Article

Tulsi - an alternative livelihood for the poor and smallholder farmers

Ghulam-Muhammad Shah1*; Farid Ahmad2; Shailesh Panwar3; Manber Khadka4; Ajaz Ali5; Suman Bisht6

1. International Centre for Integrated Mountain Development; ghulammuhammad.shah@icimod.org
2. International Centre for Integrated Mountain Development; farid.ahmad@icimod.org
3. Himalayan Action Research Centre; shailesh@harcindia.org
4. International Centre for Integrated Mountain Development; skmanbar@yahoo.com
5. International Centre for Integrated Mountain Development; ajaz.ali@icimod.org
6. International Centre for Integrated Mountain Development; suman.bisht@icimod.org

*Correspondence: ghulammuhammad.shah@icimod.org; Tel.: +977-1-5275223

Abstract: This study assesses the pursued impacts of Tulsi value chain development intervention on the livelihoods of rural poor in Uttarakhand state of India. Tulsi as an alternative livelihood, particularly for the rural poor, is less explored. With increased crop depredation of major cereal crops grown in the district by wild animals and pests, and decreasing availability of water agriculture, attempts were made to improve earnings from Tulsi as an alternative livelihood. Findings suggest that the average households’ gross profit from Tulsi farming increases by more than double within a span of two years. Total crop income of beneficiary farmers’ increases by 0.8 percent for every 1 percent increase in Tulsi income. Intervention helped enhance productivity of Tulsi, thereby enhancing earnings from Tulsi farming. Most importantly, intervention has shown a tremendous adoption rate. Towards the end of the intervention, the value chain work was out-scaled to another 19 villages in Chamoli district, thereby reaching out to more than 400 households.

Keywords: Ocimum sanctum; alternative livelihoods; crop depredation; out-scaling; tulsi; value chain development
1. Introduction

There is growing consensus that agriculture remains fundamental for poverty reduction, economic growth and environmental sustainability for agriculture based countries [1]. Enhancing smallholder productivity and sustainable economic growth are pre-requisite to achieve the full contributions of agriculture to overall growth and development [2]. The most common traditional crops generally grown in the mountains and hills of the Hindu Kush Himalaya (HKH) region included wheat, barley, maize, potatoes, paddy, and millet. Crops namely, wheat, rice, and maize account for more than half of the dietary supply [3]. Hill agriculture has inherent constraints of remoteness and inaccessibility, marginality and fragility in terms of moisture stress and the poor soil conditions and a short growing season. Added to these are socio-economic constraints such as small holdings, poor productivity, poor production management, labour shortages, poor post-production management, poor marketing and networks and lack of entrepreneurship have led to under-utilisation of resource bases in the hills and limited generation of surpluses [4]. In particular, rural agriculture in hills lack an established market for agroforestry products, even though these products could be a significant source of additional income [5]. Besides, in parts of the HKH region, for example, the hilly districts of Uttarakhand state in India, traditional crops grown also suffer from depredation by wild animals, depleting water agriculture, and pest infestations. In the face of such vulnerabilities, provision of alternative livelihood options for the poor and smallholder farmers becomes a high priority. At the same time mountains of KHK region are endowed with an extensive variety of high value resources, including non-timber forest products (NTFPs) and medicinal and aromatic plants (MAPS), which can be grown, harvested, and processed into high value products [6].

Ocimum Sanctum (Sanskrit: Tulasi [or Tulsi]; English: holy basil; family: Labiatae), one such NTFP. Tulsi (Ocimum sanctum), an aromatic shrub, is a perennial plant with purple-pink flowers that produces light lemon scent. Historically, it is known for its healing power that dates back over thousands of years. The plant acts as a natural anti-stress agent and boosts immune system [7]. Tulsi is less water intensive crop and is less affected by animal depredation and pest-diseases as opposed to other major cereal crops. Tulsi is found throughout the semi tropical and tropical parts of India. Tulsi is an important medicinal plant in the various traditional and folk systems of medicine in Southeast Asia [8]. Given its importance as medicinal and aromatic plant, Tulsi today is also commonly consumed in supplement form as Tulsi tea. While Tulsi is believed to have originated in north central India, it is widely popular today and is grown throughout the eastern world tropics [9]. Approximately 50 million people in India rely on non-timber forest products and medicinal and aromatic plants for sustaining their livelihoods [10]. Non-timber forest products and medicinal and aromatic plants significantly contribute towards the annual cash income of the local people in southern Meghalaya of India [11]. Data show that the collection and processing of medicinal and aromatic plants in India contribute at least 35 million working days of employment in a year [12]. The global demand of medicinal and aromatic plants has grown substantially with an estimated sale of herbal medicines to have exceeded from 12.5 billion USD in 1994 to 30 billion USD in 2000 [13]. In fact, the global demand of medicinal and aromatic plants is growing at an annual rate of 5 to 15 percent. The secretariat of the Convention on Biological Diversity has forecasted that the world market for herbal medicines and associated products will reach 5 trillion USD by 2050 [14]. The environment in which agricultural discovery and innovation occurs has been constantly changing with
resultant significant influences on the organization and the social processes of discovery and innovation [15]. As a result, there have been significant paradigm shifts in agricultural knowledge generation, dissemination and utilization [16].

Development of agro-industries with an emphasis on promoting effective agro-value chains has been increasingly practiced to enhance agricultural growth and reduce poverty. Value chain development not only helps to generate employment opportunities but also offers market access to smallholders and creates business linkages to small and medium enterprises [17]. It is especially important in many poor and developing nations across the globe as it helps to minimize the post-harvest losses and reduce rural poverty [17]. The value chain approach is among the most effective ways to improve linkages between businesses and poor communities, tackle poverty, and develop a local resource-based enterprise that benefits local people [18; 19]. Value chain development comprises of a full range of activities and services of market actors that are essential to transform a product or service from its origin to end-use product or service [20]. Along the similar lines, [21] defines value chain as the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. According to [21], the development of value chains should use a practical approach that supports specific target groups and is useful in understanding how poor people in rural areas of developing countries can efficiently engage in domestic, regional, or international trade. It is a stepwise process to create a sustainable approach to enable local producer communities to generate employment and gain an equitable share of benefits from their local products [22]. It is essentially related with the concept of upgrading products that enable producers to move up the value chain, thereby enabling them to make products with more value-addition and achieving better results [23]. Upgrading of products via value chain development entail acquiring capabilities and accessing new market segments via participation in particular chains [24]. Actors who are part of the value chain mechanism include collectors, processors, manufacturers, traders, and consumers who work together for improving the supply of inputs, extension services, and access to market facilities [25; 26]. Value chain interventions depending on their nature and types tend to have positive impacts on the outcomes of interest. For instance, value chain interventions related to trainings and better harvesting practices tend to increase the income of poor households, enhance understanding of environmental values and promote gender equality, among others [27]. Similarly, skill-enhancing training programs tend to raise women empowerment in the form of increased income, more bargaining power and decision making on various fronts [27]. While studying upgrading bay leaf farmers in value chains [28] also suggested that with an upgraded value chain, the bargaining power of rural households’ increases in terms of higher market prices for their produce. Many researchers have assessed value chain based interventions and their comparative impacts. For example, [29] study the prospects of developing a sustainable smallholder commercial production of African Leafy vegetables through pro-poor market development initiatives. They show that with the set-up of collective marketing systems and increased group efficiency through production skills training, poor and marginal farmers benefit with their increased participation in the market place [30]. Further, [31] analyse the impact of commercialization of medicinal and aromatic plants such as njansang (oily seed tree) on poverty alleviation in project villages of Cameroon. They find that project interventions help increase total cash income of the poor and
marginal smallholder farmers in project households [31]. Similarly, [32] investigate the determinants and impacts of cooperative organization, especially the farmer groups on better linking smallholder farmers to emerging value chains in the Kenyan banana sector. They find that while cooperative organizations may not necessarily improve market accessibility for smallholder farmers, the potential benefits to farmers are very product and context specific depending on the concrete and collective actions pursued. [32] Further argues that farmer groups have the potential to better link farmers with emerging high-value chains thereby increasing farmers’ benefits and making the groups more sustainable. Along the similar lines, [33] assess the effect of strengthening Malta Orange value chains through institutional development on smallholder farmers in Chamoli district of Uttarakhand, India. Their assessment argues that due to unorganized market mechanisms, producers sell their produce intermediaries at lower prices. They found that a value chain targeting production, processing and marketing smallholder farmers become well organized, their bargaining power improves, and consequently sell their produce in a better price.

In essence, this paper assesses the impacts of Tulsi value chain development intervention in terms of its impacts on the beneficiary households as perused in the theory of change depicted in figure 1 below. The paper also identifies factors contributing to increased income from Tulsi farming and assesses the contribution of Tulsi farming on household welfare, particularly benefits to women farmers.

2. Material and methods

Chamoli is one of the hilly districts of Uttarakhand state in India. Farmers in the district have been facing numerous farm related problems such as crop depredation by wild animals, crop infestation by pests, and less availability of water for agriculture. Tulsi is considered as an important cash crop for a number of reasons. First, it is less water intensive and is less affected by pest infestations. Second, there is no depredation of Tulsi by wild animals. And third, value addition practices are comparatively easy to implement for enhancing the production of Tulsi via improvement along its value chain. Farmers in Chamoli district have been practicing Tulsi cultivation in a traditional way with limited know-how on value addition. Realizing the potential of Tulsi as a viable alternative livelihood option and important cash crop, the International Centre for Integrated Mountain Development initiated a value chain development intervention for Tulsi in Chamoli district of Uttarakhand state in India. As such Tulsi value chain development intervention strengthened farm-to-market nodes of Tulsi value chain bridging the gap between Tulsi producers and available market thereby enhancing the livelihoods of poor and marginal smallholder farmers involved in Tulsi.

2.1. Description of Tulsi value chain development intervention

Tulsi value chain development intervention was implemented in five selected villages in Chamoli district of Uttarakhand state in India. International Centre for Integrated Mountain Development implemented this intervention through its local partner Himalayan Action Research Centre, Uttarakhand, India. Tulsi value chain development intervention was implemented over a period of four years. The intervention targeted mountain farmers with small farm holdings and who were vulnerable to crop damages from wild animals’ especially wild boars and monkeys and lack of water due to climate stress. In a preliminary situational analysis Tulsi was identified as a crop that could address these constraints. Willingness of farmers was assessed to cultivate Tulsi as an alternative livelihood option. Beneficiary farmers were selected based on their interest to participate in the intervention. The intervention supported 200 farmers in 5 villages including Zilashu; Langashu; Chamali; Kaleswhar; and, Sonla in
Chamoli district. Beneficiary farmers were small and marginal farmers with average land holdings between 0.70 to 1.34 hectares of land. Beneficiary farmer cultivated Tulsi on a total of 8.2 hectares of land in these 5 villages.

The main objective of this intervention was to provide alternative livelihood options by providing necessary capacity building, technology, and market linkage support. It aimed to do so by strengthening Tulsi value chain coordination, improving processing and functional upgradation and, diversifying Tulsi products. For this purpose, intervention adopted a community led integrated approach to address complex issues of diversification of farm production and introduced efficient marketing strategies. Farmers were mobilised and briefed about potential of Tulsi farming for income generation and protection from wild depredation. Part of capacity building support, information and techniques on nursery management, sowing methods, quality harvesting and post-harvest handling were transferred to farmers. A comprehensive package of practice on Tulsi farming and production was developed and shared across the beneficiary households. In order to address issues related to marketing of Tulsi products a market surveys was carried out in surrounding markets of Uttarakhand and in the national capital region (NCR) in Delhi. Findings suggested that Tulsi leaf in its different forms are in demand by consumers. Based on these findings, product development trails were taken up by the intervention. Tulsi green tea, Tulsi ginger tea, Tulsi powder and Tulsi sauce were introduced. Intervention helped beneficiary communities to assemble in Tulsi producers' and collectors' groups. These groups were further trained in managing newly introduced Tulsi products. This in return not only provided poor farmers an alternative livelihood option but also helped value chain governance in terms of enhanced coordination of Tulsi production and local level trade which also resulted in transparency and equity in Tulsi value chain.

Figure 1 below depicts the theory of change realised for Tulsi value chain development intervention. Intervention theory of change suggests that important intervening factors including hardholding support provided to beneficiary farmers through establishment of women self-help groups of Tulsi producers and collectors and capacity building of farmers in Tulsi nursery establishment and management, harvesting and quality post-harvest handling - collecting, drying, grading, and packaging, of Tulsi and linking them to market not only help them realize increased proportion of sale volume of Tulsi produce but also enable them to negotiate better price for their produce. Capacity building and strengthening of coordination between groups of Tulsi producers, collectors and buyers led to smooth flow of upstream, downstream information and trade thereby improving Tulsi value chain governance resulting in transparency and equity in Tulsi value chain. These intermediary factors collectively led to increased farm-gate price received by Tulsi producers, increased benefits to women beneficiaries from Tulsi farming and increased social benefits and well-being of poor and marginal farmers. The intermediary and higher level outcomes helped farmers realise benefits of Tulsi which in contributed to adoption of Tulsi as an alternative livelihood option by wider farmers in Chamoli district thereby increased income of beneficiary households from Tulsi farming. Findings of the study discussed in the results section of this paper also suggest that the theory of change realised for this intervention remained valid.
Figure 1: Theory of Change realised for Tulsi value chain development intervention

### Intervention

- Needs Assessment Studies conducted around Tulsi Value Chain
- Supporting women cultivators through establishing women self-help producers’ and collectors’ groups
- Capacity building and facilitation in terms of collecting drying, grading, packaging, and storing Tulsi produce
- Preparation of guidelines in local language and provision of trainings to Tulsi producers and collectors in quality production, harvesting and post-harvest handling

### Immediate results of the intervention

- Understanding the end market for Tulsi leaf
- Value Chain Communication established between value chain actors on price and quality grades
- Tulsi producers’ and collectors’ groups established
- Exchange of market information between target groups
- Beneficiaries trained in Tulsi farming, harvesting and post-harvesting processes
- Establishment of a system of collecting, drying, grading, packaging and collective selling; Farmers’ groups can come up with business plans
- Viable alternative livelihood options made available for poor farmers and small farm holders
- Number of master trainers, producers’ group, collectors’ group, and federation members trained in sustainable production, nursery establishment and management, harvesting and post-harvest handling

### Intermediary level results

- Producer and collector groups negotiate and realize increased proportion of volume and value using market and price information
- Beneficiaries trained in Tulsi farming, harvesting and post-harvesting processes
- Establishment of a system of collecting, drying, grading, packaging and collective selling; Farmers’ groups can come up with business plans
- Viable alternative livelihood options made available for poor farmers and small farm holders
- Number of master trainers, producers’ group, collectors’ group, and federation members trained in sustainable production, nursery establishment and management, harvesting and post-harvest handling

### Higher level results

- Increased farm gate price received by Tulsi producers
- Increased social benefits and well-being of poor and marginal farmers
- Improved benefits to women beneficiaries from Tulsi farming
- Increased farm gate price received by Tulsi producers
- Increased social benefits and well-being of poor and marginal farmers
- Improved benefits to women beneficiaries from Tulsi farming

### Desired impact

- Adoption of Tulsi as an alternative livelihood option by wider farmers’ at least in Chamoli district
- Improved income of beneficiaries
- Improve value chain governance resulting in transparency and equity in the Tulsi value chain
- Enhanced coordination of Tulsi production and trade leading to smooth flow of up-stream, down-stream information and trade
- Viable alternative livelihood options made available for poor farmers and small farm holders
- Number of master trainers, producers’ group, collectors’ group, and federation members trained in sustainable production, nursery establishment and management, harvesting and post-harvest handling

2.2. Empirical approach

A cross-sectional survey was conducted involving beneficiary households in five of the beneficiary villages using a household survey questionnaire. Household questionnaire for this study was developed following the Theory of Change logic. Indicators relevant to intermediary, higher level results and desired impacts were included in the household survey questionnaire. Aiming at further validating quantitative findings of the study, key informant discussions were conducted with selected stakeholders.
Ordinary least squares (OLS) method was used to examine the relationship between total crop income and the income from Tulsi for the years 2016 and 2017 while controlling for other explanatory variables such as total value of crop consumption (excluding Tulsi), total value of crop production (excluding Tulsi), Tulsi production expenses, and value of total crop damages from various threats in 2016 and 2017. The findings obtained from quantitative survey were further triangulated or supplemented from the qualitative survey data gathered from key informants’ interviews.

The model used in this paper is:

\[ \ln(Y) = \alpha + \beta_1 \ln(x_1) + \beta_2 \ln(x_2) + \beta_3 \ln(x_3) + \beta_4 \ln(x_4) + \beta_5 \ln(x_5) + \epsilon \]  

(1)

Where, \( \ln(Y) \) is the dependent variable, known as log of total crop income in 2017 and is the function of \( \ln(x_1) \) (Log of total value of crop consumption in 2017), \( \ln(x_2) \) (Log total value of crop production in 2017), \( \ln(x_3) \) (Log of Tulsi income in 2017), \( \ln(x_4) \) (Log of Tulsi production expenses in 2017), \( \ln(x_5) \) (Log of total value of crop damage in 2017), and \( \epsilon \) (Error term) and \( \alpha \) (Constant). \( \beta_i \) represents regression coefficient of these explanatory variables.

Similar model has been applied to analyze the relationship between total crop income and total Tulsi income in 2016. This model assumes that total crop income will have positive relationship with Tulsi income, total value of other crop production but negative relationship with the value of crop damages, Tulsi production expenses and total value of crop consumption. In addition to linear regressions, descriptive statistics, cross tabulations and specific figures have been used to identify the changes in cropping patterns, possible major threats to cereal crops, and farmers’ coping strategies, among others.

### 3. Results

#### 3.1. Improved income and profits from Tulsi farming

Relationship between the total income from crops and from the sale of Tulsi was calculated using ordinary least square regressions method for two different time periods 2016 and 2017. Table 1 provides a summary statistics of key variables used in this empirical analysis. Worth mentioning here is the finding that the mean profit from the sale of Tulsi has substantially increased from INR 2631 in 2016 to INR 5478 in 2017 (Table 1). At the same time, the average gross profit from total crop farming also increased from a loss of INR (1622) in 2016 to INR 942 in 2017. Findings of the key informant discussions with beneficiary households suggest that increase in profit from sale of Tulsi is because beneficiary farmers have hugely benefitted from formation of Tulsi producers and collectors groups and their capacity building.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit from Tulsi in 2016</td>
<td>2631</td>
<td>1994</td>
<td>600</td>
<td>8400</td>
</tr>
<tr>
<td>Value of total crop consumption in 2016</td>
<td>3173</td>
<td>9796</td>
<td>0</td>
<td>78750</td>
</tr>
<tr>
<td>Value of total crop production in 2016</td>
<td>3068</td>
<td>3371</td>
<td>0</td>
<td>12000</td>
</tr>
<tr>
<td>Tulsi income in 2016</td>
<td>3210</td>
<td>2169</td>
<td>1050</td>
<td>9450</td>
</tr>
</tbody>
</table>

Table 1: Summary Statistics
Tulsi production expenses in 2016 | 580 | 200 | 320 | 1400
Value of total crop damage in 2016 | 98 | 13 | 0 | 103
Profit from Tulsi in 2017 | 5478 | 9405 | 705 | 53260
Value of total crop consumption in 2017 | 2166 | 4193 | 0 | 30400
Value of total crop production in 2017 | 3600 | 7981 | 0 | 60800
Tulsi income in 2017 | 6103 | 9448 | 1155 | 53960
Tulsi production expenses in 2017 | 625 | 216 | 250 | 1400
Value of total crop damage in 2017 | 98 | 12 | 0 | 100
Total crop profit in 2017 | 942 | 8625 | -5975 | 50730
Total crop profit in 2017 | -1622 | 2533 | -6250 | 6050

Note: the monetary values are reported in Indian currency denoted as INR. And 1 USD (US dollar) is equivalent to INR 73.6 in 2018. Summary statistics is based on n=65 observations.

Analysis of the OLS regression results including the correlation between total crop income and income from Tulsi in 2016 and 2017 respectively has been shown in table 2 below. In the first model, the dependent variable is the log of total crop income in 2017. The explanatory variables are log of total value of crop consumption in 2017, log of total value of crop production in 2017, log of Tulsi income in 2017, log of Tulsi production expenses in 2017 and log of total value of crop damage in 2017. Interestingly, as illustrated in table 2, we find that the total crop income for farmers increases by 0.8 percent for every 1 percent increase in Tulsi income in 2017. This relationship is statistically significant at 1 percent level. The findings of this study are consistent with the study findings conducted by [5;31;32;33] that analyze the impact of commercialization of medicinal and aromatic plants such as njansang on poverty alleviation in project villages of Cameroon.

Similarly, the farmers’ total crop income increases by 0.9 percent for every 1 percent increase in total value of crop production in 2017. This relationship is statistically significant at 1 percent level. In the second model (column 3, table 2), we find that the total crop income for farmers increases by 0.9 percent for every 1 percent increase in Tulsi income in 2016, and this relationship is statistically significant at 1 percent level.

Table 2: OLS regression estimates showing the correlation between total crop income and income from Tulsi respectively in 2016 and 2017

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
</table>
| Log (Total Value of Crop Consumption in 2017) | -0.5* (0.3) | - | -
| Log (Total Value of Crop Production in 2017) | 0.9* (0.3) | - | -
| Log (Tulsi Income in 2017) | 0.8*** (0.1) | - | -
Log (Tulsi Production Expenses in 2017) | -0.2 (0.2) | --  
Log (Total Value of Crop Damage in 2017) | 5.5 (5.4) | --  
Log (Total Value of Crop Consumption in 2016) | -- | 0.0 (0.1)  
Log (Total Value of Crop Production in 2016) | -- | 0.3*** (0.1)  
Log (Tulsi Income in 2016) | -- | 0.9*** (0.1)  
Log (Tulsi Production Expenses in 2016) | -- | -0.4** (0.1)  
Log (Total Value of Crop Damage in 2016) | -- | 0.1 (0.1)  
Constant | -24.9 (25.1) | 0.7 (0.7)  
Observations | 39 | 44  
R-squared | 0.9 | 0.9

Robust standard errors in parentheses. *** denote significance at 1 percent level, ** denote significance at 5 percent level and * denote significance at 10 percent level.

Study findings further suggest that Tulsi adoption trend has been increasing over the years. While just 200 farmers in 5 villages had adopted Tulsi farming in 2012, more than 400 farmers in 19 villages have adopted Tulsi farming as an alternative crop in 2016. Findings of the key informant discussions conducted with selected beneficiary households also validate these findings. Trend showing promising adoption of Tulsi suggests that Tulsi has a good potential of out-scaling to other villages including neighboring districts as an alternative livelihood option.

3.2. Rate of return from Tulsi farming

Interestingly, the study finds that the rate of return from Tulsi farming is higher than that of cereal crop farming. Analysis of profit and loss from Tulsi farming verses cereal crops suggests that most of the cereal crops take at least six to seven months from sowing to harvesting while basil crops take only three months. This means that within six month period (May–October), two cycles of basil crop can be harvested. This is an indication that while cereal crops provide limited income opportunity to marginal farmers, basil cultivation provides more income opportunities across its value chain such as leaf plucking, drying, blending and packaging (Table 3).

It is also clearly indicative from this analysis that farmers incur a net loss of INR 1400 with the cultivation of paddy in 0.02 hectares of land from May through October, whereas they gain a net profit of INR 2050 with the cultivation of Tulsi in the same proportion of land within a period of three to four months (Table 3). This shows a clear benefit to smallholder farmers with the cultivation of Tulsi as opposed to paddy which in return could increase wellbeing of poor and marginal farmers.

<table>
<thead>
<tr>
<th>Description</th>
<th>Paddy</th>
<th>Tulsi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time/Quantity</td>
<td>Cost (INR)</td>
</tr>
<tr>
<td>Seed (grams)</td>
<td>2000 grams</td>
<td>50</td>
</tr>
<tr>
<td>Nursery preparation / seed sowing (day)</td>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>Irrigation in nursery (days)</td>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>Weeding &amp; Hoeing ((day)</td>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>Ploughing (day)</td>
<td>1</td>
<td>200</td>
</tr>
</tbody>
</table>
Note: The comparison is based using an equal availability of arable land i.e. 0.02 hectare for Tulsi and paddy cultivation. The selling price of paddy is INR 15 per kg while that of green leaves is INR 9 per kg. The monetary values are reported in Indian currency denoted as INR. And 1 USD (US dollar) is equivalent to INR 73.6 in 2018.

3.3. Benefits to women beneficiaries

Given the involvement of women in agriculture, one can expect the potential benefits to female household members from Tulsi cultivation. Respondents were asked specifically about benefits of Tulsi farming to women beneficiaries. Findings suggest that the collection and cultivation of Tulsi has provided an important source of cash income to rural communities especially for women. Assessment findings further suggest that the intervention enabled 97% of the female beneficiaries earn an independent income from Tulsi farming. In terms of involvement of women at household level decision making, nearly all the respondents said that routine decisions pertaining to the household were made jointly by male and female heads. The cash income was usually kept by both male and female heads of the household and all the respondents said that major decisions on household expenditure were made jointly by both male and female heads of the household.

3.4. Threats to crop cultivation

The major crops like paddy, wheat and others have suffered from depredation by wild animals as well as pest infestations. The respondents were asked about the three most critical threats that have affected their crop cultivation in recent years. Notably all the farmers reported crop depredation by wild animals, water scarcity for cultivation and pest diseases as the three most frequent threats to farm cultivation.

In response to such threats, farmers were asked about the three most preferred alternative crops that they have been growing in recent years. Interestingly, 100 percent of the respondents said that they grew Tulsi as the first most preferred alternative to major crops (Figure 2). This shows that in the face of such vulnerabilities, Tulsi farming has gained prominence among the farmers in the intervention areas as an alternative to major cereal crops. More than three quarters of the respondents said that they grew dal (dal also written as dall, is a term used in the Indian subcontinent for dried, split pulses including lentils, peas, and beans) as the second most preferred alternative to major crops (Figure 2). This also indicate that

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time (day)</th>
<th>Cost (INR)</th>
<th>Output (Kg)</th>
<th>Value (INR)</th>
<th>Profit/Loss (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manuring</td>
<td>½</td>
<td>100</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Transplanting</td>
<td>1</td>
<td>200</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Irrigation in field</td>
<td>1</td>
<td>200</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Weeding &amp; Hoeing of field</td>
<td>1</td>
<td>200</td>
<td>1</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Harvesting</td>
<td>½</td>
<td>100</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>½</td>
<td>100</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Threshing/Sorting</td>
<td>1</td>
<td>200</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Drying/Packing/Storage</td>
<td>1</td>
<td>200</td>
<td>½</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Total cost (INR)</td>
<td></td>
<td>2150</td>
<td></td>
<td>1550</td>
<td></td>
</tr>
<tr>
<td>Output &amp; value (INR)</td>
<td></td>
<td>50</td>
<td>750</td>
<td>400</td>
<td>3600</td>
</tr>
<tr>
<td>Net profit &amp; loss (.02 hectare land)</td>
<td></td>
<td>-1400</td>
<td></td>
<td>2050</td>
<td></td>
</tr>
<tr>
<td>Crop cycle from nursery to harvesting (months)</td>
<td></td>
<td>6-8</td>
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a growing number of farmers in rural villages in Chamoli district have been switching to Tulsi farming in recent years as a way to escape from vulnerabilities defined above. Tulsi farming requires far less water for cultivation as opposed to paddy cultivation and other major cereals. This also suggests that Tulsi farming has potential to increase resilience of farmers in responding to such threats and vulnerabilities.

Figure 2: Most preferable crops due to the potential threats (percent of respondents)

![Most preferable crops due to the potential threats (percent of respondents)](image)

3.5. Factors influencing earning from Tulsi farming

Given the fact that Tulsi farming has gained prominence among the farmers in the intervention areas. Farmers were asked about the various factors that have enabled them to earn more from Tulsi cultivation. Almost 94 percent of the respondents said that the first main factor that enabled them to maximize earnings from Tulsi farming was the formation of Tulsi producers and collectors groups. Finding of key informant discussions further revealed that formation of these groups not only helped beneficiaries realize increased proportion of sale volume of Tulsi produce but also enable them to negotiate better price for their produce. Nearly 89 percent of the respondents said that the second main factor that enabled them to earn more from Tulsi farming was capacity building which helped them better manage Tulsi farming in terms of nursery establishment and management, quality harvesting and post-harvest handling of Tulsi produce. Slightly more than 90 percent of the respondents said that the third main factor that enabled them to maximize earnings from Tulsi farming was the increased productivity.

3.6. Other benefits of Tulsi farming

The respondents were asked about the specific ways in which Tulsi farming had benefitted the rural households. Two-thirds of the respondents said that their household income had increased as a result of Tulsi farming. Slightly more than one-tenth of the respondents said that they had been able to meet daily family needs with increased earnings from Tulsi farming (Table 4).

Table 4: Other benefits from Tulsi farming

<table>
<thead>
<tr>
<th>Tulsi farming contribution</th>
<th>Percent of responses</th>
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<tbody>
<tr>
<td>Increment in income source</td>
<td>68</td>
</tr>
<tr>
<td>Meet daily family needs</td>
<td>14</td>
</tr>
<tr>
<td>Increase saving</td>
<td>3</td>
</tr>
<tr>
<td>Increase purchasing power</td>
<td>3</td>
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</table>
4. Conclusion and discussion

The value chain development intervention on Tulsi has created pursued impacts at the household level. It created opportunities particularly for women farmers to earn independent cash income. The agriculture requirement for cultivating Tulsi is less as compared to other traditional crops grown in Chamoli district. On the other hand Tulsi is less water intensive, less affected by pest diseases and is less affected by animal predation thereby reducing risk of poor and marginal farmers of their crops being vulnerable to these intense agriculture requirements. This also suggests that Tulsi farming has potential to increase resilience of farmers in order to respond to threats and vulnerabilities to other traditional crops grown in the district.

The intervention applied a holistic approach to address complex issues of diversification of farm production and introduction of efficient marketing strategies with local institution. It facilitated capacity building of beneficiaries and social mobilization through the formation of Tulsi producers’ and collectors’ linking them to available market. This in return value chain governance in terms of enhanced coordination of Tulsi production and local level trade which resulted in transparency and equity in Tulsi value chain. Hence the integrated and community led value chain approach adopted by the intervention has proved to be the basis for generating income from Tulsi thereby improving resilience in their livelihoods.

Given the findings of this study, Tulsi value chain as an alternative source of livelihood diversification option could be further expanded. This could be out-scaled at district level in the larger Chamoli district in particular and up-scaled to other districts of Uttarakhand state in India. However, this will require commitment and support from the government as well as development agencies. Similarly, at present, product testing and diversifying Tulsi products is done at a small scale with limited resources. Taking it to a proposed scale also requires equal commitment and support from government.

Markets access and linking farmers at least to available is among the key drivers for adopting alternative crops and farmers adopt alternative crops if their risks from market failures and loss of income are adequately addressed. Reducing risk and vulnerability of farmers and processors from market failure is required to be seen as an integral part of adaptation strategies. This could be attained through further strengthening market linkages with producers, buyers and end users for producing and marketing Tulsi products.

Process and functional upgrading for different value added products from Tulsi, for example, Tulsi oil, Tulsi powder, Tulsi Tea and niche branding, quality production and identifying relevant consumer market for such value added products from Tulsi could have positive and multiplier effects on beneficiaries’ income from Tulsi value chain. This would require establishing Tulsi as a niche product at least in the national market. At producers’ level, this would require further capacity building in post-harvest practices like proper drying, quality grading and storage. At processors level this would require introduction of new technology for quality processing and packaging. At the same time, this would also require further strengthening of community led local institutions including local level institutions involved in processing and marketing of Tulsi products.

Women are mainly responsible for farm based activities in mountains. Therefore, it is highly desirable that such interventions recognises gender and social equity aspects of particularly women and
adequately addresses gender and equity aspects so that women are not only able to earn an independent income from such interventions but their social equity is also recognized.

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