58	14.73
- Labour charges (Wages)	5.36	40.78	216.12	41.22
- Polythene bags	7.52	20.24	140.16	28.07
- Gauze or string	1.85	3.00	0.67	1.94
- Cost of training	27.39	7.48	12.59	21.19
- Agriculture lime	0.53	2.32	22.28	3.84
- Rice bran	0.98	0.72	10.00	2.14
- Packaging materials	2.16	4.65	7.93	3.46
- Others	10.40	17.36	57.49	18.21
- Interest on variable cost (US Dollar	3.36	6.17	35.42	8.27

interest rate yearly 1.5%)					
Total Variable Costs (1)		**227.15 (69.11)**	**417.80 (76.75)**	**2,396.81 (90.8)**	**559,58 (80.90)**
Fixed Costs (US $)					
-	Housing*	145.52	215.24	326.48	184.64
-	Metallic Drum (barrel)*	18.4	33.12	65.04	27.76
-	Weighing Scale*	12.74	18.96	16.16	14.52
-	Sprayer/watering can*	3.60	7.76	6.48	4.88
-	Tarpaulin*	11.44	15.36	19.28	13.36
-	Opportunity cost of Family Labour	211.52	211.52	528.76	317.24
-	Interest on Fixed capital for 1 year	2.88	4.36	6.50	3.68
Total Fixed Costs					
Total Fixed Costs per 1 Period (3 months) (2)		101.53 (30.89)	126.58 (23.25)	242.18 (9.20)	141.52 (19.10)
Total Fixed Costs for a year		406.12	506.32	968.7	566.08
Total Production Cost per 1 period (1+2)=(3)		328.68 (100)	544.38 (100)	2,638.99 (100)	741.10 (100)
Total Mushroom Production (kg)(4)		606.44	1,136.82	9,604.29	1,929.88
Average Selling Price (US$/kg)(5)		1.54	1.82	1.72	1.62
Mushroom cost per kg (US$)3/4		0.54	0.48	0.27	0.38
Gross Product Value (4x5)=(6)		933.92	2,069.01	16,519.38	3,126.41
Gross Profit (6-1)		706.77	1,651.21	14,122.57	2,566.83
Net Profit (6-3)		605.24	1,524.63	13,880.39	2,385.31

Notes: (i) Figures within the parentheses are the percentages of total; (ii)Total sample size is 52; (iii) 1 US$ =3,404.205 Uganda Shillings october 2016); (iv) Duration of mushroom cultivation is 3 months, thus all costs are calculated based on 3 months.

The total fixed costs and variable costs of production were 30.89% of 69.11% respectively for farmers with gardens between 50-500, the total fixed costs and variable costs of production were 23.25% and 76.75% respectively for farmers with gardens between 501-1000 and the total fixed costs and variable costs of production were estimated to be 9.20% and 90.8% respectively for farmers with mushroom gardens of 1000 and above, whereas the average fixed costs were 19.10% and the average total variable costs were 80.90%.

The total variable costs occupy the biggest percentage during mushroom production as evidenced in table 8 above. The value of fixed costs reduces with the number of gardens (bags) a farmer cultivates and the value of variable costs increases with the number of gardens (bags) a farmer cultivates.

Table 9: Agriculture incomes from mushroom production US dollars

Particulars	50-500	501-1000	1001+	Average
Net profit	646.98	1,524.15	15,514.90	2,833.99
Opportunity cost	52.88	52.88	132.19	79.31
Total	**699.86**	**1,577.03**	**15,647.09**	**2,913.30**

The table below shows the average net profit is 2,385.31US dollars and shows the average cost benefit analysis of 4.08 and return on investment of 3.08 in three months

implying that mushroom production is a profitable enterprise. The more gardens (bags) a farmer cultivates the more yields obtained and eventually the net profit obtained also increases.

Table 10: Costs and Returns from mushroom production on different categories of farms

Particulars	50-500	501-1000	1001+	Average
Total Variable Costs ($)	227.15	417.80	2,396.81	559.58
Total Fixed Costs ($)	101.53	126.58	242.18	141.52
Total Production Costs ($)	328.68	544.38	2,638.99	741.10
Gross profit ($)	912.43	1,998.20	17,970.63	3,438.41
Net profit ($)	605.24	1,524.63	13,880.39	2,385.31
Cost Benefit Ratio ($)	3.51	4.20	6.62	4.08
Break Even point (Kg)	86.78	87.30	164.75	106.41
Average selling price/kg ($)	1.54	1.82	1.72	1.62

Notes: (i) Figures within the parentheses are the percentages to total; (ii)Total sample size is 52; (iii) 1 US$ =3,404.205 Uganda Shillings (October, 2016); (iv) Duration of mushroom cultivation is 3 months, thus all costs are calculated based on 3 months.

The average price per kilogram of mushroom is shown in the table below in dollars.

Table 11: Average price per fresh kilogram (US dollars/kg)

Number of bags (gardens)	N	Mean	Minimum	Maximum
50-500	34	1.54	1.18	2.64
501-1000	11	1.82	1.47	2.94
1001+	7	1.72	1.47	2.06
Total	52	1.62	1.18	2.94

The study also revealed that some farmers also sells dry mushroom and 10 kilograms of dry mushrooms gives 1 kilogram of dry mushroom and the average price for the dry mushroom was 11.75 US dollars. The major markets for both fresh and dry mushroom were markets, supermarkets, hotels, restaurants and neighbors of mushroom farmers. It was revealed that most farmers market their produce directly or through middlemen.

4.4. Challenges facing mushroom enterprise in Uganda

The problems facing mushroom were ranked as shown below (Table 12). They range from low market prices to difficulties in obtaining water to water mushroom during the cultivation process.

Table 12: Challenges facing mushroom enterprise

Problems	Number	Percentage
Low market prices	31	59.6
Scarcity and expensive cost of cotton in some seasons	29	55.8
Scarcity and poor quality of mushroom spawn	25	48.1
Inadequate extension services	21	40.4
High temperatures	12	23.1
Less capital to expand	4	7.7
Termites, snails, fungus and infections	5	9.6
Perishability nature of mushroom	4	7.7
Difficulty in obtaining water	3	5.8
Others	3	5.8

Mushroom farmers identified low farm gate prices of mushroom products per kilogram as a major challenge facing the industry followed by difficulties in obtaining cotton seed hull as a substrate used in mushroom production, sometimes it is imported from Tanzania making it more expensive and scarce, low quality mushroom spawn supplied by breeders and sometimes it is not available in time when it is needed which makes farmers incur losses, there is also a challenge of inadequate extension and advisory services among the local extension workers as well as other challenges as summarised in Table 12 above.

4.5. Conclusion and Recommendations.

Farmers suggested a number of solutions to the challenges facing mushroom production as summarized below (Table 13).

Table 13: Solutions to the challenges

Problem	Solutions
Low market prices	Organizing farmers in groups/cooperatives, gathering and disseminating market information among the farmers, negotiating for better markets within & abroad as well as sensitizing Ugandans about the health benefits associated with consuming mushrooms.
Scarcity and expensive cost of cotton seed hulls in some seasons	Government designing a deliberate policy to boost cotton production in the country to boost textile industry as well as mushroom production in the country, giving subsidies, offering free cotton seed hulls as the case with other crops and using other substrates like bagasse.
Scarcity and poor quality of mushroom spawn	Uganda National Bureau of Standards should develop standards for spawn breeders and effectively monitor their conformity to the set standards to ensure quality spawn production, government needs to support mushroom spawn breeders with necessary infrastructure to produce quality adequate spawn in time.
Inadequate extension services	Training and re-training local extension workers about mushroom production and the activities involved.
High temperatures	Modernizing mushroom activities, constructing better suitable structures that make watering easy.
Less capital to expand	Through organizing Saving and Credit Cooperative organizations (SACCOs) to raise capital amongst members and acquire loans at a cheaper interest rates.
Termites, snails, fungus and infections	Ensuring hygiene during the preparation of mushroom gardens, using appropriate fungicides, insecticides etc and conducting more research about these emerging challenges.
Perishability nature of mushroom	Improving marketing infrastructure such as cold storage facilities and proper arrangements are needed by drying & processing units for the management of surplus mushroom during bumper production.
Difficulty in obtaining water	Investing in water harvesting technologies and obtaining water via National Water and Sewerage Cooperation which is cheaper.
Others	Including mushroom enterprise in government agriculture programs, emphasizing value addition and designing a deliberate policy aimed at boosting mushroom production.

The estimates of benefit cost analysis, net profit, gross profit, net profit and break even analysis indicate that mushroom production is generally profitable and therefore all interested and potential investors can invest in it and expect to reap benefits out of it. The analysis of production costs indicates that, total variable costs occupy the biggest percentage during mushroom production whereas the value of fixed costs reduces with the number of gardens (bags) a farmer cultivates and the value of variable costs increases with the number of gardens (bags) a farmer cultivates.

Majority of the respondents were women (55.8%) indicating their high involvement in mushroom production as a way of being empowered economically. The study also revealed

that majority of the people who were involved in mushroom production were married (78.8%). The major supplier of mushroom spawn was NARL followed by Makerere University and other suppliers, one farmer with an experience of 21 years in mushroom production reported to be producing her own spawn and eventually sell to other farmers.

The majority of respondents indicated that they are neither member of cooperatives nor farmer group/associations (73.1%) and those who belonged to farmer groups and cooperatives indicated ineffectiveness and that is why majority opted out. If the bottlenecks affecting mushroom production are tackled as suggested in table 13, mushroom production will boom into a vibrant sector that can be relevant in creating employment opportunities.

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