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# Organic Farming of Vegetables and Fruits in Nepal: A Cost Benefit Analysis

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*Abstract*

*The importance of organic farming has been lately realized in the developing parts of the world as one of the vital tools to mitigate the adverse impact of the climate change. Environmental degradation and health problems brought in by the use of chemical fertilizers and pesticides in farming have been the concern of all today. The case studies of three organic products: Shiitake Mushroom, Sugar Beet and Kiwi at Aashapuri Organic Farm of Kavrepalanchok district of Nepal are performed to assess their commercial viability. An attempt is made to recommend the state as well as poor farmers to take up these products as a sustainable alternative to the farming of traditional crops if found profitable. Basically, standard Cost Benefit Analysis techniques such as Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) are used for this purpose. The Financial Analysis suggests that each of these products possess high commercial viability. Almost all the parameters of Cost benefit Analysis showed significant positive results. BCR is the highest in the case of Kiwi followed by Shiitake Mushroom and Sugar Beet. However, the study recommends poor farmers to undertake Shiitake Mushroom farming due to the fact that the project takes very little space and cost with returns within short period of time. Sensitivity Analysis is also performed to assess the viability under alternative worse situations. It also indicated the desirability of the products under different scenarios.*

## Introduction

Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, growth regulators and livestock feed additives. To the maximum extent feasible organic farming rely on crop rotations, crop residues, animal manures, legumes, green manures, off farm organic wastes and aspects of biological pest

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control to maintain soil productivity and tilt to supply plant nutrients and to control insect pests diseases and weeds (Lampkin, 1990). Organic farming is an environmental friendly ecological production system that promotes and enhances biodiversity, biological cycles and biological activities. It ensures production of healthy and nutritious food year after year without environmental degradation. The primary goal of organic farming is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people (Dahama, 2002).

Given the available natural resources of Nepal, agriculture is the strong basis to alleviate poverty through sustainable economic development and strong rural economy. Unless there is a departure from the low use of technology by its extensive use to raise productivity per unit and be competitive in the production aspect, agricultural development cannot be accelerated (NPC, 2002). More than two-thirds of the population depends in agricultural sector. Reducing poverty through income and employment generation is the focus of different development plans. It is supported by implementing different project and activities in agricultural sectors. There is interlinking between agricultural farming and environment (Dhakal, 2007). Sharma (2001) makes a case for organic farming as the most widely recognized alternative farming system for sustainable production without seriously harming the environment and ecology. Veeresh (1999) opines that both high technology and sustainable environment cannot go together.

In developing countries, the growth of organic sector is quite slow and faces tremendous challenges. Nepal's organic agricultural production has a relatively short history. Adoption of organic farming is quite slow, market for organic products is not well developed and no market statistics are available in Nepal (Bhatta *et al.*, 2008). A systematic approach to promote Organic farming was started in 1986 after establishment of Institute for Sustainable Agriculture Nepal (INSAN). Commercial organic farming in Nepal was initiated in 1987 by Judith Chase, an American woman. She started organic farming in *Gamcha* Village of Bhaktapur under the name of Appropriate Agricultural Alternatives (AAA).[1]

Organic Farming is gaining momentum for its ecological importance and economical opportunities. The common practices adopted by the organic growers are crop rotation, natural pest management and using bio-fertilizers and organic manures mainly farmyard manure, vermi-compost and green manure in soil fertility management. The major organic products grown in Nepal and available in the market are tea, coffee, large cardamom, ginger, fresh-vegetables, honey and herbal products. However, data related to area coverage, production, certification procedures and market situation of the commodities are extremely limited (Pokhrel and Pant, 2009). The number of organic farms in Nepal is 1,247 and the area under organic management is 1000 ha. If the area under traditional farming where farmers never used fertilizers and pesticides is considered, the area under organic farming should be much higher (Yussefi, 2006).

There are several challenging issues to be resolved both on theoretical and practical grounds for promoting organic farming in Nepal. The major being setting up own norms

[1] See: http://www.ecs.com.np/archive/may_03/article_5.htm

and standards for individual products, developing product guarantee and certification mechanism and awareness building to state agencies, organic producers, traders, consumers and other stakeholders (Pant, 2006). Ranabhat (2007) identifies various constraints in developing organic agriculture in Nepal. They are production constraints, policy constraints, marketing constraints and several other constraints such as lack of research and awareness on organic products, problems of coordination among different organizations etc (Table 1).

**Table 1: Key Constraints of Organic Agriculture Development in Nepal**

| Constraints | Description |
|---|---|
| **Production Constraints** | • Lack of appropriate and adaptive technology<br>• Lack of promotional incentives to the farmers<br>• Lack of efficient alternatives for the management of soil plant nutrients and pests<br>• Organic conversion period takes longer time which is risky for small farmers |
| **Policy Constraints** | • Clear and supportive Organic Agriculture policy (including standard and certification body) has not yet been formulated<br>• Lack of incentive mechanisms for supporting organic agriculture at operational level |
| **Marketing Constraints** | • Non availability of market information and no storage facilities<br>• Too many administrative hurdles to get final clearance for export outside |
| **Other Constraints** | • Limited research and convincing information on how organic farming contributes to sustainable agriculture development<br>• Less awareness about organic products in the city area<br>• Lack of information and effective co-ordination among the different organizations and professionals<br>• Inspection and certification process is expensive |

*Source:* Ranabhat, 2007.

Though institutions of organic farming are weak, they are gaining momentum. Organic Agriculture has maintained its pace of development and recognition. Many actors viz., Government Organizations (GOs), Non Government Organizations (NGOs), private sector and farmers are involved in different activities in its promotion and consolidation. The problems of mass poverty and unemployment can be significantly addressed if people resort to commercial organic farming in a large scale. This may also be a relief to local farmers as they can avoid rising prices of chemical fertilizers and pesticides and use local resources and labour in farming.

This article basically presents a Cost Benefit Analysis of three organic products i.e. Shiitake Mushroom, Sugar Beet and Kiwi to assess their commercial viability in the context of Nepal. It also intends to recommend adopting these products as a viable option to sustainable agriculture when found profitable.

## Data and Methodology

Both primary and secondary source were utilized in collecting the data. A field visit was undertaken at *Aashapuri* Organic Farm of *Kavrepalanchok* district of Nepal to collect primary data. Direct interview was conducted with the key informants especially the manager and the staff members of the farm. The details of the socio-economic condition of the locality along with the description of the farm area were collected from the informants. Besides, they also provided us with the details of the benefits and costs of the respective products undertaken for the case studies. Observation of the field was made to cross examine the validity of the respondent's answers.

Secondary data were collected from various governmental and non governmental organizations dealing with organic farming especially Ministry of Agriculture and Cooperatives/Government of Nepal (MOAC/GON), Nepal Agricultural Research Council (NARC), Organic Certification Nepal (OCN) etc. Various reports, magazines, newspaper, books and journals are referred to collect information on the history and practices of organic farming in Nepal and abroad. Internet surfing has been one of the important tools to collect secondary data in this study.

Financial Analysis is conducted in the study to analyze the data collected. The analysis makes the use of the standard cost benefit techniques to identify the project viability i.e. Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR). Sensitivity Analysis is also conducted to test the viability of the project under various uncertain situations. Both supply side and demand side uncertainties may appear during the project life. Supply side uncertainties may be in the form of political upheaval, change in weather conditions, difficulties in the adoption of modern technology, peoples' claim over ownership of locally available resources, government rules and regulations etc. Demand side uncertainties may include abrupt changes in prices from the competition, changes in demand of the organic products and unpredictable nature of the behavior of competitors.

### *Aashapuri* Organic Farm: An Introduction

*Aashapuri* Organic farm lies in *Sanga* Village Development Committee (VDC) of *Kavrepalanchok* district. *Sanga* VDC has a total population of 4,801 of which the proportion of male and female are approximately 50 percent each. Majority of the population belong to *Newar* (39%) and *Tamang* (28%) caste[2]. There are altogether 665 households in the VDC with land ownership of less than 0.5 hectares (National Labour Academy and *Sanga* VDC, 2000). *Aashapuri* organic farm lies 5 km south of the *Arniko* highway. It was established in 1980 at *Dadhikot* in *Bhaktapur* district. Later, the farm was shifted to *Kavrepalanchok* district in 1986. Initially, it started with paddy production with the technical and financial support of German Technical Cooperation (GTZ) that continued only for three years due to low production and declining profits. Then it started producing varieties of organic products especially vegetables and fruits from the last five years like broccoli, spinach, broses spout, shiitake Mushroom, sugar beet among others (Table 2).

The farm is spread in 10 hectares but only about 1.25 hectares are utilized for the farm purpose. The farm is on lease for 10 years with the renewal after every three years.

**Table 2: Vegetables, Fruits and the Area Covered by *Aashapuri* Organic Farm**

| Vegetables & Fruits | Area (in hectares) |
|---|---|
| Sugar beet | 0.3 |
| Carrot seed | 0.05 |
| Korean onion | 0.05 |
| Mushroom | 100 sq. m (4 houses) |
| Spinach *(Palungo)* | 0.05 |
| Selari (like *dhaniya)* | 0.0125 |
| Faba Bean | 0.075 |
| Swiss chard(*Desi Palak*) | 0.075 |
| Cauliflower | 0.2 |
| Kiwi | 0.05 (60 plants) |
| Asparagus *(Kurilo)* | 0.05 |
| Sweet Potato | 0.05 |
| Ground Apple | 0.075 |
| Gourd | 0.05 |
| Pumpkin | 0.25 |

*Source:* Field Survey and *Aashapuri* Farm Records, 2009.

[2] The Newar are the indigenous people of Kathmandu Valley. They are a linguistic community with Tibeto-Burman and Indo ethnicity/race, bound together by a common language. (See: http://en.wikipedia.org/wiki/Newar). The Tamang (also known as Murmi) are one of the several ethnic groups from north central hilly region of Nepal. (See:http://en.wikipedia.org/wiki/Tamang )

It is a private partnership farm owned by two entrepreneurs from Kathmandu district. They have recruited 16 staff members both skilled and unskilled. Most of them are seasonal and local workers and do not specialize in any particular type of vegetable or fruit and have no formal training. They have to look after the whole farm and they believe in 'learning by doing'. For technical support, technicians from within and outside the country visit the farm frequently. The staff members receive salary on a monthly basis.

## Organic Products under Consideration

### *Shiitake Mushroom* (*Lentinus edodes*)

The oriental mushroom Shiitake has been cultivated since 2000 years in China and Japan. Cultivation of this crop and its technology must be a very ancient art (Aryal, 2008). The first written record of shiitake cultivation can be traced to Wu Sang Kwuang, during the Song Dynasty (960–1127 AD). However, some documents record the uncultivated mushroom being eaten as early as 199 AD.[3]

It is grown commercially in major parts of the world including Japan, USA, Korea, China, and other parts of the Asia. There are many methods of mushroom cultivation but bag cultivation, bottle cultivation, log cultivation and shelf cultivation are usually common. Rice straw, wheat straw, sugarcane waste, banana leaves, grass and sawdust are the major fibrous ingredients important for mushroom cultivation substrates (Imtiaj and Rahman, 2008). However, shiitake mushroom is commercially grown by drilling holes in cut wood, inoculating with shiitake spawn, incubating the logs until they are colonized and then harvesting during the spring and autumn rainy seasons.

The market for shiitake mushroom is growing. It can represent a supplement income source to the landowner with low initial costs compared to other food enterprises. A low quality hardwood including waste log and waste land can be utilized with no additional cost. Three to four crops of shiitake mushroom can be cultivated in a year which makes it more profitable than that of either rice or wheat.

Shiitakes are low in fat, high in protein, vitamins, and minerals. Fresh and dried shiitake mushrooms are used nutritionally to fight cancer, fibrocystic breast disease, high blood pressure and viruses, to strengthen the immune system, improve circulation and reduce cholesterol. It may be considered as a pool of nutrients and also popularly called "Vegetable Meat".

The history of mushroom cultivation is not so long in Nepal. Mushroom cultivation was initiated by the Division of Plant Pathology, Nepal Agricultural Research Council (NARC) in 1974. Button mushroom (*Agaricus bisporus*) and Oyster mushroom (*Pleorotus spp.)* were introduced and extended to farmers during the period of 1970s and 1980s. Later in 2001, the Centre for Agricultural Technology (CAT) introduced straw mushroom (*Volvoriella volvacea*) cultivation in the Terai districts and shiitake in the hill (Manadhar,

[3] See: http://en.wikipedia.org/wiki/Shiitake

2004, Aryal, 2008). The Directorate of Industrial Entomology Development (DOIED) has the main responsibility of formulating policies, norms, monitoring and supervision of mushroom development programmes in Nepal. The programmes are implemented through the District Agriculture Development Offices (DADO). Many local entrepreneurs in various parts of the country have commenced the commercial farming of mushroom in Nepal. Basically, Shiitake mushroom is produced in some specific farms including *Aashapuri*. Shiitake Mushroom in *Aasapuri* farm is cultivated in the area of about 100 square meters divided into four sheds of same area and size of 25 square meters each.

*Sugar Beet* (*Beta vulgaris L.*)

Sugar beet is a member of the *Chenopodiaceae* family. Although it has been grown as vegetables and for fodder since antiquity, its use as a sugar crop is relatively recent. The sugar beet industry in Europe rapidly developed after the Napoleonic Wars. By the end of the wars, over 300 sugar beet mills operated in France and central Europe. The first sugar beet mill in the U.S. opened in 1838, and the first commercially successful mill was established by E. H. Dyer in 1879. The European Union, the United States, and Russia are the world's three largest sugar beet producers, although only the European Union and Ukraine are significant exporters of sugar from beets. The U.S. harvested 1,004,600 acres of sugar beets in 2008 alone. Sebewaing, Michigan is known as the sugar beet capital of the world.[4]. Besides, it is also commercially produced in major parts of the world including France, Germany, Turkey, Czechoslovakia, Syria, Iran, Iraq, Algeria, Israel, Pakistan and other 14 countries. Beet sugar accounts for 45 percent of the world's sugar production, 10 percent of the bio fuel (ethanol building) production and about INR 100 billions of foreign exchange saving per year *(See: http://www.tnau.ac.in/tech/swc/sugarbeet.pdf)*.

Sugar beet is largely useful for medicinal as well as industrial purpose thus adding large value to the local and national economy if exploited in a large scale. It is found to be good for liver, blood purification, urine purification etc. It contains heavy iron and thus is more useful for women in menstruation. However, it turns urine and stool red in color. It is also used in the production of beverages, syrup, betaine, uridine etc.

In Nepal, the history of sugar beet farming is not long. A local entrepreneur at *Dhalkebar* in *Dhanusa* district is believed to start the commercial farming of sugar beet in Nepal. Sugar beet is cultivated in 0.3 hectares in *Aasapuri* farm, the largest area covered of all the vegetables. It has been two years that sugar beet cultivation was started in the farm. Initially, its seed was brought from *Sultan*, Punjab in India. Basically, it grows in a tropical climate and hence *Terai* in Nepal is suitable for its production. It is mainly produced in *Dhalkebar* of Dhanusa district in Nepal besides *Aashapuri*.

[4] See: http://en.wikipedia.org/wiki/Sugar_beet

***Kiwi Fruit*** *( Actinidia Deilciosa)*

Although Kiwi fruit (formerly known as the Chinese gooseberry) is associated with New Zealand, it actually originated in the Chang Kiang Valley of China. The kiwi fruit arrived first in 1904 in the United States and later in 1906 found its way to New Zealand. Yet it was the New Zealanders who recognized the potential of this succulent fruit and began cultivating it for commercial profit. Due to novella cuisine movement of the 70's, the kiwi fruit gained great popularity in the USA.[5]

As of 2007, the leading producers of kiwi fruit are, in order: Italy, New Zealand, Chile, France, Greece, Japan and the USA. Kiwi fruits are also cultivated in China, albeit in smaller amounts, in the regions of the mountainous Yangtze River and Sichuan[6]. Kiwi berries are one of the most exciting new fruits to come into the product market in years.

Hurst's kiwi berries are rich in vitamin C and naturally low in fat, cholesterol and sodium. They are also high in fiber and a great source of potassium, vitamin E and magnesium. It is beneficial for asthma patients, prevents wheezing and coughing especially in children, protects our deoxyribonucleic acid (DNA) from mutations and helps prevent colon cancer. Moreover, it is also helpful in reducing the risk of developing an eye-related disease called ARMD (the primary cause of vision impairment in adults).[7]

Japan Agricultural In-service Training Institute (JAITI) Nepal introduced Kiwi fruit cultivation in Nepal in 1989 at *Kaulethana* area of *Kakani* VDC of Nuwakot district. However, the commercial cultivation started only after six years in 1995. JAITI Nepal also provided employment to local people as in-service trainees[8]. This actually formed genesis of Kiwi fruit cultivation in Nepal. Majority of the people so employed today have their own farms cultivating various crops of different varieties along with Kiwi fruit.[9]

*Aashapuri* Organic Farm has recently initiated Kiwi fruit cultivation in an area of about 0.05 hectares with 60 plants. Besides, Vaconet Pvt. Ltd. has also started Kiwi farming in Makawanpur after its two years of research on Nepali Kiwi (EDN, 2007). There is also a Kiwi farm in Phalung Valley which is one of the "Orchid hotspots" among the few areas of Nepal. The farm was basically supported by the Global Environment Facility (GEF) Small Grants Programme.[10]

**Assumptions**

Following assumptions are made to conduct cost benefit analysis in the study.

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[5] See: http://homecooking.about.com/od/foodhistory/a/kiwihistory.htm

[6] See: http://kiwi-fruit.info/kiwi-fruit/History+of+Kiwi+Fruit

[7] See: http://kiwi-fruit.info/kiwi-fruit/Health+Benefits+of+Kiwi+Fruit

[8] In-service trainees are those who are paid the local wages during the training period.

[9] See: http://www.jaiti.org/modules/tinycontent5/index.php?id=6)

[10] See:http://sgp.undp.org/web/projects/8984/conversation_of_endangered_orchids_and_cultivation_of_hybrid_orchids_through_partcipatory_approach_html

1. The project life of shiitake mushroom is assumed to be 3 years. The calculation is based on 1 cycle. Each cycle completes in 3 years. The project life of sugar beet and Kiwi is assumed to be 5 years. However, the yield in case of sugar beet occurs every three months i.e. 4 times in a year and Kiwi starts bearing fruit only after 3 years. So benefit is taken into account only from the fourth year. The same applies to the cost of transportation which incurs once the kiwi plants start bearing fruit.
2. The capital cost is assumed to incur at the very beginning of the first year and variable cost at the end of each year in all the cases. The terms and conditions with landlord stipulate 10 percent increment in lease amount every three years. However, this increment in lease amount of land has not been considered in the analysis. It is presumed that the increment is very small to affect the outcome of our analysis. In the case of shiitake mushroom, the cost of land is included in the cost of shed.
3. The cost benefit analysis calculation of shiitake is based on one shed (1000 logs) and sugar beet and kiwi on 0.05 hectares each.
4. The discount rate is assumed to be 17 percent. This is based on the borrowing rate prevalent in the local market.

**Estimation of Values for Cost Benefit Parameter**

The cost benefit parameters used in the study are computed along the following lines.

The ***Net Present Value (NPV)*** is a measure of the absolute value of the discounted net benefits of a project. Following formula is utilized to compute NPV of the products under study.

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

where $B_t$ is the value of project benefits in Year t;
$C_t$ is the value of project costs in Year t;
r is the rate of discount; and
n is the number of years in the project life.

The NPV is obtained by multiplying the net benefit in each year by the appropriate discount rate (in our case 17%) and summing the values.

The ***Benefit Cost Ratio(BCR)*** is the ratio of discounted benefits to discounted costs. Following formula is utilized to compute BCR of the products under study.

$$BCR = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

where $B_t$, $C_t$, r and n are as defined above.

The ***Internal Rate of Return (IRR)*** is defined as the rate of discount at which the present value of benefits is equal to the present value of costs i.e. the rate of discount at which NPV is zero. Thus IRR = r where

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} = 0$$

The IRR is estimated by iteration. It is necessary to estimate the NPV for the project at a number of different discount rates. When two values for the NPV are found, one of which is positive and the other negative, at discount rates that are reasonable close together, the IRR is estimated either graphically or formula

$$IRR = r_1 + \left( \frac{(r_2 - r_1) * NPV_1}{(NPV_1 - NPV_2)} \right)$$

where $r_1$ and $r_2$ are the lowest and the highest discount rates respectively;

$NPV_1$ and $NPV_2$ are the values for the NPV at the discount rates $r_1$ and $r_2$.

While NPV gives an absolute measure of benefits, i.e., so many rupees, BCR gives a measure of benefits per rupee of investment. IRR on the other hand, shows the capacity of the project to generate benefits given costs, expected returns and the life-span of the project. The NPV should be positive in order to accept the project. The higher the NPV, the better the project is. If BCR is greater than one, then the project is acceptable. If the IRR is greater than market rate of interest or social discount rate or social opportunity cost, the project will be selected ( Pitale, 1982 and Potts, 2005).

## Results and Discussions

### *Financial Analysis*

Financial Analysis deals with the commercial profitability of the project. Net present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) are computed to find out the commercial viability of the project. Finally, sensitivity analysis is done to check its viability in alternative worse situations.

Taking into consideration the above assumptions of respective organic products and the streams of their costs and benefits, following results are obtained:

**Table 3: NPV, BCR and IRR of Shiitake Mushroom, Sugar Beet and Kiwi**

| | Financial Analysis | | |
|---|---|---|---|
| **Organic Products** | **NPV (in Rs. Millions)** | **BCR** | **IRR in %** |
| Shiitake Mushroom (25 sq. m) | 1.12 | 6.53 | 602 |
| Sugar beet (0.05 hectares) | 0.58 | 3.00 | 2580 |
| Kiwi ( 0.05 hectares) | 1.69 | 6.91 | 100 |

*Source:* Based on Authors' calculation.

The cost benefit analysis of all the three products namely Shiitake mushroom, Sugar beet and Kiwi indicates the high commercial viability of those products. These products have a positive NPV of Rs. 1.12 millions, Rs. 0.58 millions and Rs. 1.69 millions respectively. The BCR are 6.53, 3.00 and 6.91 respectively. IRR in all the three cases are either greater than or equal to 100 percent much higher than the given discount rate of 17 percent. In all the cases, the benefit per rupee of investment is greater than Rs. one (Table 3).

*Sensitivity Analysis*

Sensitivity Analysis takes into considerations following three alternative scenarios for Shiitake Mushroom. An extreme adverse case of 50 percent increase in variable cost and the same percentage fall in benefits are assumed since the cost benefit analysis results report that the viability is large enough to offset even if the costs are doubled or benefits halved. Also the current price trend of fruits and vegetables in the Nepalese market is highly unpredictable with larger variability.

Scenario I: The stream of variable cost increases by 50 percent

Scenario II: The stream of benefits decreases by 50 percent

Scenario III: The stream of variable cost rises by 50 percent and the stream of benefits fall by 50 percent

**Table 4: Results of Sensitivity Analysis**

| Sensitivity Analysis | Scenario I | | | Scenario II | | | Scenario III | | |
|---|---|---|---|---|---|---|---|---|---|
| | Shiitake Mushroom | Sugar Beet | Kiwi | Shiitake Mushroom | Sugar Beet | Kiwi | Shiitake Mushroom | Sugar Beet | Kiwi |
| **NPV (in Rs. millions)** | 1.06 | 0.44 | 1.57 | 0.46 | 0.14 | 0.71 | 0.39 | 0.004 | 0.58 |
| **BCR** | 4.96 | 2.02 | 4.84 | 3.26 | 1.50 | 3.58 | 2.48 | 1 | 2.42 |
| **IRR (%)** | 569 | 1954 | 84 | 258 | 656 | 62 | 224 | 23 | 45 |

*Source:* Based on Authors' calculation.

The sensitivity analysis also suggests that all the three products are viable even under worst cases when either costs or benefits or both are adversely affected. The NPV is positive in all three alternative scenarios. The BCR in all the three cases indicates the relative benefits exceeding one as compared to the costs except the sugar beet in the third scenario where it is equal to one. BCR in this scenario for other two products are: 2.48 for Shiitake mushroom and 2.42 for Kiwi. IRR gives highly significant results. Hence, almost all the instruments are highly positive suggesting the worthiness of the project (Table 4).

The comparative CBA result shows that Kiwi is highly viable under NPV criterion though it bears fruit only after few years of its plantation and entails high initial investment. Moreover, BCR result in the case of Kiwi also shows that the benefit per rupee of investment is higher than Shiitake Mushroom. This is due to the fact that the quantity of production per plant is the highest in this case and the market price of this product is also reasonably high. The respondent reported that under better climatic conditions as well as better care, each Kiwi plant can bear as much as 200 kilograms of kiwifruit. Shiitake Mushroom and Sugar beet are also commercially viable both under NPV and BCR criterion. However, the variable cost is higher and benefits are lower in case of Sugar Beet. Therefore, BCR is the lowest of all in this case. Thus it can be said that Kiwi and Shiitake Mushroom yields reasonably higher benefit per rupee of investment. IRR of all these products are unquestionably significant. This is also true under various alternative worse scenarios that have been assumed in the study.

### Measures to Promote Organic Farming

An organic farming practice in Nepal is a recent phenomenon. It has greater prospects in the context of Nepal where large number of people is based in agriculture. Organic farming can be an emerging source of livelihood for the people.

A frame up of organic agriculture development policy that supports organic farmers especially poor with subsidies is a must. Besides implementation of organic standards and certification programs to promote the standard of Nepalese organic products is also a must to accredit its quality and ensure its sustainable demand in the international market. This can be met by establishing institutions such as National Accreditation Body to maintain and enforce organic standards and organic certifiers as per the National Standards of Organic Agriculture Production and Processing.

There is also a lack of adequate investment in the organic agriculture as compared to conventional and biotechnological approaches to agriculture. The major cause may be an inadequate research input into organics that requires more diffused, farm based and participatory approach drawing on local knowledge and tradition. Moreover, difficulties in patenting the resources and techniques utilized in organic farming further substantiate the problem. This explains why governments need to be a pioneer investor that will attract private sector when adequate policies and infrastructure are in place. There is also a need to separate organic production zones based on commodity and location so as to encourage producers and ensure marketing mechanisms. It is, therefore, a must to identify the priority

programs to be implemented including research, development, coordination and capacity building.

Many farmers are still unaware of the economic and environmental benefits of the organic farming practices, the proper balance in the ecosystem it helps to maintain and the series of health benefits that would follow from it. The seemingly profitable conventional farming may be rendered unviable on social grounds. Government has to come forth with the provision of economic incentives such as tax exemptions and subsidies as well as an awareness program to induce private growers to invest in organic farming. Effective participation between the government and private sector may help promote and utilize local skill and resources, development of cooperatives and information system to access information regarding market opportunities.

There is also a need to undertake intensive Strength, Weakness, Opportunities and Threats (SWOT) analysis of Nepalese organic sector to assess the current situation of this sector and bring clear cut policies and programs to make it commercially viable.

## Conclusion

The investment in Kiwi fruit may be suitable for the farmers with an entrepreneurial ability to manage adequate initial cost of capital and longer pay back period. Howeve,r this may not be possible for poor farmers to initiate this project due to the requirements of high initial set up cost, larger spaces and longer pay back period. It is, therefore, recommended that the poor farmers take up Shiitake Mushroom for farming which stands to be the second best alternative in our study after Kiwi fruit. The mushroom cultivation tends to stand highly profitable even the input costs are doubled with the requirement of little space and cost with consistent returns over a short period of time. The state can play a crucial role in promoting Organic farming of Shiitake Mushroom cultivation to generate employment and thereby help reducing poverty. This will also ensure healthy and clean environment to live in.

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