

1 Article

2 **Tulsi - an alternative livelihood for the poor and smallholder farmers**

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

26

27 **Keywords:** *ocimum sanctum*; alternative livelihoods; crop depredation; out-scaling; tulsi; value chain
28 development

29 1. Introduction

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

50 Ocimum Sanctum (Sanskrit: Tulasi [or Tulsi]; English: holy basil; family: Labiateae), one such
51 NTFP. Tulsi (Ocimum sanctum), an aromatic shrub, is a perennial plant with purple-pink flowers that
52 produces light lemon scent. Historically, it is known for its healing power that dates back over thousands
53 of years. The plant acts as a natural anti-stress agent and boosts immune system [7]. Tulsi is less water
54 intensive crop and is less affected by animal depredation and pest-diseases as opposed to other major
55 cereal crops. Tulsi is found throughout the semi tropical and tropical parts of India. Tulsi is an important
56 medicinal plant in the various traditional and folk systems of medicine in Southeast Asia [8]. Given its
57 importance as medicinal and aromatic plant, Tulsi today is also commonly consumed in supplement
58 form as Tulsi tea. While Tulsi is believed to have originated in north central India, it is widely popular
59 today and is grown throughout the eastern world tropics [9]. Approximately 50 million people in India
60 rely on non-timber forest products and medicinal and aromatic plants for sustaining their livelihoods
61 [10]. Non-timber forest products and medicinal and aromatic plants significantly contribute towards the
62 annual cash income of the local people in southern Meghalaya of India [11]. Data show that the collection
63 and processing of medicinal and aromatic plants in India contribute at least 35 million working days of
64 employment in a year [12]. The global demand of medicinal and aromatic plants has grown substantially
65 with an estimated sale of herbal medicines to have exceeded from 12.5 billion USD in 1994 to 30 billion
66 USD in 2000 [13]. In fact, the global demand of medicinal and aromatic plants is growing at an annual
67 rate of 5 to 15 percent. The secretariat of the Convention on Biological Diversity has forecasted that the
68 world market for herbal medicines and associated products will reach 5 trillion USD by 2050 [14]. The
69 environment in which agricultural discovery and innovation occurs has been constantly changing with

70 resultant significant influences on the organization and the social processes of discovery and innovation
71 [15]. As a result, there have been significant paradigm shifts in agricultural knowledge generation,
72 dissemination and utilization [16].

73 Development of agro-industries with an emphasis on promoting effective agro-value chains has
74 been increasingly practiced to enhance agricultural growth and reduce poverty. Value chain development
75 not only helps to generate employment opportunities but also offers market access to smallholders and
76 creates business linkages to small and medium enterprises [17]. It is especially important in many poor
77 and developing nations across the globe as it helps to minimize the post-harvest losses and reduce rural
78 poverty [17]. The value chain approach is among the most effective ways to improve linkages between
79 businesses and poor communities, tackle poverty, and develop a local resource-based enterprise that
80 benefits local people [18; 19]. Value chain development comprises of a full range of activities and services
81 of market actors that are essential to transform a product or service from its origin to end-use product or
82 service [20]. Along the similar lines, [21] defines value chain as the full range of activities which are
83 required to bring a product or service from conception, through the different phases of production
84 (involving a combination of physical transformation and the input of various producer services), delivery
85 to final consumers, and final disposal after use. According to [21], the development of value chains
86 should use a practical approach that supports specific target groups and is useful in understanding how
87 poor people in rural areas of developing countries can efficiently engage in domestic, regional, or
88 international trade. It is a stepwise process to create a sustainable approach to enable local producer
89 communities to generate employment and gain an equitable share of benefits from their local products
90 [22]. It is essentially related with the concept of upgrading products that enable producers to move up the
91 value chain, thereby enabling them to make products with more value-addition and achieving better
92 results [23]. Upgrading of products via value chain development entail acquiring capabilities and
93 accessing new market segments via participation in particular chains [24]. Actors who are part of the
94 value chain mechanism include collectors, processors, manufacturers, traders, and consumers who work
95 together for improving the supply of inputs, extension services, and access to market facilities [25; 26].
96 Value chain interventions depending on their nature and types tend to have positive impacts on the
97 outcomes of interest. For instance, value chain interventions related to trainings and better harvesting
98 practices tend to increase the income of poor households, enhance understanding of environmental
99 values and promote gender equality, among others [27]. Similarly, skill-enhancing training programs
100 tend to raise women empowerment in the form of increased income, more bargaining power and
101 decision making on various fronts [27]. While studying upgrading bay leaf farmers in value chains [28]
102 also suggested that with an upgraded value chain, the bargaining power of rural households' increases in
103 terms of higher market prices for their produce. Many researchers have assessed value chain based
104 interventions and their comparative impacts. For example, [29] study the prospects of developing a
105 sustainable smallholder commercial production of African Leafy vegetables through pro-poor market
106 development initiatives. They show that with the set-up of collective marketing systems and increased
107 group efficiency through production skills training, poor and marginal farmers benefit with their
108 increased participation in the market place [30]. Further, [31] analyse the impact of commercialization of
109 medicinal and aromatic plants such as njansang (oily seed tree) on poverty alleviation in project villages
110 of Cameroon. They find that project interventions help increase total cash income of the poor and

111 marginal smallholder farmers in project households [31]. Similarly, [32] investigate the determinants and
112 impacts of cooperative organization, especially the farmer groups on better linking smallholder farmers
113 to emerging value chains in the Kenyan banana sector. They find that while cooperative organizations
114 may not necessarily improve market accessibility for smallholder farmers, the potential benefits to
115 farmers are very product and context specific depending on the concrete and collective actions pursued.
116 [32] Further argues that farmer groups have the potential to better link farmers with emerging high-value
117 chains thereby increasing farmers' benefits and making the groups more sustainable. Along the similar
118 lines, [33] assess the effect of strengthening Malta Orange value chains through institutional development
119 on smallholder farmers in Chamoli district of Uttarakhand, India. Their assessment argues that due to
120 unorganized market mechanisms, producers sell their produce intermediaries at lower prices. They
121 found that a value chain targeting production, processing and marketing smallholder farmers become
122 well organized, their bargaining power improves, and consequently sell their produce in a better price.

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

127 **2. Material and methods**

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

141 **2.1. Description of Tulsi value chain development intervention**

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

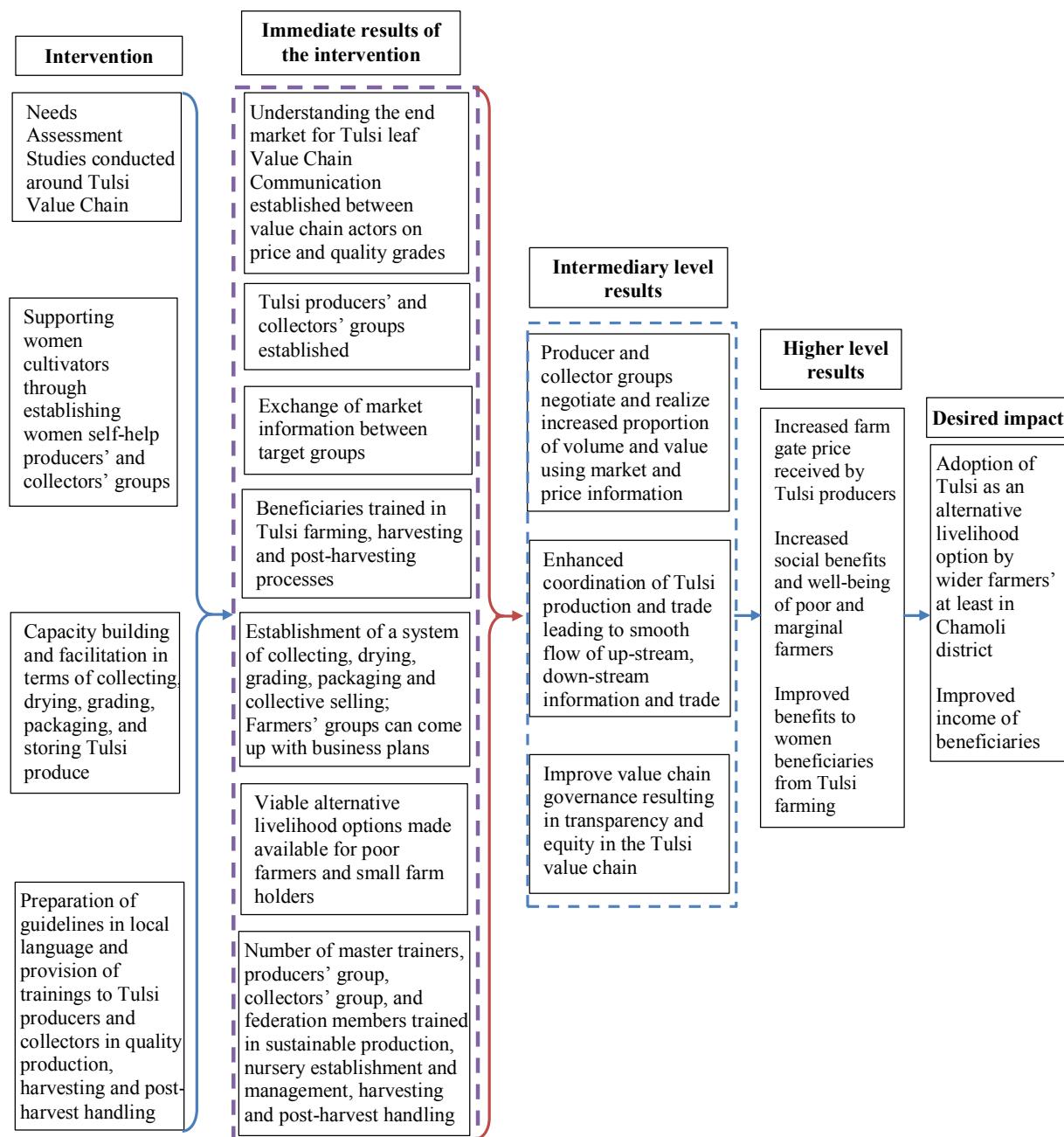
152 Chamoli district. Beneficiary farmers were small and marginal farmers with average land holdings
153 between 0.70 to 1.34 hectares of land. Beneficiary farmer cultivated Tulsi on a total of 8.2 hectares of land
154 in these 5 villages.

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

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

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Figure 1: Theory of Change realised for Tulsi value chain development intervention

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197 2.2. Empirical approach

198 A crosssectional survey was conducted involving beneficiary households in five of the
 199 beneficiary villages using a household survey questionnaire. Household questionnaire for this study was
 200 developed following the Theory of Change logic. Indicators relevant to intermediary, higher level results
 201 and desired impacts were included in the household survey questionnaire. Aiming at further validating
 202 quantitative findings of the study, key informant discussions were conducted with selected stakeholders.

203 Ordinary least squares (OLS) method was used to examine the relationship between total crop income
 204 and the income from Tulsi for the years 2016 and 2017 while controlling for other explanatory variables
 205 such as total value of crop consumption (excluding Tulsi), total value of crop production (excluding
 206 Tulsi), Tulsi production expenses, and value of total crop damages from various threats in 2016 and 2017.
 207 The findings obtained from quantitative survey were further triangulated or supplemented from the
 208 qualitative survey data gathered from key informants' interviews.

209 The model used in this paper is:

210 $\ln(Y) = \alpha + \beta_1 \ln(x_1) + \beta_2 \ln(x_2) + \beta_3 \ln(x_3) + \beta_4 \ln(x_4) + \beta_5 \ln(x_5) + \epsilon$ ----- (1)

211 Where, $\ln(Y)$ is the dependent variable, known as log of total crop income in 2017 and is the
 212 function of $\ln(x_1)$ (Log of total value of crop consumption in 2017), $\ln(x_2)$ (Log total value of crop
 213 production in 2017), $\ln(x_3)$ (Log of Tulsi income in 2017), $\ln(x_4)$ (Log of Tulsi production expenses in
 214 2017), $\ln(x_5)$ (Log of total value of crop damage in 2017), and ϵ (Error term) and α (Constant). β_i
 215 represents regression coefficient of these explanatory variables.

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

223 3. Results

224 3.1. Improved income and profits from Tulsi farming

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

233 **Table 1:** Summary Statistics

Variables	Mean	Standard deviation	Minimum	Maximum
Profit from Tulsi in 2016	2631	1994	600	8400
Value of total crop consumption in 2016	3173	9796	0	78750
Value of total crop production in 2016	3068	3371	0	12000
Tulsi income in 2016	3210	2169	1050	9450

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

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

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

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

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

(1)	(2)	(3)
Variables	Log Total Crop	
	Income in 2017	Income in 2016
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

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

255 Study findings further suggest that Tulsi adoption trend has been increasing over the years.

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

261 3.2. Rate of return from Tulsi farming

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

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

274 **Table 3:** Rate of return analysis for the cultivation of Tulsi versus cereal crops (paddy)

Description	Paddy		Tulsi	
	Time/ Quantity	Cost (INR)	Time/ Quantity	Cost (INR)
Seed (grams)	2000 grams	50	50 grams	50
Nursery preparation / seed sowing (day)	1	200	½	100
Irrigation in nursery (days)	1	200	½	100
Weeding & Hoeing ((day)	1	200	1	200
Ploughing (day)	1	200	1	200

Manuring (day)	½	100	½	100
Transplanting (day)	1	200	½	100
Irrigation in filed (day)	1	200	½	100
Weeding & Hoeing of field (day)	1	200	1	200
Harvesting (day)	½	100	½	100
Transportation (day)	½	100	½	100
Threshing/ Sorting	1	200	½	100
Drying/Packing/Storage	1	200	½	100
Total cost (INR)		2150		1550
Output & value (in Kg)	50	750	400	3600
Net profit & loss (.02 hectare land)		-1400		2050
Crop cycle from nursery to harvesting (months)	6-8		3-4	

275 Note: the comparison is based using an equal availability of arable land i.e. 0.02 hectare for Tulsi and paddy
 276 cultivation. The selling price of paddy is INR 15 per kg while that of green leaves is INR 9 per kg. The
 277 monetary values are reported in Indian currency denoted as INR. And 1 USD (US dollar) is equivalent to INR
 278 73.6 in 2018

279 **3.3. Benefits to women beneficiaries**

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

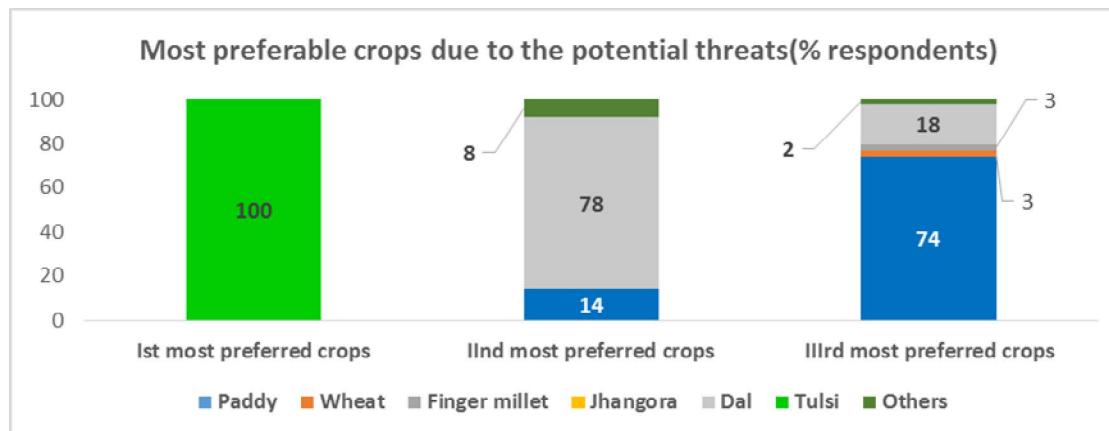
290 **3.4. Threats to crop cultivation**

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

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

303 a growing number of farmers in rural villages in Chamoli district have been switching to Tulsi farming in
 304 recent years as a way to escape from vulnerabilities defined above. Tulsi farming requires far less water
 305 for cultivation as opposed to paddy cultivation and other major cereals. This also suggests that Tulsi
 306 farming has potential to increase resilience of farmers in responding to such threats and vulnerabilities.
 307

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



310

311 3.5. Factors influencing earning from Tulsi farming

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

324 3.6. Other benefits of Tusli farming

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

329 **Table 4:** Other benefits from Tulsi farming

Tulsi farming contribution	Percent of responses
Increment in income source	68
Meet daily family needs	14
Increase saving	3
Increase purchasing power	3

Others	12	330
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332 **4. Conclusion and discussion**

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

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

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

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

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

369 Women are mainly responsible for farm based activities in mountains. Therefore, it is highly
 370 desirable that such interventions recognises gender and social equity aspects of particularly women and

371 adequately addresses gender and equity aspects so that women are not only able to earn an independent
372 income from such interventions but their social equity is also recognized.

373

374 **Acknowledgments:** The authors would like to thank the anonymous reviewers of this paper. We would
375 also like to acknowledge support of the Internal Fund for Agriculture Development (IFAD) for
376 supporting Improving Livelihoods and Enhancing Resilience of the Rural Poor in the Hindu Kush
377 Himalayas to Environmental and Socio-economic Changes (AdaptHimal) initiative of the International
378 Centre for Integrated Mountain Development. Under this initiative Tulsi value chain development
379 intervention was implemented in Chamoli district of Uttarakhand state in India. The authors gratefully
380 acknowledge the support of core donors of ICIMOD: the Governments of Afghanistan, Australia, Austria,
381 Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United
382 Kingdom. The views and interpretations expressed in this paper are those of the authors and are not
383 attributable to ICIMOD or any other organizations.

384 **Conflicts of Interest:** The authors of this article declare no conflict of interest. Authors also declare that
385 there is no any personal circumstances or interest that influenced the representation, interpretation of
386 research results reported herein. The funders had no role in the design of the study, in the collection,
387 analyses, and interpretation of data used for this study, in the writing of the manuscript, or in the
388 decision to publish the results.

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390 **References**

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