

Economics of Production and Marketing of important Medicinal and Aromatic Plants in Mid Hills of Himachal Pradesh

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Abstract

Himachal Pradesh has a rich diversity of medicinal and aromatic plants. These plants have good potential of generating income. Owing to its natural habitat the economics of production of some important medicinal and aromatic plants (MAPs), has been examined based on the field level information from the state of Himachal Pradesh. This study was designed to appraise multistage random sampling technique to select the sample of 50 farmers cultivating MAPs. Local and distant markets were selected purposively for conducting marketing study. A total sample of five traders from local markets and five wholesalers from Amritsar market was drawn randomly from the selected markets dealing in MAPs. Cost of cultivation of these medicinal plants was calculated and the financial tools like NPV, BCR, and IRR were applied to determine the financial feasibility of the plantations. The analysis revealed that the net return per hectare was maximum from *Stevia* (₹ 173627.29), followed by *Safed Musli* (₹ 85462.01), *Aloe vera* (₹ 63832.29) and *Lemon grass* (₹ 43325.69). The benefit–cost ratio was found to be in the similar trend i.e., *Safed Musli* (1.30), followed by *Stevia* (1.27), *Aloe vera* (1.22) and *Lemon grass* (1.19). However, the internal rate of return was found to be highest in case of *Lemon grass* (40%), followed by *Aloe vera* (36%) and *Stevia* (32%). Hence the cultivation of MAPs seems to have good returns which farmers can opt instead of growing other plants.

Keywords: Medicinal & aromatic plants, *Aloe vera*, *Stevia*, *Lemon grass* and *Safed musli*

Introduction

Plants primarily used for their medicinal or aromatic properties in pharmacy or perfumery are defined as medicinal and aromatic plants in the European Union (Overwalle, 2006). Forests have played key roles in the lives of people living in both mountains and lowland areas by supplying fresh water and oxygen as well as providing a diversity of valuable forest products for food and medicine (Kala, 2004). Furthermore, the cosmetic industries are increasingly using natural ingredients in their products, and these natural ingredients include extracts of several medicinal plants (KIT, 2004). India and China are two of the largest countries in Asia, which have the richest arrays of registered and relatively well-known medicinal plants (Raven, 1998).

Since the Indian subcontinent is well known for its diversity of forest products and the age-old healthcare traditions, there is an urgent need to establish these traditional values in both the national and international perspectives realizing the ongoing developmental trends in traditional knowledge (Kala, 2006). Apart from health care, medicinal plants are mainly the alternate income-generating source of underprivileged communities (Myers, 1991 and Lacuna-Richman, 2002) therefore; strengthening this sector may benefit and improve the living standard of poor people. A great deal of traditional knowledge of the use of various plant species is still intact with the indigenous people, and this fact is especially relevant with the mountainous areas such as the Himalaya due to less accessibility of terrain and comparatively slow rate of development (Kala, 2002 and Farooquee *et al.* 2004)

National and regional demands for herbal medicine are accelerating (WWF, 2000 and Karki, 2005) and globalization of herbal medicine, along with uncontrolled exploitative practices and lack of concerted conservation efforts, now threaten the country's medicinal plants (Singh *et al.* 1979 and Olsen and Larsen, 2003). Numerous drugs have been introduced to international markets (Sharma and Mujundar, 2003) through validation of traditional medicines (Busmann, 2002), indigenous therapies (Bhattarai, 1997 and Patwardhan, 2005), and ethno-pharmacological practices (Kunwar *et al.* 2009).

The present study was taken up with overall objective of enquiring into economics of production and marketing of MAPs being cultivated in mid hill zone of Himachal Pradesh. This study is an attempt to analyze the feasibility of investment in those crops and to find out the profitability in the region. It will also focus on several issues faced by the households engaged in their cultivation.

Use and diversity in medicinal plants

In India, of the 17,000 species of higher plants, 7500 are known for medicinal uses (Shiva, 1996). This proportion of medicinal plants is the highest proportion of plants known for their medical purposes in any country of the world for the existing flora of that respective country (Table 1). Ayurveda, the oldest medical system in Indian sub-continent, has alone reported approximately 2000 medicinal plant species, followed by Siddha and Unani (Table 2). The

Charak Samhita, an age-old written document on herbal therapy, reports on the production of 340 herbal drugs and their indigenous uses (Prajapati *et al.* 2003)]. Currently, approximately 25% of drugs are derived from plants, and many others are synthetic analogues built on prototype compounds isolated from plant species in modern pharmacopoeia (Rao *et al.* 2004).

The northern part of India possesses a great diversity of medicinal plants because of the royal Himalayan range. So far about 8000 species of angiosperms, 44 species of gymnosperms and 600 species of pteridophytes have been reported in the Indian Himalaya (Singh and Hajra, 1996), of these 1748 species are known as medicinal plants (Samant *et al.* 1998). The maximum medicinal plants (1717 species) have been reported around the 1800 m elevation range. On the regional scale, the maximum species of medicinal plants have been reported from Uttaranchal (Kala, 2004), followed by Sikkim and North Bengal (Samant *et al.* 1998). The trans-Himalaya sustains about 337 species of medicinal plants (Kala, 2002), which is low compared to other areas of the Himalaya due to the distinct geography and ecological marginal conditions (Kala and Mathur, 2002).

Table 1. Distribution of medicinal plants

Country or region	Total number of nativespecies in flora	No of medicinal plant species reported	% of medicinal plants	Source
World	297000	52885	10	Schippmann <i>et al.</i> 2002
India	17000	7500	44	Shiva 1996
Indian Himalayas	8000	1748	22	Samant <i>et al.</i> 1998

Table 2: The status of various medical systems in India

Characteristics	Medical Systems				
	Ayurveda	Siddha	Unani	Tibetan	Homeopathy
Medicinal plants known	2000	1121	751	337	482
Licensed pharmacies	8533	384	462	-	613
Hospitals	753	276	74	-	223
Dispensaries	15193	444	1193	-	5634
Registered practitioners	438721	17560	43578	-	217460
Under graduate college	219	6	37	-	178
Post graduate college	57	3	8	-	31

Modified after Anonymous 2004, 2005 [79, 80]

Challenges in medicinal and aromatic plants sector

Medicinal and aromatic plants have played a major role in rural economy of Himachal Pradesh. Twenty four of the 100 most important medicinal plant species traded in the country are found in this state. The state exports 2,500 tonnes of medicinal plants and their economic parts. The legal annual trade in medicinal plants in the state is worth about ₹ 10 crore at current market prices. The state government earns about ₹ 40 lakh per annum from export permits for medicinal plants. The Himachal Pradesh Forestry Sector Medicinal Plants Policy (HPFSMPP, 2006) for instance, aims on further basic objectives of meeting the minor forest produce requirements of the state's rural and tribal populations in accordance with the National Forest Policy, 1988.

Realizing the importance of MAPs the state government is providing impetus to the cultivation of medicinal plants to make Himachal, a 'Herbal State' of the country. As a result of those initiatives, the cultivation of MAPs is picking up in the state. The persuasion of the local people has started bearing results and now people are carrying out this trial with zeal. This novel initiative will not only bring larger areas under green cover and medicinal plants but at the same time it open up an effective means of livelihood to the rural people reeling under problems of shrinking land holdings and monkey menace. Though there are a number of important medicinal and aromatic plants under cultivation, this study is limited to four common plants *viz.*, *Aloe vera* (*Aloe barbedensis*), *Stevia* (*Stevia rebaudiana*), Lemon grass (*Cymbopogon citratus*) and Safed musli (*Chlorophytum borivillianum*).

Methodology

A multistage random sampling design was used for the selection of the respondents. In the first stage Mandi district in the mid hill zone was selected for the present study. In the next stage of sampling, one tehsil of the district with high concentration of MAPs cultivators *i.e.* Joginder Nagar, was selected to draw final respondents. In the final stage of sampling, a complete list of farmers was prepared in consultation with the different related departments. From the list 50 respondents were selected randomly for survey. The primary data were collected through personal interview using a pre-tested questionnaire. To examine the economics of these aromatic plants, simple cost accounting method was followed. The financial feasibility was worked out by comparing costs and returns at different stages of economic life. The prices used in the analysis were triennium averages for the period 2010-12, and the summary measures captured were net present value (NPV) benefit cost ratio (BCR), and internal rate of return (IRR) [DCF, 2014].

Results and Discussion

Cost and return structure of medicinal and aromatic plants

The per hectare annual costs and returns of *Aloe vera*, *Stevia*, Lemon grass and *Safed musli* were calculated at current prices and have been presented in Table 3, 4, 5, and 6 respectively. The economic life of *Aloe vera*, *Stevia*, and Lemon grass was five years whereas *Safed musli* is an annual crop. The per hectare cost of cultivation of *Aloe vera*, *Stevia*, and Lemon grass herbage has been found maximum during the initial year, but declined substantially in subsequent years due to the absence of cost of planting material.

Table 3: Per hectare cost of cultivation for Aloe vera (Percentage)

Sr. No.	Particulars	1st year	2nd year	3rd year	4th year	5th year
Material Costs						
	Planting Material Cost	54.51	19.31	0.00	0.00	0.00
	Fencing cost	0.61	0.00	0.00	0.00	0.00
	FYM Cost	4.46	12.24	16.85	16.85	16.85
	Vermicompost	2.05	6.95	9.82	9.82	9.82
	Miscellaneous	0.34	0.86	1.10	1.10	1.10
	Sub-Total	61.97	39.36	27.77	27.77	27.77
Labour Costs						
2	Bullock Labour	2.03	0.00	0.00	0.00	0.00
3	Human Labour					
	Layout & Preparation	1.53	0.54	0.00	0.00	0.00
	FYM+Vermicompost Application	1.28	3.69	5.10	5.10	5.10
	Planting	1.12	0.28	0.00	0.00	0.00
	Irrigation	3.32	10.79	14.19	14.19	14.19
	Weeding	1.67	5.68	7.28	7.28	7.28
	Harvesting	2.33	8.53	11.45	11.45	11.45
	Sub-Total	11.25	29.51	38.03	38.03	38.03
i.	Hired Labour Costs	4.87	12	14.84	14.84	14.84
ii.	Family Labour Costs	6.38	17.51	23.2	23.2	23.2
4	Interest on working capital	3.1	2.31	1.92	1.92	1.92
5	Risk Margin	6.89	5.14	4.26	4.26	4.26
6	Managerial cost	6.89	5.14	4.26	4.26	4.26

Contd.

	Sub-Total	16.87	12.58	10.44	10.44	10.44
	Total Variable Costs	92.13	81.46	76.24	76.24	76.24
Fixed cost						
7	Land Revenue	0.02	0.05	0.07	0.07	0.07
8	Depreciation	0.14	0.32	0.41	0.41	0.41
9	Interest on Fixed Capital	0.12	0.29	0.37	0.37	0.37
10	Rental Value of land	7.6	17.88	22.91	22.91	22.91
	Total Fixed Cost	7.87	18.54	23.76	23.76	23.76
Total Cost		100.00	100.00	100.00	100.00	100.00
Total Cost in Rupees		140057.88	60533.31	47748.06	47748.06	47748.06
Gross Returns per hectare @ ₹ 5/kg Leaves & @ ₹ 2/sucker		35755.51	97867.66	109381.81	112318.2	110227.19
Net Returns (₹)		-104302.36	37334.35	61633.75	64570.14	62479.13
Yield of Leaves (Kg)		7151.10	14850.66	15440.56	16027.84	15609.64
Yield of Suckers (no. /plant)		0.00	11807.17	16089.50	16089.50	16089.50

Cost and return structure in *Aloe vera* cultivation

The item wise plantation cost incurred in the cultivation of *Aloe vera* for different years is presented in Table 3. It is clear from the table that, farmers incurred on an average, a total cost of ₹ 140057.88 per hectare, in the first year of plantation. Cost incurred on material inputs averaged nearly 61.97 per cent of the total cost while human labour investment was around 11.25 per cent. Rental value of land shared 7.60 per cent of the total cost at large farms. Risk margin and managerial cost each accounted for 6.89 per cent of the total cost.

For the second year, farmers incurred on an average, a total cost of ₹ 60533.31 per hectare. Cost incurred on material inputs averaged nearly 39.36 per cent of the total cost while human labour investment was around 29.51 per cent. Rental value of land shared 17.88 per cent of the total cost. Risk margin and managerial cost each accounted for 5.14 per cent of the total cost at overall farms.

In the 3rd, 4th and 5th year total cost was found to be similar. Farmers incurred on an average, a total cost of ₹ 47748.06 per hectare. Human labour investment was around 38.03 per cent. Cost incurred on material inputs averaged nearly 27.77 per cent of the total cost. Rental value of land shared 22.91 per cent of the total cost. Risk margin and managerial cost each accounted for 4.26 per cent of the total cost at overall farms. The hired labour cost for overall farms was found to vary from 31.65 per cent to 28.69 per cent of the total labour cost from 1st to 5th year.

The gross returns obtained for different years were ₹ 35755.51, ₹ 97867.66, ₹ 109381.81, ₹ 112318.20 and ₹ 110227.19 for 1st, 2nd, 3rd, 4th and 5th year respectively. The net return was negative in the first year and gradually increased up to 4th year then started declining.

Cost and return structure in *Stevia* cultivation

The item wise plantation cost incurred in the cultivation of *Stevia* in different years is presented in Table 4. It is clear from the table that, farmers incurred on an average, a total cost of ₹478941.51 per hectare, in the first year of plantation. Cost incurred on material inputs averaged nearly 75.51 per cent of the total cost. Risk margin and managerial cost each accounted for 7.72 per cent of the total cost. Interest on working capital shared 3.47 per cent of total cost. Human labour investment was around 2.73 per cent and rental value of land shared 2.15 per cent of the total cost at overall farms.

Table 4: Per hectare cost of cultivation for *Stevia* (Percentage)

Sr. No.	Particulars	1st year	2nd year	3rd year	4th year	5th year
Material Costs						
1	Material Costs					
	Planting Material Cost	70.66	26.05	0.00	0.00	0.00
	FYM Cost	1.15	13.18	19.51	19.51	19.51
	Vermicompost	0.76	7.83	11.68	11.68	11.68
	Irrigation system	2.88	0.00	0.00	0.00	0.00
	Miscellaneous	0.06	0.63	0.94	0.94	0.94
	Sub-Total	75.51	47.69	32.13	32.13	32.13
Variable Labour Costs						
2	Bullock Labour	0.59	0.00	0.00	0.00	0.00
3	Human Labour					
	Layout & Preparation	0.27	0.23	0.00	0.00	0.00
	FYM+Vermicompost Application	0.39	3.55	5.32	5.32	5.32
	Planting	0.41	0.24	0.00	0.00	0.00
	Irrigation	0.66	7.19	10.77	10.77	10.77
	Weeding	0.45	3.58	5.43	5.43	5.43
	Harvesting	0.41	6.12	9.19	9.19	9.19
	Drying	0.15	1.44	2.15	2.15	2.15

	Sub-Total	2.73	22.35	32.86	32.86	32.86
i.	Hired Labour	1.11	8.25	11.50	11.50	11.50
ii.	Family Labour	1.63	14.11	21.36	21.36	21.36
4	Interest on working capital	3.47	2.52	1.96	1.96	1.96
5	Risk Margin	7.72	5.59	4.36	4.36	4.36
6	Managerial cost	7.72	5.59	4.36	4.36	4.36
	Sub-Total	18.91	13.70	10.69	10.69	10.69
	Total Variable Costs	97.75	83.75	75.68	75.68	75.68
Fixed cost						
7	Land Revenue	0.01	0.05	0.07	0.07	0.07
8	Depreciation	0.05	0.37	0.55	0.55	0.55
9	Interest on Fixed Capital	0.05	0.33	0.49	0.49	0.49
10	Rental Value of land	2.15	15.50	23.21	23.21	23.21
	Total Fixed Cost	2.25	16.25	24.32	24.32	24.32
Total Cost		100.00	100.00	100.00	100.00	100.00
Total Cost in Rupees		478941.51	66915.82	44824.00	44824.00	44824.00
Returns/ha @ ₹ 100/kg		115953.68	217254.82	227173.10	237978.97	232910.54
Net Returns (₹)		-362987.83	150338.99	182349.09	193154.97	188086.52
Yield of Dry Leaves (Kg)		1159.54	2172.55	2271.73	2379.79	2329.11

For the second year, farmers incurred on an average, a total cost of ₹ 66915.82 per hectare. Cost incurred on material inputs averaged nearly 47.69 per cent of the total cost while human labour investment was around 22.35 per cent. Rental value of land shared 15.50 per cent of the total cost. Risk margin and managerial cost each accounted for 5.59 per cent of the total cost at overall farms.

In the 3rd, 4th and 5th year total cost was found to be similar. Farmers incurred on an average, a total cost of ₹ 44824.00 per hectare. Human labour investment was around 32.86 per cent. Cost incurred on material inputs averaged nearly 32.13 per cent of the total cost. Rental value of land shared 23.21 per cent of the total cost. Risk margin and managerial cost each accounted for 4.36 per cent of the total cost at overall farms. The family labour cost at an overall level was found to vary from 29.00 per cent to 35.00 per cent of the total labour cost from 1st to 5th year.

The gross returns obtained for different years were ₹ 115953.68, ₹ 217254.82, ₹ 227173.10, ₹ 237978.97 and ₹ 232910.54 for 1st, 2nd, 3rd, 4th and 5th year respectively. The net return was negative in the first year and gradually increased up to 4th year then started declining.

Cost and return structure in Lemon grass cultivation

The item wise plantation cost incurred in the cultivation of Lemon grass in different years is presented in Table 5. It is imperative to examine the resource position of the growers before deciding to go for cultivation. It is clear from the table that, farmers incurred on an average, a total cost of ₹ 78909.47 per hectare, in the first year of plantation. Cost incurred on material inputs averaged nearly 44.58 per cent of the total cost. Human labour investment was around 24.48 per cent and rental value of land shared 12.02 per cent of the total cost. Risk margin and managerial cost each accounted for 6.16 per cent of the total cost. Interest on working capital shared 2.77 per cent of total cost at overall farms.

Table 5: Per hectare cost of cultivation for Lemon Grass (Percentage)

Sr. No.	Particulars	1st year	2nd year	3rd year	4th year	5th year
Material Costs						
1	Material Costs					
	Planting Material Cost	31.61	4.68	0.00	0.00	0.00
	FYM Cost	6.30	16.58	17.88	17.88	17.88
	Vermicompost	5.70	12.98	13.99	13.99	13.99
	Fencing	0.15	0.00	0.00	0.00	0.00
	Miscellaneous	0.81	1.32	1.42	1.42	1.42
	Sub-Total	44.58	35.56	33.28	33.28	33.28
Labour Costs						
2	Machine Labour	3.60	0.00	0.00	0.00	0.00
3	Human Labour					
	Layout & Preparation	4.80	0.75	0.00	0.00	0.00
	FYM+Vermicompost Application	5.46	9.90	10.67	10.67	10.67
	Planting	2.40	0.28	0.00	0.00	0.00
	Irrigation	4.77	8.33	8.98	8.98	8.98
	Weeding	2.95	5.22	5.62	5.62	5.62
	Harvesting	4.09	8.62	9.29	9.29	9.29
	Sub-Total	24.48	33.10	34.57	34.57	34.57
i.	Hired Labour Costs	13.57	17.23	16.92	16.92	16.92
ii.	Family Labour Costs	11.05	15.86	17.64	17.64	17.64
4	Interest on working capital	2.77	2.38	2.26	2.26	2.26

Contd.

5	Risk Margin	6.16	5.28	5.02	5.02	5.02
6	Managerial cost	6.16	5.28	5.02	5.02	5.02
	Sub-Total	15.09	12.93	12.30	12.30	12.30
	Total Variable Costs	87.75	81.59	80.15	80.15	80.15
Fixed cost						
7	Land Revenue	0.04	0.06	0.06	0.06	0.06
8	Depreciation	0.18	0.27	0.29	0.29	0.29
9	Interest on Fixed Capital	0.16	0.24	0.26	0.26	0.26
10	Rental Value of land	12.02	17.84	19.23	19.23	19.23
	Total Fixed Cost	12.41	18.41	19.85	19.85	19.85
Total Cost		100.00	100.00	100.00	100.00	100.00
Total Cost in Rupees		78909.47	53338.81	49774.57	49774.57	49774.57
Gross Returns per hectare @ ₹5/kg Leaves & @ ₹ 2/sucker		20570.26	74497.23	87120.91	89837.04	88302.98
Net Returns (₹)		-58339.22	21158.41	37346.34	40062.48	38528.42
Yield of Leaves (Kg)		3428.38	12416.20	14520.15	14972.84	14717.16

For the second year, farmers incurred on an average, a total cost of ₹ 53338.81 per hectare. Cost incurred on material inputs averaged nearly 35.56 per cent while human labour investment was around 33.10 per cent of the total cost. Rental value of land shared 17.84 per cent of the total cost. Risk margin and managerial cost each accounted for 5.28 per cent of the total cost at overall farms.

For the second year, farmers incurred on an average, a total cost of ₹ 53338.81 per hectare. Cost incurred on material inputs averaged nearly 35.56 per cent while human labour investment was around 33.10 per cent of the total cost. Rental value of land shared 17.84 per cent of the total cost. Risk margin and managerial cost each accounted for 5.28 per cent of the total cost at overall farms.

In the 3rd, 4th and 5th year total cost was found to be similar. Farmers incurred on an average, a total cost of ₹ 49774.57 per hectare. Human labour investment was around 34.57 per cent. Cost incurred on material inputs averaged nearly 33.28 per cent of the total cost. Rental value of land shared 19.23 per cent of the total cost. Risk margin and managerial cost each accounted for 5.02 per cent of the total cost at overall farms. The hired labour cost on overall farms was found to vary from 49.98 per cent to 42.76 per cent of the total labour cost from 1st to 5th year of plantation.

The gross returns obtained for different years were ₹ 20570.26, ₹ 74497.23, ₹ 87120.91, ₹ 89837.04 and ₹ 88302.98 for 1st, 2nd, 3rd, 4th and 5th year respectively. The net return was negative in the first year and gradually increased upto 4th year then started declining.

Cost and return structure in *Safed Musli* cultivation

The item wise plantation cost incurred in the cultivation of *Safed Musli* is presented in Table 6. Farmers incurred on an average, a total cost of ₹ 286217.99 per hectare. Cost incurred on material inputs averaged nearly 69.36 per cent of the total cost. Human labour investment was around 8.77 per cent of the total cost. Interest on working capital shared 3.27 per cent of total cost at overall farms. Risk margin and managerial cost each accounted for 7.27 per cent and rental value of land shared 3.32 per cent of the total cost. About 2.76 per cent share of the total cost was of hired labour. It can be noted that more than 4.30 per cent of total cost is of cleaning, drying and peeling among the labour costs in all farms. The gross returns obtained were ₹ 371680.00.

Table 6. Per hectare cost of cultivation of *Safed Musli* (Per cent)

Sr. No.	Particulars	Percentage
Material Costs		
1	Material Cost	
	Planting Material Cost	64.51
	FYM Cost	2.62
	Vermicompost	2.10
	Miscellaneous	0.12
	Sub-Total	69.36
Labour Costs		
2	Bullock Labour	0.62
	Human Labour	
	Layout & Preparation	0.59
	Planting	0.53
	FYM+Vermicompost application	0.95
	Irrigation	0.78
	Weeding	0.73
	Harvesting	0.87
	Cleaning, Drying & Peeling	4.31
	Sub-Total	8.77
3	Hired Labour Costs	2.76
4	Family Labour Costs	6.00

Contd.

5	Interest on working capital	3.27
6	Risk Margin	7.27
7	Managerial cost	7.27
	Sub-Total	15.49
	Total Variable Cost	96.56
Fixed cost		
8	Land Revenue	0.01
9	Depreciation	0.06
10	Interest on Fixed Capital	0.05
11	Rental Value of land	3.32
Total Fixed Cost		3.44
Total Cost		100.00
Total Cost in Rupees		286217.99
Gross returns per hectare @ ₹ 1000/kg (dry roots)		371680.00
Net Returns(₹) *based on existing market prices		85462.01
Yield of Wet Musli (Kg)		1984.90
Yield of Dry Musli (Kg)		371.68
Marketed		187.89
Unmarketed		183.79
BCR		1.30

Financial analysis of Medicinal and Aromatic Plants

The results of financial feasibility analysis were studied in MAPs which was calculated at discount rate of 12 % is given below.

The economics of cultivation of the selected plants, presented in Table 7 revealed that the net return per hectare was maximum from *Stevia* (₹ 173627.29), followed by *Safed Musli* (₹ 85462.01), *Aloe vera* (₹ 63832.29) and Lemon grass (₹ 43325.69). The benefit–cost ratio was found to be in the similar trend i.e., *Safed Musli* (1.30), followed by *Stevia* (1.27), *Aloe vera* (1.22) and Lemon grass (1.19). However, the internal rate of return was found to be highest in case of Lemon grass (40%), followed by *Aloe vera* (36%) and *Stevia* (32%). Therefore, it could be concluded that cultivation of all these MAPs was profitable and farmers in these areas should be encouraged to diversify their existing cropping pattern towards these crops to enhance their farm income.

Table 7. Financial feasibility of the selected medicinal & aromatic plants

Crop	NPV (₹)	BCR	IRR (%)
Aloe vera	63832.29	1.22	36
Stevia	173627.29	1.27	32
Lemon grass	43325.69	1.19	40
Safed musli		1.30	

Marketing of Selected Medicinal and Aromatic Crops

Seven marketing channels comprising of processing unit as consumer, cooperatives, local traders, local trader cum commission agents, wholesalers, traditional healers, and, consumers which is given the Table 8 were identified as the most important channels in medicinal and aromatic plants trade in the study region.

Table 8: Different Marketing channels followed for the marketing of medicinal and aromatic plants in the study area

Channel A	Producer	Processing Units Outside state	
Channel B	Producer	Cooperative societies	Local Processor
Channel C	Producer	Local Trader	Local Processor
Channel D	Producer	Local Trader	Processing Units Outside state
Channel E	Producer	Local Trader	Wholesaler Processing Units
Channel F	Producer	Traditional Healers	
Channel G	Producer	Consumer	

Channel B was found the most prominent channel in case of *Aloe vera* which routed 43.60 per cent of the produce followed by Channel D agent (24.75 %), Channel A (21.20 %), and Channel E (11.17%). Channel B was found the most prominent channel in case of *Stevia* which routed 42.99 per cent of the farm produce followed by Channel D (21.52 %), Channel A (17.87 %), and Channel F (10.93 %), Channel G, Channel E. Channel A was found the most prominent channel in case of Lemon grass which routed 76.35 per cent of the farm produce followed by Channel C (23.65 %). Channel A was found the most prominent channel in case of *Safed Musli* which routed 39.50 per cent of the farm produce followed by Channel F (8.40 %). Rest of the produce could not be sold as the farmers were not able to find market for their produce.

Constraints in Production and Marketing of Selected Aromatic Crops

The major constraints experienced by the growers of the selected MAPs were put under three categories, viz. production, marketing and general issues and have been presented in Table 6.

To identify the constraints, the speculated problems were listed and farmers' opinion on them was sought.

Study of production related problems revealed that all the farmers faced the major problem of high prices of the quality planting material in common. On an average 74 per cent of the farmers reported the lack of technical knowhow. Nearly 62 per cent of the farmers were in need for help to meet the scarcity of planting material where as 44 per cent of them opined for the problem of lack of proper irrigation facilities.

The MAP growers have large number of problems in marketing their produce. There is a need for an agency to help the growers in marketing of the produce. Majorly the problem of MAPs growers as a whole was lack of processing facilities (86 %) in the nearby areas (Shrivastava, 2000). Almost 84 per cent of the farmers felt problematic due to absence of minimum support prices. About 82 per cent of the farmers were referred to the problem of lack of regulated markets. Nearly 64 and 58 per cent farmers lacked technical knowledge about grading and that of high cost of transportation. Under the general issues the farmers reported poor access to good credit facilities due to lot of formalities involved in obtaining subsidies was also reported by the farmers.

Conclusion

The study has brought into focus many problems relating to the cultivation and marketing of MAPs in the study areas. State government is trying to promote medicinal plant cultivation but, cultivation is in a very rudimentary stage. However the efforts have resulted in the cultivation of some of the species such as *Aloe vera*, *Stevia*, Lemon grass and *Safed Musli* which are performing well in the state. The cost and financial feasibility analysis of the MAPs showed their economic viability, however, poor/ unorganized marketing was found to be the major bottleneck in their cultivation. Hence there is need to include MAPs in the regulated markets. There is a need to train local people in cultivation of the medicinal and aromatic plants. Market and trade avenues for the medicinal and aromatic crops should be properly organized in order to provide proper incentive to the cultivators and basic information about the trade should be provided to them. Identification of location specific medicinal and aromatic crops with the post harvest technology needs to be developed and disseminated to the cultivators. A provision of subsidy which is available to the farmers for the strengthening of production technologies needs to be extended for the marketing since the demand for MAPs is derived demand.

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