# Cost and return analysis of organic potato in Gasa District, Bhutan

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**Abstract:** Gasa District became the first district in Bhutan to fully embrace organic farming in 2004. The Government has been assertive to increase farmers' household earnings and alleviate poverty. Therefore, the study's objectives were to examine the cost and return analysis of organic potatoes (*Solanum tuberosom* L.) in the Gasa District. Purposive sampling was employed to select 43 organic potato farmers from Goenkhatoe *Gewog* (a group of villages in Bhutan) in the Gasa District. Primary data for the 2019 production and marketing cycle were gathered from September to October 2020, using a semi-structured questionnaire through face-to-face interviews. Descriptive statistics and cost-and-return analysis were used to analyze the data. According to the findings, the total production cost was 339,462.80 Ngultrum per hectare (Nu/ha) (1Nu=0.014 USD). The total variable cost was 338,211.89 Nu/ha, and the total fixed cost was 2,559.28 Nu/ha, comprising 99.63% and 0.75% of the total production cost, respectively. Within the variable costs, the total input cost was 142,427.99 Nu/ha, and the total labour cost was 195,783.89 Nu/ha, which made up 41.96% and 57.67% of the total production cost, respectively. The depreciation cost was the highest contributor within the fixed costs with 2,528.75 Nu/ha, comprising meagre 0.74% of the total production cost. The average yield of potato tuber was 7.48 metric tons per hectare (MT/ha). The average Gross margin (profit) was -202,708.47 Nu/ha. The break-even yield and price were 18.63 MT/ha and 45.58 Nu/ha, respectively. The benefit-cost ratio (B:C ratio) was 0.40, and Return on Investment (ROI) stood at -59.71. The Gross margin over cash and variable cost were 1,082.43 and -201,457.56 Nu/ha, respectively. Considering the lesser B:C ratio (<1), it indicated that organic potato farming is not a profitable venture in the current situation. For a profitable venture, the farmers either need to increase their yield or obtain a farm-gate price greater than the respective break-evens.

**Keywords:** farm household income; farm-gate price; potato production; production cost; profit.

## Introduction

Organic farming is viewed as a means of increasing the sustainability of agriculture (Feuerbacher *et al.*, 2018). Additionally, many studies have shown that organic farming is profitable (Adhikari, 2011, Mendoza, 2004, Suwanmaneepong *et al.*, 2020). In 2019, organic farming accounted for 1.5% of total farmland worldwide, equivalent to 72.3 million hectares (ha). There were 3.1 million organic producers worldwide. Organic activities were conducted in 187 countries, with the organic market estimated at 106.4 billion euros. The per capita consumption of organic commodities was 14.0 euros (IFOAM, 2020).

In the wake of the global movement towards organic farming, Gasa District, one of Bhutan's 20 districts located in the West-Central part of the country, became a fully organic district in 2004 (Wangmo and Iwai, 2018). Bhutan is a tiny mountainous nation on the Himalayan southeast slope (D'Avanzo, 2008), and it has an ambitious goal to be a completely organic country in the globe (Department of Agriculture [DoA], 2006). Agriculture is a vital primary sector in Bhutan, providing livelihood and jobs to 43.9% of the population (Population & Housing Census of Bhutan [PHCB], 2017). Rice, maize, mandarin, apple, potato, and other vegetables, cardamom, and other spices are among the important crops grown in the country. Bhutan has largely

smallholder farmers primarily involved in subsistence farming (National Statistical Bureau [NSB], 2017). After rice, maize, and wheat, the potato is the fourth most important crop in terms of calories. According to Bajgai (2018), the potato is one of Bhutan's most commonly grown, consumed, and traded horticultural crops, owing to favourable agro-ecological conditions. About 22% of the country's rural households cultivate it as a non-cereal crop, cash crop, and vegetable. Potato is a cash crop in Bhutan; it is primarily grown using conventional farming practices such as agrochemicals and mineral fertilizers (Lhamo, 2019). In the country, the total potato production in 2019 was 43,560 metric tonnes (MT), with a total area of 4,187 ha and average national yield of 10.40 MT/ha (Ministry of Agriculture and Forests (MoAF), 2020). Around 0.5%, equivalent to 20.34 ha of the country's total potato area, is certified organic. The certified potatoes are grown in the Gasa District, certified by a reliable Bhutanese government institution (Agriculture Research & Development Centre (ARDC)-Yusipang, 2019). The Bhutan Organic Standards is complied with by certified organic potato farmers.

Among others, poverty alleviation, increasing farm household income and job opportunities are vital priorities for the Royal Government of Bhutan (RGoB) (Ghimiray *et al.*, 2019). The Goenkhatoe *Gewog,* a research area for the study within Gasa District, has been producing certified organic potatoes since 2016 (Department of Agricultural Marketing and Cooperatives [DAMC] & DAS Gasa, 2016). However, there are no studies on the cost and return analysis of organic potatoes in Bhutan, especially in the Gasa District. Therefore, the study's objectives were to investigate the cost and return analysis (CRA) of organic potato farming and socio-demographic characteristics of the farmers in Bhutan's first and only organic district, Gasa. The CRA is a type of economic evaluation that considers both implicit and explicit farm expenditures (Ciaian *et al.*, 2013, Netayarak P, 2007). Actual expenses are classified as Explicit costs, but Imputed or Implied costs are classified as Implicit costs since they are unrelated to actual expenditure payments (Ciaian*, et al.*, 2013). In addition, a profitability performance metric indicates how effectively the farmer's resources are used to create revenue and profit (Kahan, 2010). Therefore, the application of economic indicators will be vital to measure the farm household income generated through organic potato farming.

Considering the country’s vision to be an organic state and the priorities of the RGoB, this study will help to understand the extent of farm household income generation from organic potato farming in the Gasa District and the country. Such empirical data are expected to help policymakers, obtain additional backing from agriculture officials and researchers, and assist farmers in making decisions about choosing a better potato farming system in Bhutan and around the globe. In addition, academicians and students will find it helpful in understanding field situations.

## Materials and methods

### *Study area*

The Gasa District, the first and only organic district in Bhutan, was chosen for the study. It is one of Bhutan's 20 districts located in the West-Central part of the country (ARDC-Bajo, 2020). With just 3,952 residents, Gasa is the country's least populated district, accounting for only 0.5% of the total population (Population & Housing Census of Bhutan [PHCB], 2017). The district's average annual temperature is 10°C, with a maximum of 15°C and a minimum of 6°C. It has a variety of climates, from temperate to alpine (NSB, 2011). It has around 30 ha under the total potato area with production of about 185 MT/year (MoAF, 2020).

Goenkhatoe *Gewog* (a group of villages in Bhutan) was purposively opted as a research site within Gasa District. The altitude in Goenkhatoe *Gewog* varies between 2,100 and 2,800 meters above mean sea level. The annual rainfall in the *Gewog* is approximately 2,241 millimetres (mm) (NSB, 2011). The National Soil Service Centre (NSSC), Thimphu, identified loamy and silty clay loam soil textures in the *Gewog* in 2020. Fig. 1. depicts the study area in Bhutan.


**Figure 1.** The study region is depicted on a map of Bhutan (encircled). Source: wikipedia.org/wiki/Districts of Bhutan, accessed 22/03/21.

### *Sampling procedure*

The study sample was determined using a technique of purposive sampling. The Gasa District was selected for the organic potato evaluation because its local Government proclaimed it to be the first completely organic district since 2004 (Wangmo and Iwai, 2018). Goenkhatoe *Gewog*, one of four *Gewog*s in the district, was purposefully chosen for the study due to the availability of certified organic potato farmers. Purposive sampling is ideally suited to a small population with well-understood characteristics (Kothari, 2004). Forty-three organic farmers were chosen for the study. *Gasa Rangshin Sonam Detshen* is the organic farmers' group in the *Gewog*

that cultivates organic potatoes and other crops. The group has been producing organic potatoes since 2016. Bhutan Agriculture and Food Regulatory Authority (BAFRA) has certified the group (Department of Agricultural Marketing and Cooperatives [DAMC] & DAS Gasa, 2016). Potatoes are the *Gewog*'s main cash-generating crop, but they also cultivate garlic, carrots, wheat, buckwheat, and barley.

***Data collection***

The information was randomly gathered from 43 organic potato farmers spread out across 17 villages in Goenkhatoe *Gewog*, Gasa District. Data was taken during September and October 2020. Face-to-face, individual farmer interviews were used to collect primary data. In addition, the head of the family or any family member actively involved in organic farming was interviewed during the individual farmer's interview. To collect data from farmers, a semi-structured questionnaire was used. It was divided into two parts: the first part covered the socio-demographic characteristics, and the second part on cost and return analysis data.

***Assessment of content validity***

The Item Objective Congruence (IOC) rating, interpretation, and decision as provided by (Rovinelli and Hambleton, 1977) were used to determine the content validity of the items of the questionnaire. To ensure that each questionnaire item captures the intended objectives, a draft semi-structured questionnaire was sent to three experts specific to the study field for review and feedback. Each question item with an IOC rating of 0.5 or higher was kept in the questionnaire. In addition, at least 30 potato farmers who did not belong to the sample study farmers were pre-tested with the questionnaire. In September 2020, pre-testing was carried out in Geney *Gewog*, Thimphu District, Bhutan.

***Data analysis***

***Socio-demographic characteristics***

Descriptive statistics such as frequencies, percentages, standard deviations, arithmetic means, maximum and minimum were used to analyze the socio-demographic variables.

***Cost and return analysis (CRA)***

The farm production costs may be divided into two categories: explicit and implicit costs, which are cash and non-monetary expenses, respectively (Mendoza, 2004, Suwanmaneepong*, et al.*, 2020). Microsoft Excel was used to compute the CRA. Cash costs encompassed those cash payments on farm inputs such as seeds, fuel, farm machinery rental, and hired labour payments. Non-cash expenses encompassed the farm machinery depreciation cost, own potato seeds, input support from the Government, and actual food and refreshments expenses for the exchange and family labour.

***Total cost***

The total cost (TC) was calculated using the equation as follows: (Chidiebere-Mark *et al.*, 2019, Suwanmaneepong*, et al.*, 2020):

TC=TVC + TFC ----------(i)

Where TC is a Total Cost, TVC is a Total Variable Cost, and TFC is a Total Fixed Cost.

The variable input costs, like raw materials, labour, and other variable overhead charges, are referred to as TVCs (Delaney and Whittington, 2011). TFCs, on the other hand, are production expenses that do not vary with output or production volume, like land rent (Thorpe and Thorpe, 2011). The non-cash expenses were computed using current market pricing for agriculture supplies. Labour expenses for hired, exchange and family labourers were determined (Kahan, 2013). The monetary expenses of hired labourers were based on the current agricultural labour rate, but the expenses of exchange and family labourers were determined on the farmers' real food and refreshment expenses (Tashi and Wangchuk, 2016).

The depreciation of farm implements and equipment is included in the TFCs (Charantimath, 2005). The straight-line approach gives the same depreciation expense each year (Robinson *et al.*, 2012).

Depreciation expense = (Asset cost - Salvage value)/Useful life of the asset--(ii)

***Gross return***

Gross return was calculated using the equation below (Adhikari, 2011, Tashi and Wangchuk, 2016).

Gross return (GR) = Q x P--------(iii)

Where GR is Gross Return, Q is yield, P is Selling Price (farm-gate price on this study).

***Profitability***

Profit, Gross Margin, or Net Income (NI) were calculated using the following calculation (Husin, 2012, Lyngbaek and Muschler, 2001):

Profit or GM or NI = GR – TC---------(iv)

where GM is Gross Margin, NI is Net Income; GR is Gross Return, TC is Total Cost

### *The Benefit: Cost (B:C) ratio*

The following equation calculated the Benefit: Cost (B:C) ratio (Adhikari, 2011, Tashi and Wangchuk, 2016):

B:C ratio = GR/TC---------(v)

Where, B:C ratio is Benefit: Cost Ratio, GR is Gross Return, TC is Total Cost.

***Return on Investment (ROI)*** (Chidiebere-Mark*, et al.*, 2019)

ROI = GM/TC expressed in %----------(vi)

Where GM is Gross Margin (profit), TC is Total Cost

### *Break-even analysis*

In addition to other factors, analyses for break-even price (P) and yield (Y) were performed, as shown in the equations below, based on (Dillon, 1992):

Price ($P_i$) = ($VC_i + FC_i + \pi_i$)/ $Y_i$----------(vii)

Yield ($Y_i$) = ($VC_i + FC_i + \pi_i$)/ $P_i$ ----------(viii)

Where Pi is the output price of commodity i; $Y_i$ is the yield of commodity i; $VC_i$ are the variable costs incurred to produce commodity i; $FC_i$ represents the fixed costs to produce commodity i; Break-even price or yield can be inspected by setting profits ($\pi_i$) equal to zero.

### *Yield calculation*

The yield was calculated using the formula below (FAO, 2017):

Land productivity (yield) = Volume of output/Planted Area----------(ix)

The production volume was determined in metric tons (MT), while the planted area was determined in hectares (ha).

## Results

### *Socio-demographic characteristics of farmers*

The socio-demographic characteristics of the farmers are provided in Table 1. Gender, age, education, household members, family labour, farm size, experience in farming, farmers' training,

farmers' group, and others were the parameters to study organic farmers' socio-demographic characteristics. The findings indicated that organic farmers had a higher female (69.77%) than male population (30.23%). The average age of organic farmers was 52 years, the minimum was 26, and the maximum was 84 years.

Most of the organic farmers (21%) who went to school did their primary schooling (1-6 grade). The highest educational achievement was the lower secondary (9-10 grade), with only 5% making it. Around 9% of organic farmers also went to non-formal education. More than half of organic farmers were illiterate (63%). Most organic farmers (88%) were married. The average household member was four, the minimum was one, and the maximum was 12.

The average family labour of organic farmers was two, the minimum was one, and the maximum was five. The average year of farming experience for organic farmers was 31 years, with a minimum of five and a maximum of 70 years. Organic farmers attended an average of two training per year, the minimum was zero, and the maximum was three. The average farm size of organic potato farmers was 1.17 ha, with a minimum of 0.13 and a maximum of 6.88 ha. Most of the farmers (95.3%) were a member of the organic farmers' group–*Gasa Rangsin Sonam Detchen.* The majority of farmers (83.7%) depended purely on farming for their income. More than half (72.1%) of the farmers frequently contacted the Agriculture Extension Agent for farming-related enquiries.

### *Cost and return analysis (CRA) of organic potatoes*

The CRA is provided in Table 2. Organic potato cultivation cost a total of 340,771.17 Nu*/ha. The total variable cost per hectare was 338,211.89 Nu, accounting for 99.25% of the total production cost. The total fixed cost was 2,559.28 Nu/ha, and its proportion of total production cost was just 0.75%. The total cash cost per hectare was 135,671.90 Nu, whereas the total non-cash cost per hectare was 205,099.27 Nu. The Government offered input support in the form of seeds and bio-pesticides worth an average of 1,308.37 Nu/ha. As a result, with this input assistance, the real cost of organic potato production to a farmer was 339,462.80 Nu/ha. The labour cost was more than the input cost under variable costs. The total input cost per hectare was 142,427.99 Nu, accounting for 41.96% of the total production cost. The highest input cost was spent while acquiring potato seeds, which was 62,565.50 Nu/ha and accounted for 18.43% of the total production cost. While the cost of bio-pesticides resulted in the lowest input cost of 145.38 Nu/ha, accounting for just 0.04% of the total production cost. The total labour cost was 195,783.89 Nu/ha, accounting for 57.67% of the total production cost. It was the highest contributor to the total cost of production.

Weeding and earthing up activities incurred the highest labour cost of 86,655.70 Nu/ha, accounting for 25.53% of the total production cost. While applying biopesticides had the lowest labour cost of 83.73 Nu/ha, it accounted for just 0.02% of the total production costs. Under fixed costs, the depreciation cost contributed the most, amounting to 2,528.75 Nu/ha, accounting for just 0.74% of the total production cost. Farmers got an average farm-gate price of 18.29 Nu/kg, with a negative gross margin (GM) or a profit of -202,708.47 Nu/ha. The gross margin over cash and

* Nu=Ngultrum (Bhutanese currency); 1 Nu= 0.014 USD

variable costs was 1082.43 Nu/ha and -201,457.56 Nu/ha, respectively. The average organic potato yield was 7.48 MT/ha. The break-even yield and prices were 18.63 MT/ha and 45.58 Nu/kg, respectively, with a benefit-cost ratio (B:C ratio) of 0.40 and a return on investment (ROI) of -59.71%.

**Table 1.** Socio-demographic characteristics of organic potato farmers (n=43).

| Item | Frequency | % | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|---|
| Gender | | | | | | |
| Male | 13 | 30.23 | | | | |
| Female | 30 | 69.77 | | | | |
| Age (years) | | | 52.35 | 13.90 | 26 | 84 |
| Education attainment | | | | | | |
| Illiterate | 27 | 62.79 | | | | |
| Non-formal education | 4 | 9.30 | | | | |
| Primary School | 9 | 20.93 | | | | |
| Middle School | 1 | 2.33 | | | | |
| Lower secondary | 2 | 4.65 | | | | |
| Marital status | | | | | | |
| Single/widow/er/divorce | 5 | 11.70 | | | | |
| Married | 38 | 88.37 | | | | |
| Household members | | | 4.49 | 2.43 | 1 | 12 |
| Family labour (persons) | | | 1.98 | 0.91 | 1 | 5 |
| Farming experience (years) | | | 31.05 | 19.81 | 5 | 70 |
| Attend farmers' training (numbers per year) | | | 1.65 | 0.92 | 0 | 3 |
| Farm size (ha) | | | 1.17 | 1.07 | 0.13 | 6.88 |
| Membership in a farmers' group | | | | | | |
| Member | 41 | 95.30 | | | | |
| Non-member | 2 | 4.70 | | | | |
| Off-farm income | | | | | | |
| None | 36 | 83.70 | | | | |
| Yes | 7 | 16.30 | | | | |
| Consult Agriculture Extension Agent | | | | | | |
| Never | 6 | 14.00 | | | | |
| Frequently | 31 | 72.10 | | | | |
| Seldomly | 6 | 14.00 | | | | |

**Table 2.** Cost and return analysis of organic potatoes.

| Item | Cash (Nu) | Non-cash (Nu) | Total (Nu) | % |
|---|---|---|---|---|
| A) Variable costs (VCs) (Nu/ha) | | | | |
| 1) Input cost | | | | |
| i) Seed | 9,321.90 | 53,243.60 | 62,565.50 | 18.43 |
| ii) Farmyard Manure (FYM) and other organic fertilizers | 1,550.39 | 56,792.70 | 58,343.09 | 17.19 |
| iii) Bio-pesticides | 0 | 145.38 | 145.38 | 0.04 |
| iv) Fuel & rental | 21,374.03 | 0 | 21,374.03 | 6.30 |
| **Total input cost** (Nu/ha) | **32,246.32** | **110,181.68** | **142,427.99** | **41.96** |
| 2) Labour cost | | | | |
| i) Land preparation | 8,681.41 | 14,998.68 | 23,680.09 | 6.98 |
| ii) Compost/FYM application | 6,570.37 | 6,801.57 | 13,371.94 | 3.94 |
| iii) Planting | 13,814.76 | 8,338.41 | 22,153.17 | 6.53 |
| iv) Weeding & earthing up | 43,861.92 | 42,793.78 | 86,655.70 | 25.53 |
| v) Bio-pesticides application | 0 | 83.73 | 83.73 | 0.02 |
| vi) Harvesting/curing | 30,466.60 | 19,372.67 | 49,839.27 | 14.68 |
| **Total labour cost** (Nu/ha) | **103,395.05** | **92,388.84** | **195,783.89** | **57.67** |
| **Total Variable Cost (TVC)** (Nu/ha) | **135,641.37** | **202,570.52** | **338,211.89** | **99.63** |
| B) Fixed Costs (FCs) (Nu/ha) | | | | |
| 1) Land tax | 30.53 | 0 | 30.53 | 0.01 |
| 2) Land rent | 0 | 0 | 0 | 0.00 |
| 3) Depreciation cost | 0 | 2,528.75 | 2,528.75 | 0.74 |
| **Total Fixed cost (TFC)** (Nu/ha) | **30.53** | **2,528.75** | **2,559.28** | **0.75** |
| **Total Cost (TC) = (TVC + TFC)** (Nu/ha) | **135,671.90** | **205,099.27** | **340,771.17** | |
| **Total cost with deductions of an average Govt. support on seeds & bio-pesticides worth of Nu.1,308.37/ha.** (Nu/ha) | **135,671.90** | **203,790.90** | **339,462.80** | |
| Gross Return (GR) (Nu/ha) (Q x P) | | | 136,754.33 | |
| Yield (kg/ha) (Q) | | | 7,477 | |
| Farmgate price (Nu/kg) (P) | | | 18.29 | |
| Gross margin (GM) (profit) (Nu/ha) (GR-TC) | | | -202,708.47 | |
| Break-even productivity (kilograms/ha) | | | 18,631.56 | |
| Break-even price (Nu/ha) | | | 45.58 | |
| Benefit-cost ratio (B:C ratio) (GR/TC) | | | 0.40 | |
| Return on Investment (GM/TC x 100) (%) | | | -59.71 | |
| Gross margin over cash cost (Nu/ha) (GR-Total cash cost) | | | 1,082.43 | |
| Gross margin over variable cost (Nu/ha) (GR-TVC) | | | -201,457.56 | |

Nu=Ngultrum (Bhutanese currency); 1 Nu= 0.014 USD

## Discussion

### *Socio-demographic characteristics*

In the study, more female than male population composed the organic potato farmers. Suwanmaneepong*, et al.* (2020) also found more women than men practising organic rice farming. It was found that organic potato farmers were ageing. Takagi *et al.* (2020) also found that more than half of organic farmers were above 50 years old. More than half of organic farmers were illiterate. According to the (Population & Housing Census of Bhutan [PHCB], 2017), the Gasa District has the lowest literacy rate in the country.

Organic farmers had only two-family farm labourers on average signifying farm labour shortage. The shortages are becoming more of a concern in Bhutan, owing mostly to rising rural-to-urban migration (Population & Housing Census of Bhutan [PHCB], 2017). The study indicated that the organic potato farmers were well experienced in their field, and additionally, they were regularly receiving technical training from the Agriculture Department. Suwanmaneepong*, et al.* (2020) also found that organic rice growers attended more training. The average farm size of organic potato farmers was comparable with the national mean landholding in rural areas of 1.18 ha (Population & Housing Census of Bhutan [PHCB], 2017). Most of the farmers belonged to the organic farmers' group in the district, and a majority of them depended purely on farming for their income. Many organic potato farmers were in constant touch with the Agriculture Extension officer for farming-related enquiries.

An ageing population, higher illiteracy rate, and more female gender observed with the organic farmers could affect the farmers' performance, subsequently affecting the crop yield and other farm outputs. In addition, farmers' education level (Andaregie and Astatkie, 2020, Nyagaka *et al.*, 2010) and age (Chemak *et al.*, 2014) influenced the potato production efficiency.

### *Cost and Return Analysis*

It was found that most of the production cost was due to the variable cost, whereas the fixed cost was a negligible one. Kahan (2013) stated that small scale farmers often have a low level of fixed costs. Much of the time, they do not have to bother about distributing fixed expenses across farm businesses. The variable costs are almost all their expenses. The total non-cash cost was greater than the total cash cost; it was mainly due to higher expenses on the labour cost incurred on serving the food and refreshments to the exchange and family labour. The actual cost of production to an organic potato farmer was reduced due to farm inputs support of the Government on the potato seeds, bio-pesticides, and other inputs. It was observed that the labour cost exceeded the input cost under variable costs.

Additionally, the total labour cost was the highest contributor to the total production cost. Within the labour cost weeding and earthing up activities incurred the highest cost. Other organic and conventional rice research supports this finding (Mendoza, 2004, Tashi and Wangchuk, 2016) and organic and conventional maize (Adamtey *et al.*, 2016). The lowest labour cost on the application of bio-pesticides and also being the lowest input cost suggest that organic farmers do not use it much for plant protection activities. Tashi and Wangchuk (2016) also reported that conventional rice producers in Bhutan paid considerably high for agrochemicals. Regarding lesser input costs, Morshedi *et al.* (2017) also stated that organic farming lowers the expense of purchasing farm raw materials.

Many organic potato farmers perceived that the average farm-gate prices obtained by them were below the normal prevailing rates. They reasoned that the general poor appearance of organic potato tubers than the conventional potatoes characterized by smaller tuber size and rough appearance led to lower price. The average yield of organic potato was lower than the average national potato yield. This finding agrees with (Ierna and Parisi, 2014, Maggio *et al.*, 2008) on lower yields in organic potatoes. It contradicted with the findings of (Tashi and Wangchuk, 2016),

where no significant differences in rice grain yields were observed between organic and conventional rice in Bhutan. Organic potato production had a B:C ratio of <1 and a negative ROI, indicating that it was not lucrative. If the B:C ratio is larger than one, the benefits outweigh the costs; if it is less than one, the costs outweigh the benefits, and the business is unprofitable (Hay, 1982). A prominent indicator for assessing a company's profitability is the return on investment (ROI) (Rosenbaum *et al.*, 2013, Tiffany and Peterson, 2011).

The organic potato was unprofitable mainly owing to low yield and a lower farm-gate price. Therefore, organic potato farmers either need to increase their yield or obtain farm gate prices higher than their respective break-evens to ensure profitability. Additionally, there is a need to research to find the actual causes of the low yield of organic potatoes and generate appropriate technologies. There is also a need to implement market research to increase the income of the organic potato farmers in the Gasa District, Bhutan.

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