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**CONTRIBUTION OF SMALL SCALE
MUSHROOM PRODUCTION FOR
FOOD SECURITY IN THE AMHARA
REGION, ETHIOPIA**



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SUMMARY

Presently, mushroom farming is being practiced in more than 100 countries and its production is increasing at the rate of 7 per cent per annum. Production of mushroom reaches 7 million metric tons annually in the world. The world market for the mushroom industry in 2005 was valued at over \$45 billion.

Production of mushrooms worldwide has been steadily increasing, mainly due to contributions from developing countries such as China, India, and Vietnam. China produces about 60% of world production and about 80% its mushrooms come from small scale production. Mushrooms are known for their nutritional and medicinal benefits.

In Ethiopia due to a number of constraints the economic, food, and medicinal value of mushrooms have not been exploited so far. However, currently, there is increasing interest and production endeavors in some parts of the country.

Mushroom cultivation has a variety of advantages such as, enabling the use of agricultural and agro-processing wastes, it does not require a large area of land or it can be grown in non arable land, it is high yielder per unit area of land viz a viz about 20,000 quintal per ha per annum, it is environmentally friendly technology, and though it requires skilled labor it has an alternative production options for marginal and small scale producers.

In this way mushroom production creates job opportunity for marginal and unemployed youth of the society, increases food production and diversification, it reduces malnutrition, plays a role in the improvement of the GDP of the country, serve as an import substitution item, and a source of foreign currency.

In the Amhara National Regional State (ANRS), Bahir Dar, Zenzelima Kebele, there exists one pioneer mushroom growing enterprise “Kings’ Mushroom Production and Marketing Enterprise”. The enterprise is currently engaged in the production and marketing of oyster mushrooms in Bahir Dar for a number of Hotels and individuals. According to our observation, Bahir Dar has suitable climatic conditions that favor cultivation of mushrooms with little modification of the growing environment. Furthermore, Bahir Dar, as one of the tourist attraction centers of the country, needs the surplus supply of mushrooms for her visiting guests.

Therefore, the objectives of this paper are: to demonstrate how we can create small scale mushroom producers in Amhara Region; to illustrate how we can enable these

small scale mushroom producers to contribute their part in fighting against poverty in the Amhara Region; and to give you an idea about the contributions of small scale mushroom industry in achieving the concepts of food security (food availability, access, and utilization).

1. INTRODUCTION

1.1. WHAT ARE MUSHROOMS?

Mushrooms are the edible fleshy fruiting bodies of certain fungi, which may be gathered wild or grown under cultivation. The cap and stem that we commonly eat is just the fruiting body.

The edibility of mushrooms has been known to humans since time immemorial, but the intentional cultivation of mushrooms had its beginning in China, around A.D. 600, when *Auricularia auricular* was first cultivated on logs. The use of mushrooms as food is probably as old as civilization itself (Chaube, 1995) and mushrooms have been treated as a special kind of food (Tripathi, 2005). Greeks believed mushroom provides strength in battle. The Chinese treasured mushrooms as a health food the elixir of life. The Egyptians regarded them as food for Pharaohs. Romans regarded it as food of the gods. Moreover, the Romans were very fond of mushrooms; often it was the lord of the house himself who prepared mushrooms. Story goes that picking the Emperor's Amanite (*Amanita caesarea*) was punished by cutting off the hands of the offender (Oei, 2003).

Current studies estimate that **1.5 million** species of fungi may actually exist and that there may be **140,000** species that produce fruiting bodies of sufficient size and structure to be considered as mushrooms. However, out of these, about **7000** species possess varying degrees of edibility, and more than **3000** species may be considered prime edible species, of which only **200** species have been experimentally grown, **100** economically cultivated, approximately 60 commercially cultivated, and about **10** species cultivated on an industrial scale (Chang and Miles, 2004).

In addition, 2000 species have been suggested to possess medicinal properties. Such medicinal mushrooms produce substances that can improve biological functions and thus the health of the consumer. These products have been called by various names, including dietary supplements, functional foods, phyto-chemicals, nutraceuticals, and nutriceuticals. Industries providing these substances have expanded in the United States, where the supplement sales were valued at U.S. \$3.3 billion in 1990. These sales have increased steadily, and in 2000 there was an estimated value of U.S. \$14 billion (Chang and Miles, 2004).

Most acceptable varieties among cultivated type are *Agaricus bisporus* (*Button mushroom*), *Pleurotus spp.* (*Oyster mushrooms*), *Lentinula edodes* (*Shiitake mushroom*), *Auricularia spp.*, *Flammulina velutipes* (*Velvet stem collybia or Gold*

needle mushroom), *Tremella spp.* (*Silver ear*), and *Volvariella spp.* (Bhupinder and Ibitwar, 2007).

1.2. DEFINITION OF FOOD SECURITY

Though the recent concept of food security is broad most of its definitions often has concepts of availability, access, and utilization. For example, according to USAID Policy Determination No, 19 (1992), food security is when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life. Correspondingly, EU defines food security as the **availability** of food and the capacity to have **access** to it, constituting a threshold from which the households can start to accumulate reserves (stocks, cattle or monetary savings), to develop a more powerful means of production or to increase income and organize social relations comprising more reliable solidarity networks (European Commission, April 1996). Accordingly terms such as availability, access, and utilization have the following connotation:

Availability refers to when sufficient quantities of appropriate, necessary types of food from domestic production, commercial imports or donors are consistently available to individuals, are in reasonable proximity to them or are within their reach.

Access refers to when individuals have adequate income or other resources to purchase or barter to obtain levels of appropriate foods needed to maintain consumption of an adequate diet and nutritional level.

Utilization refers when food is properly used; proper food processing and storage techniques are employed; adequate knowledge of nutrition and child care techniques exist and is applied; and adequate health and sanitation services exist.

1.3. OBJECTIVES OF THE PAPER ARE:

- To demonstrate how we can create small scale mushroom producers in Amhara Region;
- To illustrate how we can enable these small scale mushroom producers to contribute their part in fighting against poverty in the Amhara Region; and
- To give you an idea about the contributions of small scale mushroom industry in achieving the concepts of food security (food availability, access, and utilization).

2. BENEFITS OF MUSHROOMS

2.1. ECONOMIC VALUE MUSHROOMS

Presently, mushroom farming is being practiced in more than 100 countries and its production is increasing at the rate of 7 per cent per annum. Production of mushroom has already crossed 6 million metric tons annually in the world and is expected to reach around 7 million metric ton in the next ten years (Bhupinder and Ibitwar, 2007).

The world market for the mushroom industry in 2005 was valued at over \$45 billion (Chang, 2006). The global increase in mushroom production is mainly due to contributions from developing countries such as China, India, and Vietnam. China produces about 60% of world production and about 80% its mushrooms come from small scale production.

2.2. FOOD VALUE OF MUSHROOMS

Mushrooms have been recognized by FAO as food contributing high protein in nutrition (Bhupinder and Ibitwar, 2007). Mushrooms usually contain 20-30% protein (about 3% on fresh weight basis) which is higher than most of the vegetables. Quality of mushroom protein is superior to that of vegetable protein. The proteins have high digestibility. Mushrooms are rich in essential amino acids that cannot be synthesized by our body as well as the most commonly occurring non-essential amino acids. In mushrooms, starch is absent. Moreover, cholesterol and the sterol known to be dreaded for heart patients, remain absent in mushrooms. Mushrooms are rich in Vitamin B-Complex and they contain Vitamin C. The vitamins are well retained during cooking, canning, drying and freezing (Chaube, 1995). Fresh mushrooms contain relatively large amount of carbohydrate (4-5%) and fiber. And they contain significant amount of phosphorous, sodium and potassium with lesser amount of calcium and iron (Tripathi, 2005).

2.3. MEDICINAL EFFECT OF OYSTER MUSHROOMS (*PLEUROTUS SPP.*)

According to *Icons of Medicinal Fungi from China* cited in Chang and Miles (2004), the medicinal part of the oyster mushroom is in its fruiting body. *Pleurotus* is used in traditional medicine to prevent or assist in more than 30 diseases or disorders. Antitumor activity was found in the polysaccharide fractions of the fruiting bodies of almost all *Pleurotus* species. These polysaccharides belong to (1→3)- β -D-glucans. Different glucans from *Pleurotus* have been found to enhance the activity of natural killer cells and lymphokine activated killer cells. In addition to modulating the immune system, *Pleurotus* spp. have hypoglycemic activity, antithrombotic effects, inhibit tumor growth, and reduce inflammation, and lower blood pressure and plasma lipid concentration. In addition, they have antioxidant activity. The investigation of antioxidant activity of different extract fractions - acidic, phenolic, alkaline, and neutral - showed that the highest activity level was present in the phenolic fraction. It was also demonstrated that the extracts of fruiting bodies had higher antioxidant activity than mycelium and cultured liquid extracts. Differences in antioxidant activity between samples of extracts may be related to different fatty acid composition of their lipids. Thus, the content of unsaturated fatty acids in fruiting body extracts was higher than in mycelium and cultured liquid extracts (Chang and Miles, 2004).

The value of mushrooms has recently been promoted to tremendous levels with medicinal mushrooms trials conducted for HIV/AIDS patients in Africa, generating encouraging results (Chang, 2006).

3. PROSPECTS OF MUSHROOM PRODUCTION IN AMHARA REGION

3.1.POTENTIALS

The Amhara Region has a favorable climate, comparatively abundant land and agricultural wastes, labor as well as reasonably good water resources that created ample opportunities for horticulture production. The region has a wide range of altitude, temperature, and soil variability. All these potentials can be used to the advantage of intensification of new crops including mushrooms in the region.

3.2.MUSHROOM: ETHIOPIAN TABOO CROP

In most cultures of the people in Ethiopia wild mushrooms have different names tagged with them. The Amharic names of wild mushrooms reflecting negative intuition include: “Ye-abohay fes” meaning the “Pert of Monk”, “Ye-Jib Tilla” meaning “Hyena’s Umbrella”, “Dem Astefy” meaning “that causes vomiting of blood” etc. Due to this bad impression about mushrooms in Ethiopia, the food and medicinal values of mushrooms have been undermined. However, in some cultures on the other hand mushroom is named as “Enguday” meaning “Mushroom”. In this group of society there is a culture of wild mushroom harvesting and consumption whenever they encounter it in the wild by a stroke of luck.

On top of these, lack of concept and skill on production technology, lack of research, extension, and adaptation works, lack of appreciation about the food and dietary importance of mushrooms, and the monotonous traditional diets and the conservative eating habit of the people may be the reasons that constrained the introduction of this delicious vegetable into the menu of most Ethiopians.

However, regardless of the constraints mentioned, there are also good opportunities that can be taken as the precursor of the product’s excellent future in this country.

3.3.OPPORTUNITIES

- Mushroom cultivation is based on recycling of agricultural residues, which are available in huge amount in every corner of the country;

- Mushroom cultivation does not require a large area of land or it can be grown in non arable land;
- Mushrooms are high yielder per unit area of land viz a viz according to Cooke cited in Dawit (1998) one can produce about 45 quintal of grain per hectare of land per annum but about **20,000 quintal** of mushrooms can be produced per hectare of land per annum;
- Mushrooms are short season crops and their cultivation is environmentally friendly;
- The availability of alternative production options for marginal and small scale producers is a good opportunity for those interested to engage in small scale level;
- Initiation of development and research projects on low cost production of mushrooms by different bodies of the country;
- The increasing level of awareness and interest about mushrooms among certain group of the society; and
- The appearances of a few mushroom growers and spawn producers in Addis Ababa are indicators of the products good future.

As a result, today one may encounter mushrooms in cafes and restaurants served as condiments and pizza flavoring items. Particularly in Addis Ababa there is high demand of fresh mushrooms in the market surpassing the current supply by growers in and around Addis.

3.4. CURRENT STATUS OF MUSHROOM PRODUCTION IN AMHARA REGION

In the Amhara Region, Bahir Dar, Zenzelima Kebele, there exists one pioneer mushroom growing enterprise “Kings’ Mushroom Production and Marketing Enterprise”. The enterprise has a strong conviction that food self sufficiency and security can be brought about through diversification of food products and sources of incomes especially from first to last utilization of less exploited or new crop types such as mushrooms.

3.4.1. History of the Enterprise

- Established in 2008
- Acquired working land of 1.5 hectare in October, 2009

Figure 1 our project land size (partial view)



- Constructed mushroom growing room, mushroom laboratory, office and store, fenced, and well cared.

Figure 2 Mushroom growing house, laboratory (left) and office and store (right)



Figure 3 front views of the above buildings



3.4.2. Produces of the Farm

Oyster mushrooms

Figure 4 we produce oyster mushrooms



Spawn (mushroom seed)

Figure 5 we produce our spawn, pure culture (left) and mother grain spawn (right) preparation



Grafted fruit seedlings and Fruit and vegetable crops, etc

Figure 6 Mango seedling rootstocks (left) grafted mango seedlings (right)



Figure 7 A year old grafted mango flowering (left), papaya (right)



3.4.3. Services Rendered by the Enterprise

- Short term training on mushroom production, postharvest handling, and utilization;
- Short term training on postharvest handling and processing of horticultural produces;
- Short term training on vegetative propagation techniques of fruit tree seedlings; and
- Short term training on plant nursery establishment and management.

3.5. WHY MUSHROOMS IN AMHARA REGION?

- Bahir Dar and other cities of the region are major tourist attraction centers of the country, needs the surplus supply of mushrooms for their visiting guests;
- The developments of service centers like grand hotels, lodges and spa, restaurants and cafeterias in the region necessitates the supply of mushrooms more than ever;

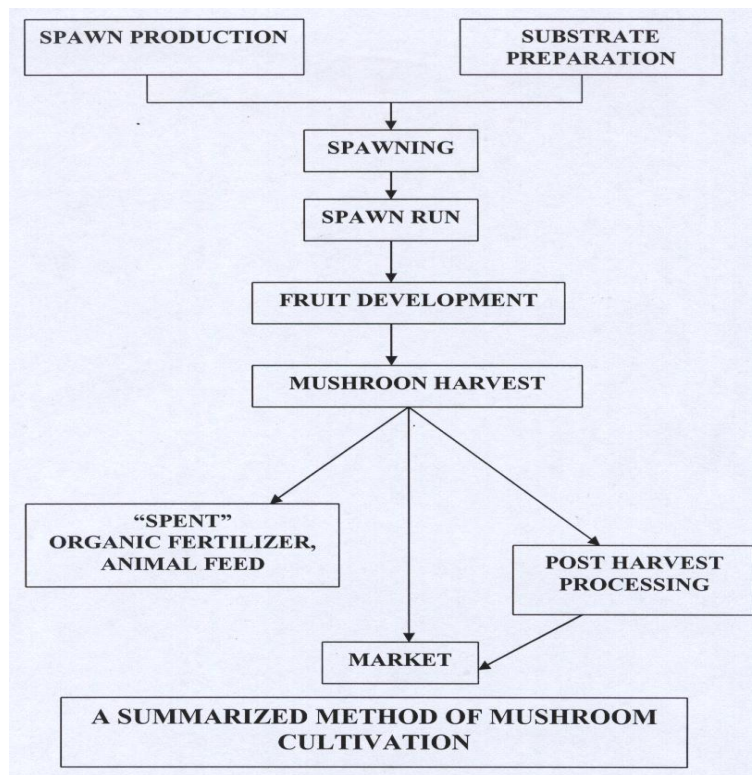
- Mushroom production creates job opportunity for marginal and unemployed youth of the society;
- Malnutrition is common place in the region, animal protein is beyond the reach of low income group of the society and mushrooms are rich sources of protein;
- Mushrooms grow on cheap agricultural materials and wastes, abundant in the region;
- Mushroom technology can go to rural poor and marginal farmers in a short period of time and bring about significant impact on food security;

4. PROCESSES OF MUSHROOM PRODUCTION

According to Chang and Miles (2004), the practices of mushroom cultivation, or mushroom technology, consist of six major phases. These phases generally occur in the sequence that follows:

- (1) Selection of a mushroom species,
- (2) Selection of a fruiting culture,
- (3) Development of spawn,
- (4) Preparation of compost (or substrate media),
- (5) Spawn running, and
- (6) Mushroom development.

Figure 8 summary of methods of mushroom cultivation (Source: Dawit, 2008)



4.1. SUBSTRATE IN AMHARA REGION FOR MUSHROOM CULTIVATION

A wide range of plant wastes, such as sawdust, paddy straw, bagasse, cornstalks, waste cotton, stalks and leaves of bananas, cattle/horse dung, chicken manure, brewers spent, wheat bran, sorghum /maize stalk, etc. can all be used for mushroom production.

4.2. SPAWN PREPARATION

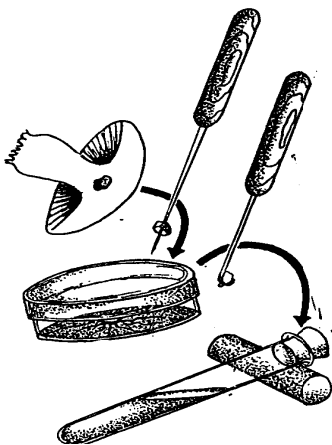
4.2.1. The Minimal Requirements for a Spawn Production Unit

- A sterilization unit (pressure cooker, autoclave)
- Sterile environment: inoculation box (inoculation cabinet), laminar flow cabinet or clean room
- Incubation rooms
- Laboratory equipment like
 - Petri dishes
 - Test tubes
 - Scales, alcohol, flame
- The raw materials include:
 - Elements for media preparation
 - Substrate material (grain, wooden sticks, sawdust, or even oil palm fruit fiber)
- Spawn containers.

4.2.2. Method of Spawn Preparation

- ❖ There are **three steps** involved in spawn production:
 - Raising pure culture,
 - Preparation of mother spawn and
 - Multiplication of spawn.

Figure 9 method of spawn preparation (tissue culture)



4.3. GROWING OYSTER MUSHROOMS (*PLEUROTUS OSTREATUS*)

Construction of separate spawn run and fruiting rooms, Preparation of materials needed, Substrate formulation and preparation, Preparation of substrate containers, Spawning, Transferring to spawn running room: for spawn run (at our farm, Kings' Mushroom, spawn run will take 12-14 days), and Transferring to cropping room: for fruit-body formation.

Control the humidity, temperature, and CO₂ concentration of the room. In this way, small pinheads of mushrooms will come out from beds after 5-7 days of opening (or after the beds have been transferred to the cropping room).

Harvesting date usually takes 5 to 7 days from tiny pinhead to the harvested oyster mushroom. When the caps have almost completely spread out, the mushrooms should be picked.

Generally at Kings' Mushroom farm in Bahir Dar, the cropping time for oyster mushroom from spawning to first round harvest takes from 28-30 days.

Oyster mushrooms can utilize a wide variety of raw materials and can be grown in a wider range of temperature. Their production method is convenient for Small scale production (low cost). Thus, it is a good choice for beginner mushroom growers. Oyster mushroom is the first mushroom to be introduced to the market in Ethiopia. Currently, a few growers are engaged in the cultivation of the mushroom. In market both fresh and dried mushrooms are acceptable (Dawit, 2007).

Oyster mushroom can be grown in a variety of containers including brick pots, racks, plastic and wooden boxes, bamboo baskets, polyethylene bags, etc.

Figure 10 Oyster mushrooms growing in different containers (pot, rack, & plastic bag)



4.4. GROWING SHIITAKE (*LENTINULA EDODUS*) MUSHROOMS

Lentinula edodes (Berk.) Sing. (common name: black forest mushroom; Chinese name: shiang-gu; Japanese name: shiitake) is the second most important edible mushroom next to *Agaricus spp.* in the world from the standpoint of production; and it is the most popular fungus cultivated in China, Japan, and other Asian countries.

For a long time, this mushroom has been valued for its unique taste and flavor and as a medicinal tonic. At the present time, numerous scientific investigations have established the nutritive value and medicinal benefits of *Lentinula* in lowering serum cholesterol levels, and possessing antitumor and antiviral activities. For all these reasons the demand for *Lentinula* has greatly increased in recent years, and with the demand there has also been an increase in production. With new production methods it is anticipated that there will be continuous expansion of production in the future (Chang, 2004).

Shiitake mushroom can be cultivated by one of the following containers/methods: 1. The **bottle method** for small-scale cultivation; 2. The **plastic bags** referred to as the “**space bags**” method, in which mushrooms were cultivated on particulate, sawdust-based substrates in autoclavable small plastic bags; 3. The **brick method** or the **pressed cake method**; 4. The **synthetic log**, also called the “**mushroom cylinder method**,”; 6. The **synthetic bag method**; and 8. The **small rush shed** or **plastic shed method** was derived from the synthetic bag method.

This mushroom can be produced both on log and sawdust media. In growing shiitake using log method, the spawn is inoculated into holes and covered. After a few months, the mushroom starts to grow. The production could continue to 4-6 years.

Figure 11 Shiitake mushrooms grown on wood log (left) and sawdust media (right)



4.5. GROWING OF BUTTON MUSHROOMS (AGARICUS SPP.)

Button mushroom is globally the most important mushroom, which requires composted substrate. The compost must be covered with casing material after spawning. The compost is made of cereal straw, horse dung and chicken manure, and fertilizers. Then the compost must be pasteurized by steam in pasteurization chamber. This mushroom is relatively more difficult for a small scale grower.

Figure 12 Growing of button mushrooms in compost



5. SO WHAT IS KINGS' MUSHROOM GOING TO DO?

Kings' Mushroom has already the technology of mushroom production and the competence to provide series of trainings on Mushroom Production, Postharvest Handling, Utilization and Marketing. The enterprise has already developed the training package and plans to provide the above mentioned training for about 600 trainees coming from Bahir Dar, Gondar, Dessie, and Debre Markos.

The training package clearly shows how low cost mushroom growing houses can be built using different materials by providing three options left for trainees' choice. Moreover, we have also estimated the financial needs to construct a single low cost mushroom growing room, the amount of inputs and operational costs it needs and the amount of yield that can be harvested and the total gross income that may be drawn from such growing room per season and annum bases.

Table 1 Planned number of trainees in Amhara Region in year 2010/11

Trainees from	Unit	Quantity of batch	No, of trainees/batch	Total no, of trainees
Bahir Dar	Batch	5	40	200
Gondar	Batch	4	40	160
Dessie	Batch	4	40	160
Debre Markos	Batch	2	40	80
Total		15		600

5.1. LOW COST MUSHROOM GROWING HOUSES

We have prepared three options of low cost mushroom growing houses each having an area of 35 m² but varying in costs of construction that ranges from 24,000 to 37,000 Birr.

The estimated cost of grow room furniture and equipments do not exceed Birr 1,400.

The estimated costs of one season grow room inputs reach Birr 1,600.

Distribution and packaging expenses for mushrooms produced in one season in low cost houses do not exceed Birr 260.

Table 2 Projected yield of mushroom in one growing season in such low cost houses

Description	Unit	Quantity	Unit yield/bag in kg	Total yield in kg
Fresh mushrooms	3 kg plastic bag	144	1.5	216

*One season is 2 months of period

Assuming the selling price of a kg of fresh mushrooms Birr 35, the grower will have Birr 7560.00. Minus costs for consumables and distribution and packaging costs (7560.00-1,653.80-259.20) and without considering the grower's costs of labor one can have an income of Birr 5,647.00/two months.

5.2. EXPECTED OUTCOME OF THE TRAINING PACKAGE

5.2.1. Increased Food Production, Diversity, and thus Increased GDP

As it is discussed above, totally 600 trainees will be trained in 15 consecutive batches, each batch consisting of 40 trainees, who will be trained for 7 days in mushroom production. These trainees have a minimum capacity of producing from 972.00 quintal to 3,888.00 quintal of fresh mushrooms per annum. This range of yield is based on the assumptions that if trainees build one of the above-mentioned mushroom growing houses (i.e., 35 m² area) and if 25% to 100% (or from 150 to 600) of the trainees entered into mushroom production and marketing business as tabled under.

Table 3 Yield estimation per trainee at different proportion of the total number of trainees who have taken the training

Description	Quantity	No. of production/year	Yield/season in kg	Total yield in qtl per annum	Individual yield in qtl/annum
If all 600 youths enter into production	600	3	216	3,888.00	6.48
If 75% of trainees enter into production	400	3	216	2,592.00	6.48
If 50% of trainees enter into production	300	3	216	1,944.00	6.48
If 25% of trainees enter into production	150	3	216	972.00	6.48

And if 100% of the total trainees enter into mushroom production and marketing business, and if these 600 trained youths produce mushrooms 3 times a year the total yield mushrooms in quintal per annum reach 3,888.00.

And if 75% of the total trainees enter into mushroom production and marketing business, and if these 400 trained youths produce mushrooms 3 times a year the total yield mushrooms in quintal per annum reach 2,592.00.

And if 50% of the total trainees enter into mushroom production and marketing business, and if these 300 trained youths produce mushrooms 3 times a year the total yield mushrooms in quintal per annum reach 1,944.00.

Hence, if the project could attain its objectives it contributes for increased food production and diversification, and reduced malnutrition in the region and the country as a whole. Because of this the project contributes for improvement of the GDP of the country.

5.2.2. Unemployment Reduced and Income of Trainees Increased

Similarly the annual income of these youths will increase as it is charted below.

Table 4 Estimated income of trainees

Description	Quantity	Annual yield in qtl	Price/qrtl in Birr	Total income in Birr	Individual income per annum
If all 600 youths enter into production	600	3888	3500	13,608,000.00	22,680.00
If 75% of trainees enter into production	400	2592	3500	9,072,000.00	22,680.00
If 50% of trainees enter into production	300	1944	3500	6,804,000.00	22,680.00
If 25% of trainees enter into production	150	972	3500	3,402,000.00	22,680.00

If all of the trainees enter into the mushroom business the income of youth will increase by Birr 13,608,000.00 per annum. Even by more pessimistic thinking if 25% of the total trainees enter into mushroom business the income of youth will increase by Birr 3.4 million.

In this way it is possible to reduce unemployment rate in the region and also create additional income for those who will be engaged as par-time business.

5.2.3. Provides Market Opportunities for Local Materials

The great value in promoting the cultivation of mushrooms lies in their ability to grow on cheap carbohydrate materials and to transform various waste materials, which are inedible by man into a highly valued food protein for direct human consumption. This is extremely important in the rural areas where there is enormous quantity of wastes that have been found to be ideal as growing substrates for mushrooms. Thus production of mushrooms creates market opportunities for locally produced agricultural materials and wastes.

Moreover, promoting the cultivation of mushrooms in the region will result in increased credit transaction and tax payments for the banks and the government, respectively.

5.2.4. Serves as an Import Substitution Item

Presently, most of mushrooms used as condiments and flavoring items in most of the country's hotels, restaurants, and cafes are canned mushrooms imported from abroad by the use of hard gained foreign currency. Thus, promotion of the development of the mushroom industry in the country helps to reduce the importation of canned mushrooms their by substituting the once imported item by locally produced item.

5.2.5. Increased Foreign Currency Sources

The production of mushrooms in excess leads to the establishment of mushroom processing industries, in order to preserve the produce for longer time and to better arrange the produce for long haul transportation. The mushrooms that are properly processed and canned can be exported and be a source of foreign currency.

5.2.6. Be Exemplar for the Development of Similar Agricultural Endeavors.

5.3. BENEFICIARIES OF THE TRAINING PACKAGE

- ❖ The unemployed urban and rural youths of the Amhara Region in general;
- ❖ The employed urban and rural dwellers having interest to run mushroom production as a par-time business;
- ❖ The rural poor and marginalized farmers of the Amhara Region;
- ❖ Hotels, restaurants, and cafeteria service providers of the Region;
- ❖ The government, banks, and other institutions; and
- ❖ The country at large.

5.4. CONCLUSION

Promotion of small scale mushroom production in the Amhara Region increases food production (availability of food), increases the income of producers (access to basic needs), and reduces malnutrition for consumers (increased food utilization). Thus, we can conclude that small scale mushroom production is one of contributing factors to our food security efforts in the Amhara Region.

5.5. RECOMMENDATION

Let us work together for the betterment of our people!!!

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