**Research Note**

# VALUE CHAIN ANALYSIS OF CUCUMBER IN ARGHAKHANCHI, NEPAL

**R. Khanal and S. C. Dhakal***
Agriculture and Forestry University, Rampur, Chitwan, Nepal

*Corresponding author: scdhakal@afu.edu.np

## ABSTRACT

This study was done to analyze the value chain of cucumber in Arghakhanchi district during 2018. Four major cucumber producing areas, such as- Ghoche khola, Bhagwati, Baghi and Jagata were purposively selected. The value chain analysis was done with the objective to calculate benefit cost ratio in cucumber enterprise, draw the value chain map, assess the factors of production, and find out the major constraints in cucumber cultivation. A total of 64 cucumber growers and ten traders were selected using simple random sampling technique. Majority of respondents (95%) had cultivated Bhaktapur Local variety while only thirty percent of respondents cultivated hybrids. The benefit cost ratio was also higher in case of Bhaktapur Local (3.18) followed by hybrids (2.44). The most dominating marketing channel involved flow of products from farmers to retailers and then to consumers. The highest farm gate price was seen in farmers to producers' channel. The regression estimate showed that the input variables such as- organic manure, fertilizers, materials, labor, plant protection materials had significant effects on production of cucumber. The findings showed that the major problems associated with cucumber production was diseases and insects pests attack while the major problem related to cucumber marketing was middlemen-taking higher margin. The findings also pointed out the absence of wholesalers in the value chain which somehow affected to the less production of cucumber and minimized the export opportunity.

**Key words:** Benefit-cost ratio, value chain map, marketing channel,

## INTRODUCTION

Agriculture significantly contributes to the Nepalese economy providing 26.24% of the total Gross Domestic Product (GDP) to the nation (ABPSD, 2018). Among the agricultural products, cereals rank first followed by livestock and vegetables. The contribution of cereals, livestock and vegetables to the Agricultural GDP are 49.41%, 25.68% and 9.71%, respectively (ABPSD, 2014).

Vegetables are commercially important agricultural commodities with significant contribution to the AGDP. Out of two hundred cultivated vegetable species and their varieties in Nepal, fifty are grown in commercial scale (Shrestha et al., 2004). Cucumber is one of the major vegetables of Nepal. In terms of total cultivated area, cucumber with the area of 8,634 ha ranks fifth behind cauliflower, tomato, cabbage and pumpkin in descending order (CBS, 2011). The total production of cucumber in Nepal was 1,27,918 t with productivity of 14.3 ton/ha in year 2012/13 (ABPSD , 2013).

According to DADO Arghakhanchi, despite the huge potential Arghakhanchi has not been able to meet its vegetable production demand. Particularly, cucumber production in the district is quite low in comparison to national figures. The production of cucumber in Arghakhanchi district in the year 2017 was 300 t in 25 ha land (DADO Arghakhanchi, 2018). Less production of cucumber hints towards problems in cucumber marketing and prices irregularity. Farmers have little knowledge of market and value chain and they only target local markets which has less quantity demand. Furthermore, majority of farmers do not keep record of their profit and investment which makes economics of cucumber production in the district still unknown. The resource use in the area is haphazard and no study on these topics has been done in the district. Development plans in the district have focused primarily on production aspect of agriculture sector. Lack of coordination between the actors of value chain and inefficient marketing channels has led to the high price gap between the consumers and the farmers. Based on this scenario, following research questions were formulated- (1) what is the production cost, gross margin and producer's share in cucumber in the district? (2) what does value chain map of cucumber look like and what are the actors in the value chain? (3) what are the factors that contribute to the cucumber production? (4) what are the major problems in cucumber production and marketing?

## MATERIAL AND METHODS

The research was conducted on four sites, namely Bhagwati, Jagata, Baghi and Ghoche khola. These sites are purposively selected as they are the principle vegetable producing regions of Arghakhanchi district. Total of 64 farmers, 14 from each site were included in the sample. The sample selection was done by simple random sampling technique. Primary data were collected through household survey by using pre-tested questionnaires. Information was further collected through Focus Group Discussion, and Key Informants Survey. Secondary data collection was done through the desk study of grey literatures and various authentic publications.

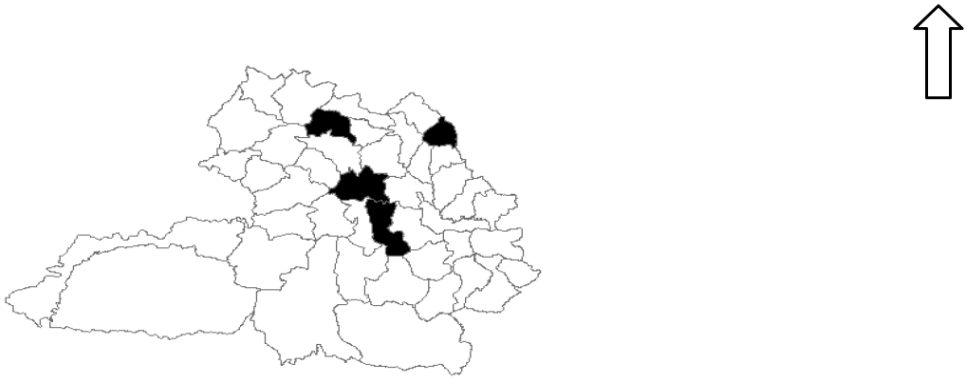

**Figure 1. Map of Arghakhanchi showing study locations**

The vegetable market of Sandhikharka, was the source of market information. Market Information was also collected from Tamghas market. Ms. Excel and SPSS were used for the descriptive analysis. Regression analysis was done using Stata. Data analysis was done on the basis of following indicators:

**Benefit cost analysis**

Benefit cost analysis was done by calculating the total variable cost and gross returns from the cucumber cultivation. The following formula was used:

B:C ratio = Gross return/total variable cost

Where,

Gross return= total quantity of cucumber sold* average price

Total variable cost= Cost of seed + cost of organic manures + cost of fertilizer + cost of land preparation + cost of staking + cost of weeding + cost of plant protection + cost of harvesting

**Marketing margin**

The difference between the farm gate price and retailer's price is the marketing margin which was calculated by using formula

Marketing margin=retailer's price-farm gate price

**Producers' share**

Producers' share is the price received by farmer expressed as a percentage of the retail price, i.e., the price paid by consumers. It will be calculated by using following formula

Producer's share=Producer's price/Retailer's price×100

**Analysis of factors affecting production of cucumber**

Multiple regression function was used to estimate the cucumber production in a ropani of land. The choice of the functional form was based on its R squared value and its computational manageability. The function is given by

$$Y_i = b_0 + b_1A + b_2B + b_3C + b_4D + b_5E + b_6F$$

Where Y is production which is a dependent variable and A, B, C, D, E, F are explanatory variables and represents various inputs. $b_1, b_2, b_3, b_4, b_5, b_6$ are the production coefficients.

## RESULTS AND DISCUSSION

**Cucumber production system**

**Cucumber variety**

Bhaktapur local was the highly preferred cucumber variety in the survey area. Bhaktapur local was cultivated by 95 percent of the cucumber growers. Only 30 percent of the farmers cultivated others variety which included Beli, Dynasty, Kheera, Malini and Ninja. Cucumber growers in Hemja and Bhaktapur also reported that

the Bhaktapure variety of cucumber is preferred over others. The preference on this variety may be due to the high demand and high market price it fetches because of its superior taste. Table (1) shows the details about cucumber variety in the survey area.

**Table 1. Adoption of cucumbers variety by farmers in survey area**

| Variety | Frequency | Percentage |
|---|---|---|
| Bhaktapur local only | 45 | 70 |
| Hybrids (Dynasty, Beli, Kheera, Malini, Ninja) only | 3 | 5 |
| Both | 16 | 25 |

**Source:** Field Survey, 2018

**Area, production and productivity**

The area of cucumber cultivation was 2.10 ropani per household. The productivity of Bhaktapur local variety in the survey area was found to be 17.95 ton/ha and productivity of hybrids was 15.5 ton/ha. According to CBS (2011), the average yield of cucumber in Nepal was16.5 ton/ha and the yield for western development region was 19.9 ton/ha. Annual report of DADO (2017) had also shown the average productivity of cucumber in Bhagwati vegetable pocket in Arghakhanchi district to be 21 ton/ha. The detailed information is shown in Table (2).

**Table 2. Area, production and productivity of cucumber in survey area**

| Variety | Area (per household) (ropani) | Production(per household) (kg) | Productivity (t/ha) |
|---|---|---|---|
| Bhaktapur local | 1.23 | 1093 | 17.95 |
| Others(hybrids) | 0.87 | 615 | 15.5 |

**Source:** Field Survey, 2018

Comparative study of four research sites viz Ghoche khola, Baghi, Jagata and Bhagwati showed that average area of cucumber (Bhaktapur local) cultivation in ropani, was highest in Bhagwati(1.81 ropani) followed by Ghoche khola (1.65 ropani), Jagata (0.88 ropani) and Baghi (0.63 ropani).. The information are presented in Table (3).

**Table 3. Area, production and productivity of Bhaktapur local variety of cucumber in four research sites viz. Ghoche khola, Baghi, Jagata and Bhagwati**

| Sites | Area (per household) (ropani) | Production (per household) (ropani) | Productivity (t/ha) |
|---|---|---|---|
| Ghoche khola | 1.65 | 1696 | 20.55 |
| Baghi | 0.63 | 547 | 17.37 |
| Jagata | 0.88 | 693 | 15.75 |
| Bhagwati | 1.81 | 1650 | 18.23 |

**Source:** Field Survey, 2018

**Cost of production and gross returns**

The average cost of production of cucumber was found to be Rs 9.87/kg and Rs 11.16 per kg for hybrids and Bhaktapur local respectively. The higher average cost of production of Bhaktapur local variety is partly due to its extensive vegetative growth which increases staking costs and partly due to its comparatively higher susceptibility to insects(red pumpkin beetle) and diseases(CMV) increasing the cost for plant protection. Similarly, the cost of production per ropani for Bhaktapur local and hybrids were found to be Rs. 14182 and Rs. 12427, respectively. Informal study about the price revealed that the cost of production of cucumber in Kavre district was Rs 9201/ ropani. Higher cost of production per ropani obtained in this research is simply due to prices hike over time from 2010 to 2018. Small area of cultivation has also increased the cost of production to some extent.

The average price obtained by farmers for Bhaktapur local and hybrids were Rs. 47.75 and Rs 40.2, respectively. The higher price for Bhaktapur localis due to its higher market demand and superior taste.. The B:C ratio for Bhaktapur local and hybrids were calculated to be 3.18 and 2.44, respectively.

**Table 4. Cost, returns and B:C ratio from cucumber production in survey area**

| Variety | Average cost (per ropani) (Rs.) | Gross returns (per ropani) (Rs.) | B:C ratio |
|---|---|---|---|
| Bhaktapur local | 14182 | 41830 | 3.18 |
| Hybrids | 12427 | 28200 | 2.44 |

**Source:** Field Survey, 2018

**Factors of production**

The effect of various inputs (NRs) to the total production (kg) of Bhaktapur local cucumber on an average farm size was analyzed using linear regression method. Regression estimate showed that in an average sized farm, increase of organic manure worth one rupee increased the production by 0.157 kg. Similarly, one rupee worth increase in chemical fertilizer, labor, materials and disease control increased the production by 0.38 kg, 0.569 kg, 0.344 kg and 0.417 kg, respectively. R squared value of the regression analysis was found to be 0.88. This means 88 percent of the variation in total production of Bhaktapur local variety of cucumber is governed by the input factors taken in the regression equation.

**Table 5. Regression estimates showing effect of different inputs on production of bhaktapur local variety of cucumber in study area**

| Variables (Rs) | Coefficients | Standard error | t- value | P>\|t\| |
|---|---|---|---|---|
| Seed cost | -0.255 | 0.441 | -0.58 | 0.566 |
| Organic manure cost | 0.157*** | 0.035 | 4.45 | 0.000 |
| Chemical fertilizer cost | 0.380** | 0.154 | 2.45 | 0.018 |
| Labor cost | 0.569** | 0.024 | 2.34 | 0.023 |
| Materials cost | 0.344** | 0.151 | 2.27 | 0.027 |
| Disease control cost | 0.417** | 0.180 | 2.32 | 0.025 |
| Constant | -405.91 | 144.613 | -2.81 | 0.007 |
| F | 64.71*** | | | |
| Probability> F | 0.000 | | | |
| R squared | 0.88 | | | |

Note: *** and ** indicate significance at 1% and 5% levels, respectively.

**Marketing channel and market margin**

Farmers were found to be selling major portion of their cucumbers to retailors. 76 percent of the cucumbers were sold to retailers while 3 percent and 21 percent were sold to wholesalers and consumers respectively. The small amount of cucumbers sold to consumers was found to be fetching higher prices. The market channel along with price involved is shown in Figure (2).

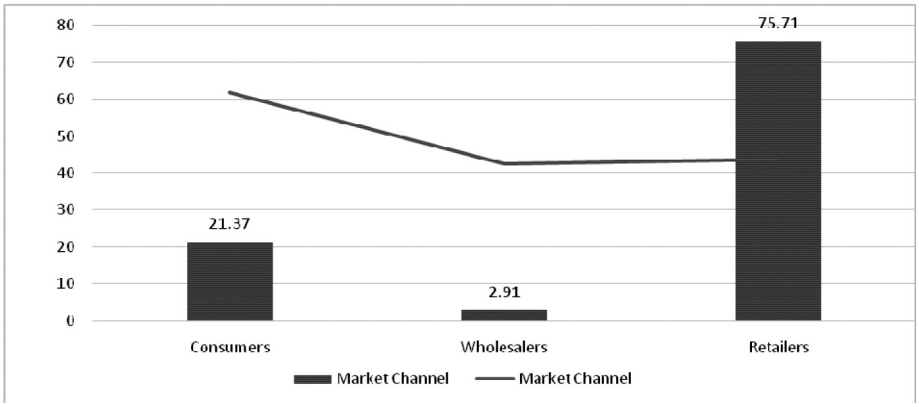


**Figure 2. Market channel, percentage sales and price obtained from cucumber in survey area**

**Source**: Field Survey, 2018

The production was not even enough to meet the local market demand and thus it had no outlet outside of the district. The major market of the district was Sandhikharka. However, one of the pockets, Bhagwati lies in the border region and thus its major market was Tamghas, Gulmi. The cucumbers from Bhagwati were found to be reaching Butwal through the traders of Gulmi at the peak season.

**Market margin**

The average price farmers fetched was found to be Rs 40.21 for hybrids and Rs 47.75 for Bhaktapur local. From FGD of vegetable retailers, it was found out that average consumers' price for hybrids and Bhaktapur local in the market were Rs 60 and Rs 73 respectively. The higher farm gate price of cucumber in Arghakhanchi is due to the high demand of cucumber along with less supply and an isolated market. PMAMP, PIU, Arghakhanchi (2018) in zone profile has also mentioned the average farm gate price of cucumber in the zone area to be Rs 47/kg.

The producers' share for Bhaktapur local was calculated to be 65 percent whereas producers' share for hybrids was 67 percent. Market margin for Bhaktapur local and hybrids are calculated to be Rs 25.25/kg and Rs 19. 79/kg, respectively. The higher price and market margin indicates towards higher demand and lesser supply of cucumber in the area. These information are also presented in Table (6).

**Table 6. Market margin and producers' share from cucumber in survey area**

| Variety | Farm gate price(Rs) | Retailers' price(Rs) | Market margin(Rs) | Producers' share (%) |
|---|---|---|---|---|
| Bhaktapur local | 47.75 | 73.00 | 25.25 | 65 |
| Hybrids | 40.21 | 60.00 | 19.79 | 67 |

**Source:** FGD, 2018

**Gross margins at different level for producer----retailer----consumer channel**

Market margin was found to be highest for both variety at farm gate level. Between two varieties bhaktapur local was found to be fetching higher margin (Rs 36.59 ) followed by hybrids ( Rs 30.34 ). Similarly, the market margin for bhaktapur local and hybrids at retailers' level was Rs 23.75 and Rs 17.76, respectively.

**Table 7. Market margin in cucumber at different level**

| Variety | Farmer | | Retailer | |
|---|---|---|---|---|
| | Price (NRs) | Profit | Price (NRs) | Margin |
| Bhaktapur local | 47.75 | 36.59 | 73 | 23.75 |
| Hybrids | 40.21 | 30.34 | 60 | 17.76 |

**Value chain map**

The value chain map shows the market channel and the flow of cucumber from one level to another. Cucumber growers were found to be selling 21 percent of their products directly to consumers, 74 percent to

retailers, 3 percent to the wholesalers and 2 percent to the local collectors. The value chain map was developed and is represented in the Figure (3).

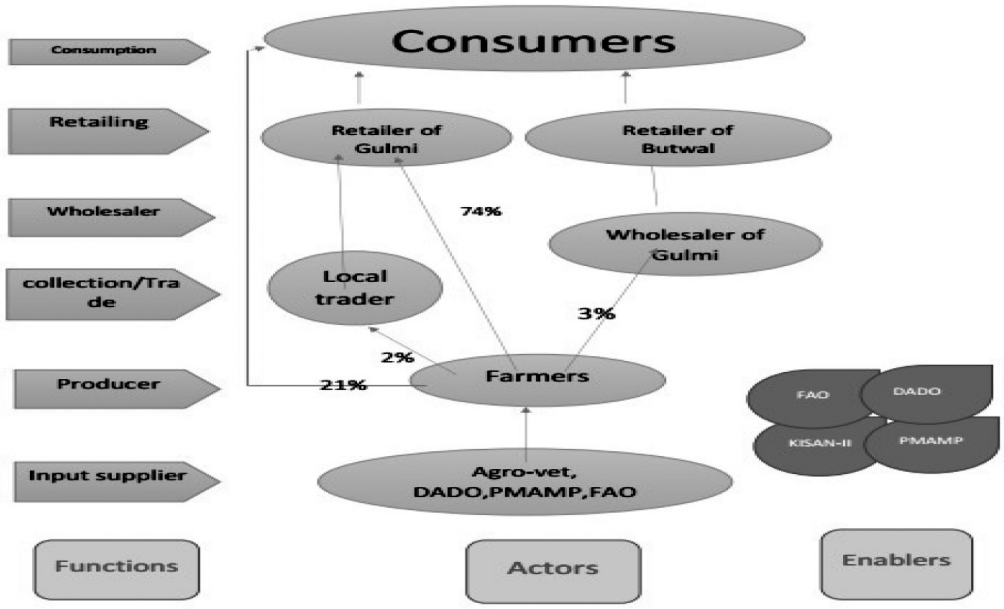


**Figure 3. Value chain map of cucumber in Arghakhanchi district**

**Actors involved in value chain**

All the actors involved from the production of a commodity to its final composition are included in the value chain. The major value chain actors in the area were input suppliers, producers, retailers and consumers. There were few farmers who also fulfilled occasional role of local collectors. Wholesalers were not functional in the cucumber market of Sandhikharka. However, at the time of surplus production the cucumbers from Bhagwati reached Butwal market through the wholesalers and collectors of Tamghas.

Input suppliers play important role in production of cucumber. The quality of seed, fertilizer dose, plant protection measures and their cost and time of availability largely decides the fate of cucumber production. The major input suppliers of cucumber production in the area were agrovets. Cucumber growers obtained input supplies and valuable information regarding cultivation from agrovets. Other input suppliers were DADO, PMAMP, FAO and other non-government organizations in the area. These organizations supplied inputs on various schemes of subsidies and technical assistance. Similarly, producers are the farmers who grow cucumber. Farmers were limited in number and the production of cucumber was lower than the demand. The farmers were producing lower quantity and fetching higher price which is not sustainable in the long run. Most of the cucumber farmers were commercial in the sense that they sell their cucumber in the markets. The farmers producing comparatively low quantity sold the product in *haat bazaar* while those producing comparatively higher sold it to the retailers.

Few progressive farmers also acted as collectors as they collected the products from neighbouring farmers and took it to the retailers in the market. The wholesaler had no role in Sandhikharka market as all the cucumbers were sold either to retailers or consumers directly. The wholesalers were found active in the peak period in Tamghas market carrying cucumbers from Bhagwati to Butwal.

Retailers were the major traders of the area. They were the chief governors of price and were present in sufficient number. The retailers in the area were deriving more margins from local produce rather than cucumbers imported from terai. The imports from terai required higher transportation cost per unit quantity as the market demand is limited. In addition to that, the wastage or post harvest loss was found to be much higher in imported cucumbers. The retailers of the area were thus focused on selling local vegetables rather than importing it from the plains.

Consumers are the ultimate price bearers. The consumers of the area were found to be paying higher price for the cucumber due to the high market margin at farm-gate as well as retailers' level. High demand of Bhaktapur local variety of cucumber despite the higher price explains that the consumers of this area were also found to be seeking quality and paying premium price.

**Enablers and facilitators in value chain**

Enablers and facilitators are those parties who support the activities in the value chain one way or another. The support may be technical help regarding production, innovative technologies dissemination or marketing aids.

DADO Arghakhanchi was found to be providing various support services to the farmers. Major activities of DADO included technical assistance during cucumber production, distribution of high yielding seeds, support on agricultural machineries and providing trainings and visits. DADO also had been promoting farmers' group formation and cooperative farming.

The vegetables zone which is a PIU of PMAMP started from 2017/18 was found effective in helping the farmers. It provides farmers with vegetable cultivation training, inputs like seed, fertilizers and machineries at subsidies. It works specifically on vegetables sector and provides technical help to farmers at field level. "Climate Change Adaptation in Agriculture", a project of FAO was also found to be enabling farmers to grow quality vegetables by providing quality seeds and training related to vegetable cultivation. It supports farmers to mitigate the effects of climate change on vegetable cultivation and teaches the ways to adapt to it. KISAN-II is a project by USAID which aims at systemic changes at agricultural sector. It has been providing grants to the input suppliers (agrovets) and promoting contract farming minimizing market risks of the farmers.

**Problems associated with cucumber production and marketing**

The result obtained from indexing is represented in table 8 and it showed that diseases infestation was the most severe problem in cucumber production. The most prevalent diseases were cucumber mosaic, powdery mildew and downy mildew of cucumber. The second ranked problem was found to be insect pests attack. The attack by vertebrate pests was fifth in the ranking. The vertebrate pests included monkey, rabbits and wild boars.

**Table 8. Major problems in cucumber production in the survey area**

| Problems | Frequency of each weight | | | | | | Total index | Rank |
|---|---|---|---|---|---|---|---|---|
| | 1 | 0.8 | 0.6 | 0.4 | 0.2 | 0 | | |
| Diseases | 41 | 15 | 3 | 5 | 0 | 0 | 56.8 | I |
| Insect pests | 9 | 30 | 18 | 7 | 0 | 0 | 46.6 | II |
| High price of input | 2 | 9 | 39 | 14 | 0 | 0 | 38.2 | III |
| Lack of irrigation | 9 | 20 | 13 | 7 | 6 | 9 | 36.8 | IV |
| Vertebrate pests | 0 | 13 | 23 | 18 | 7 | 3 | 32.8 | V |

**Source:** Field Survey, 2018

**Problems in cucumber marketing**

The most severe problem in the marketing was found to be the middlemen taking high margin. Middlemen in the study area are the retailers who are dominant and have principal role in price fixation. Small market was the second major problem in the marketing. Similarly, poor transportation, low price and lack of market knowledge were ranked third, fourth and fifth respectively.

**Table 9. Major problems in marketing of cucumber in the study area**

| Problems | Frequency of each weight | | | | | | Total index | Rank |
|---|---|---|---|---|---|---|---|---|
| | 1 | 0.8 | 0.6 | 0.4 | 0.2 | 0 | | |
| Middlemen take large margin | 6 | 24 | 32 | 2 | 0 | | 45.2 | I |
| Small market | 3 | 23 | 24 | 12 | 2 | | 41 | II |
| Poor transportation | 0 | 23 | 28 | 11 | 2 | | 40 | III |
| Low price | 3 | 13 | 34 | 13 | 1 | | 39.2 | IV |
| Lack of market knowledge | 4 | 15 | 24 | 16 | 5 | | 37.8 | V |

**Source:** Field Survey, 2018

**SWOT Analysis**

Table (10) shows internal and environmental factors that need to be addressed and worked upon for the improvement of the value chain. Along with exploiting the strength, weaknesses needs to be adressed as well, as

theses are internal and thus controllable factors. Weaknesses like scattered land, lack of year round irrigation, lack of transportation and lack of market information are the concerns for government organisations and policy makers. Similarly, external factors that influence the cucumber enterprise are also analysed. Climatic suitability, subsidies, establishment of PMAMP, high market price and market margin are the oppurtunities for the farmers. Presence of threats like diseases, vertebrate pests, absence of wholesalers in the value chain needs to be addressed as much as possible by the technnicians and policy makers.

**Table 10. SWOT analysis of cucumber production and marketing**

| | |
|---|---|
| **Strength**<br>• Higher B:C ratio<br>• Comparative advantage over cereals and other vegetables<br>• Farmers establishing strong linkage with retailers | **Weakness**<br>• Scattered land<br>• Labor shortage<br>• Lack of year round irrigation<br>• Lack of market information<br>• Transportation problems on rainy season |
| **Opportunities**<br>• Climatic suitability<br>• Different subsidies<br>• Establishment of vegetable zone by PMAMP in the district<br>• Higher price and market margin in cucumber | **Threats**<br>• Severe risk of diseases and pests.<br>• Improved linkage to the terai in future may lead to higher competition<br>• Absence of wholesalers may create problems in the peak production period |

Source: Field Survey, 2018

## CONCLUSION

The B:C ratio for Bhaktapur local and hybrids were calculated to be 3.18 and 2.44, respectively. High B:C ratio clearly shows that cucumber farming has been a highly profitable business in the district. The high value of producers share clearly indicates that the farmers are being highly benefitted from cucumber cultivation. The higher price and market margin also indicates towards higher demand and lesser supply of cucumber in the area. Agro-vets were the major input suppliers and DADO, PMAMP, FAO and KISAN-II were the facilitators in the value chain. The input variables that showed significant effect on production were organic manure, chemical fertilizer, labor, materials and disease control. Disease infestation and insect pests attack were the two major problems in cucumber production while retailers taking higher margin were the major problem in marketing of cucumber.

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