



Study on Cost and Returns of Cash Crops in Sirmour District, Himachal Pradesh, India

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This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study examines the cost and returns of major cash crops raised by different category of farmers in district Sirmour, Himachal Pradesh. The study also identified the different production problems faced by farmers using weighted rank method. Two stage stratified random sampling technique was followed to select a sample of villages and the ultimate farmers. A random sample of 60 farmers was chosen for the study. The major findings revealed that production of vegetables varied from 6.42 qtl for peas to as high as 25.93 qtl of tomato per farm. Garlic being a spice crop recorded the production of 14.37 quintal per farm. In the study, per hectare cost of cultivation was found to be highest for tomato, i.e., Rs. 34200, followed by garlic (Rs. 26134) and beans (Rs.

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15427) and lowest for peas (Rs. 11247), The per hectare net return was found to be higher for garlic crop (Rs.115066) when compared to tomato crop (Rs. 55785), beans and peas (Rs. 17108 to Rs. 6703). Therefore, garlic crop was found to be the most profitable crop with the net return of Rs. 115066 which was more and double of profit earned from tomato (Rs. 55785), peas (Rs. 6703) and beans (Rs. 17108). Similarly, the cost of cultivation was found to be highest for the large farmers and the per hectare net return also seemed to be the highest for the large farmers. Likewise, gross returns were also found highest for large farmers than that of small farmers. Further, the study revealed that major production problems faced by the farmers were availability of quality seed, high cost of inputs which were rated at top, followed by monkey & stray animals, quality of seed not available, high cost of inputs and high incidence of pest and pesticides etc. In order to increasing farm production and to minimise operational costs, the availability of high yielding variety seeds, reasonable prices of inputs like seed, fertilizers, pesticides etc., may enhance the farmers' net return and income.

Keywords: Cost; returns; cash crops; cropping pattern.

1. INTRODUCTION

In Himachal Pradesh, agriculture is a very crucial part of state's economy as agriculture is the prominent occupation of people. The economic growth in the State is predominantly governed by agriculture activities. The agriculture & allied sectors as a key sector supports more than 60 percent of the population. Only 11 per cent of the total geographical area is available for agriculture out of which 80 per cent is rain-fed and the holdings are small and scattered (Economic Survey, H.P.2019-20). More than 67 per cent of the farmers fall in the category of marginal (<1ha), 19 per cent farmers belong to small farms (1-2ha) and 11 per cent farmers belong to large farm (10ha & above) category (Bala and Sharma, 2005). Several vegetables such as tomato, potatoes, beans, peas, capsicum, cabbage, ginger, garlic etc (Mukherjee & Kumar, 2024). are grown during kharif and rabi season in the state (Vyas, 1996; Sharma, 2005). Tomato, beans, cabbage, cauliflower, peas and garlic are important crops accounting for most of the area under high value crops (Chand, 1996; Joshi et al., 2004, Kumar et al., 2007; Show, 2018). The net returns per hectare from the cultivation of these crops on different categories of households were very high (Sharma, 2011).

Sirmour is the southernmost district in the south-eastern region of Himachal Pradesh. It is largely mountainous and rural with 90 per cent of population living in villages (Kaburu et al., 2022). The district economy is generally based on agriculture including potatoes, ginger, tomatoes, peas, beans and garlic which are the major cash crops in this region (Agarwal et al., 2018). Ginger, tomato, peas, beans, capsicum and garlic are the important cash crops in district Sirmour. However, tomato, beans, peas and

garlic are major four cash crop grown in study area. It requires huge investment and maintenance cost. Increasing cost of cultivation and low returns in these crops may not encourage farmers to adopt improved technology in farm (Gnansekaran & Vijayalakshmi, 2014). Hence, it is important to estimate the cost and returns structure of these crops on the farm in the district Sirmour.

Objectives: 1. To analyse costs and returns structure of commercial crops raised by farmers under different crop sequences. 2. To identify the various production problems faced by farmers and suggest ways to overcome them.

2. MATERIALS AND METHODS

Study area: The study was carried out in adopted villages of Eternal University, district Sirmour of H.P. Likewise, the study mainly pertained to Lana Bhalta, Lana Miun, Kotla Mangan, Riwadla, Bhanog villages etc.

Sampling design: Two stage stratified random sampling technique was followed to select a sample of villages and the ultimate farmers. A random sample of 60 farmers was chosen through proportional allocation method. Both primary and secondary data were collected for present investigation. The primary data were collected from village key informants on schedules and from farmers on household schedules. Personal interview method was followed to collect data from respondents by making visits to their houses. The secondary data were collected from panchayat record of concerned village, books, articles, journals, published reports, unpublished thesis, census report and government document etc.

Following formulations have been used to arrive at the objectives:

Net returns = gross returns – total costs

$$NR_i = GR_i - TC_i \quad ; i = 1,2,3,\dots,n$$

Where,

NR_i = Net Returns for ith crop

GR_i = Gross Returns from ith crop

TC_i = Total Costs incurred on ith crop

$$\text{Further } TC_i = TFC_i + TVC_i$$

Where;

TFC_i = Total fixed cost incurred on ith crop

TVC_i = Total variable cost incurred by ith crop

In order to identify the constraints in production of vegetables, Weighted rank technique was applied. Different production problems have been assigned a rank from 1 to 7 where 7 carries the maximum weight and 1 carries the minimum weight. Weighted rank is calculated as follows:

$$\text{Weighted rank} = \frac{\sum x_i w_i}{\sum w_i}$$

Where; w_i is the rank assigned to the i^{th} problem, and x_i is the frequency of different production problems.

3. RESULTS AND DISCUSSION

Landholdings and utilization pattern: The average landholding size was 0.78 ha/farm, which ranged from 1.39 ha on large farms to 0.65 ha on small farms (Table 1). The cultivated land constituted a lower proportion (35.85 %) of the total holdings on large than small (50 %) farms because they kept a sizeable proportion of their holdings as pastures and orchards. The small farmers devoted 50 per cent of the total holdings to the horticultural crops while on large farms, it was 64.15 per cent.

Cropping pattern: The cropping pattern presented in Table 2, revealed that vegetables were grown in different seasons (kharif, rabi) all the year. The average area allocated to vegetables during the kharif season was 19.64 per cent of the total cropped area. Among foodgrains, maize was the main cereal crop occupying 19.64 per cent area equal to tomato crop. During the rabi season, the area allocated to vegetables was 30.36 per cent and the main vegetables grown were beans, peas and garlic. Garlic were found to be major crop which constituted 14.28 per cent of the gross cropped area on overall basis, followed by beans (8.94%) and peas (7.14%), respectively. The main foodgrains grown during rabi season was wheat which occupied about 21.43 per cent of the total cropped area in this season. The overall cropping intensity turned out to be 172 per cent.

Table 1. Land use pattern of sample farms

Sr. No.	Particulars	Farm size (ha/farm)		
		Small	Large	Overall
1	Owned operational land	0.24 (48)	0.36 (33.97)	0.30 (38.46)
2	Leased - in land	0.05 (10)	0.02 (1.88)	0.04 (5.13)
3	Leased - out land	0.04 (8)	0.00 (0.00)	0.02 (2.56)
4	Total Operational land (1+2-3)	0.25 (50.00)	0.38 (35.85)	0.32 (41.03)
5	Others (Orchard, Grassland & Barren)	0.25 (50.00)	0.68 (64.15)	0.46 (58.97)
	Total Land (4+5)	0.50 (100)	1.06 (100)	0.78 (100)

Note: Figures in parentheses are percentages
Source: Field survey, 2019-20

Table 2. Cropping pattern of the sample farms

Sr. No.	Categories Crops	Area under crops (ha./farm)		Overall
		Small	Large	
1.	Kharif crop			
	A) Vegetables			
	i. Tomato	0.09 (23.08)	0.12 (16.22)	0.11 (19.64)
	ii. Ladyfinger	0.00 (0.00)	0.01 (1.35)	0.00 (0.00)
	B) Cereal cro			
	iii. Maize	0.08 (17.95)	0.15 (20.27)	0.11 (19.64)
	iv. Chari	0.00 (0.00)	0.01 (1.35)	0.00 (0.00)
	v. Millet	0.01 (2.56)	0.01 (1.35)	0.01 (1.79)
	Total (A+B)	0.17 (43.59)	0.30 (40.54)	0.23 (41.07)
2.	Rabi crop			
	A) Vegetables			
	i. Beans	0.03 (7.69)	0.06 (8.11)	0.05 (8.94)
	ii. Peas	0.03 (7.69)	0.05 (6.76)	0.04 (7.14)
	B) Spices			
	i. Garlic	0.06 (15.38)	0.09 (12.16)	0.08 (14.28)
	C) Cereal crops			
	i. Wheat	0.08 (20.51)	0.16 (21.62)	0.12 (21.43)
	ii. Barley	0.01 (2.56)	0.04 (5.41)	0.02 (3.57)
	D) Oilseeds			
	i. Mustard	0.01 (2.56)	0.04 (5.41)	0.02 (3.57)
	Total (A+B+C)	0.22 (56.41)	0.45 (60.81)	0.33 (58.93)
3	Cropped area (1+2)	0.39	0.74	0.56
4	Sown area	0.25	0.38	0.32
5	Cropping Intensity (%)	156	195	172

Source: Field survey, 2019-20

Note: Figures in parentheses are percentages

Cost of cultivation and returns structure of cash crops:

1. Tomato crop:

The Table 3 depicts the cost of cultivation of tomato crop in the study area. The overall average expenditure worked out for human labour was Rs. 9064/ha. While the expenditures made on hired labour for one hectare were Rs. 8016 and Rs. 10261 in case of small and large farms, respectively. Overall average expenditure

on bullock labour and machinery was Rs. 221 per ha which is very low because tomato crop is a labour intensive crop. From the table it is also cleared that in tomato cultivation the farmers of the study area had made very less expenditure on irrigation due to sufficient rain. If the total expenditure on human labour of different categories of farmers are compared, it is clear that the small farmers used less human labour than other categories of farmers respectively. Similar results were recorded by Brijbala et al. (2011).

The variable cost mainly consists of the cost of human labour, seed material, bullock, machinery pesticides and chemical fertilizers etc. accounting for 80.44%, 81.45% and 80.87% respectively, of the total cost of cultivation. Whereas, per hectare variable cost on small, large and all farms were found to be Rs. 24274/ha, Rs. 31525/ha and Rs. 27658/ha, respectively. Among the fixed costs, the rental value of the owned land was the major cost accounting for 11.17% of the total cost of cultivation. As a result, large farmers were found to spend highest on tomato cultivation (Rs.38707/ha), which was 1.3 times more than that of the small farmers (Rs.30175/ha).

Thus, it is concluded from the above analysis that total cost was highest for large farmers. In other words the positive relationship was observed between the magnitudes of per hectare cost of production and the operational size of the holdings.

Further Table 4 describes that per hectare gross returns for tomato crop on small, large and overall farms was Rs. 79660/ha, Rs. 101815/ha and Rs. 89985/ha, respectively. The net returns per hectare after subtracting the total cost from the gross return was found to be Rs. 49485, Rs. 63108, and Rs. 55785 on small, large and overall farms, respectively. Similar findings were recorded by Gnanasekaran and Vijaylakshmi (2014) in their study.

And on the other hand, in case of per quintal cost of production of tomato crop, it is seen that the large farmers were spending relatively large amount of money for producing one quintal of tomato than the other categories of farmer.

2. Beans crop:

Total cost of beans crop was found to be Rs. 15427/ha for the overall size group of farms as shown in Table 3. However, per hectare total cost on small and large farms were found to be Rs.13841/ha, Rs.17161/ha, respectively. Expenditure on the operational cost was highest for large farmers and it has been observed that as the land holding size increases, the total cost also increases, employing direct relationship between the two. It was also found that variable cost, fixed cost and cost of production also showed the increasing trend with the increase in area cultivated by the farmer. It was found that large farmers were found to spend highest on beans cultivation (Rs.17161/ha).

The average cost of cultivating on one hectare of beans was Rs.15427/ha for all the farms in the study area. The important point noted here that the per quintal cost of production turned out higher on small than large farms. The reason behind lower costs was efficient use of inputs on large farms.

The Table 4 further reveals that the per hectare gross returns for beans crop on small, large and overall farms were Rs. 21195/ha, Rs. 45495/ha and Rs. 32535/ha, respectively. The net return per hectare after subtracting the total cost from gross return were found to be Rs. 7354/ha, Rs. 28334/ha on small and large farms, respectively.

3. Peas crop

In peas farming also, the investment on seed, hired human labour, bullock labour, FYM & fertilizers and pest control measures etc. constituted the 41.84% of the total cost. On an average, per quintal cost of production was found to be higher for small farmers that varied from Rs. 3943 to Rs. 2590 for large farms.

Further table reveals that per hectare gross return over total cost came out Rs. 17950 on overall basis. It varied from Rs. 13100/ha to Rs. 23550/ha for small and large farmers. The net return of small farmers was Rs. 2769/ha whereas for large farmers it was Rs. 11348/ha. The overall net return of peas farmers accounted Rs. 6703/ha. The net return over variable cost was Rs. 8670/ha, Rs. 18530/ha and Rs. 13245/ha for small, large & overall farmers respectively. The output-input ratio was found to be 1.26 in case of small farmers and 1.93 in case of large farmers while for overall farmers it was found 1.59. Singh et al. (2020) recorded that the cost of cultivation of pea in case of small farms was higher as compared to large farm size category whereas gross returns and net returns from peas in case of large farms were higher as compared to small farm size category. One of the major point noted here that all farmers obtained minimum returns from peas farming as compared to tomato and beans crop. Therefore, it has been suggested that the area under peas cultivation can be utilised intensively for garlic crop as both crops are grown simultaneously.

4. Garlic crop:

The overall expenditure made on variable and fixed cost for garlic cultivation accounted to

Rs. 19592/ha and Rs. 6542/ha with percentage share of 74.97 and 25.03 per cent in total cost of production. Expenditure on human labour accounted for a major proportion (20.77%) of the total cost, followed by costs on seeds (19.43%) and FYM (14.82%). The cost of hired human labour was more on large than small farms. Labour was generally hired at the time of transplanting and harvesting/picking of the garlic produce. Fixed cost which included the rent for leased-in land, came out to be Rs.3822/ha.

It has been further observed in Table 4 that all farmers in study area were getting highest net returns over total cost. Highest return over total cost was received by large farmers. The net return over variable cost were earned Rs. 89242/ha, Rs. 158874/ha and Rs. 121608/ha by small, large and overall farmers, respectively. The output-input ratio was 4.58 for small farmers and 6.23 for large farmers while the overall ratio was found to be 5.41. Similar results were recorded by Singh and Dhillon (2015).

Thus it can be concluded that all the major cash crops viz., tomato, beans, peas and garlic were profitable for all the farmers of the study area, but garlic was the highest profitable crop when compared to the other crops, because the per quintal cost of production for garlic was the lowest than that of beans and peas crops.

Comparison of net returns obtained from major cash crops: In the comparison of net returns obtained from selected cash crops, garlic is found to be most profitable crop for the farmers as on overall net returns obtained from the crop i.e. Rs. 115066/ha. It varied from Rs. 83341/ha to Rs. 151692/ha for small and large farmers. Similarly, tomato was found second profitable crop (Sherpa et al. 2023) with overall return earned Rs. 55785/ha and Rs. 49485/ha to Rs. 63108/ha on small and large farmers of tomato crop, respectively. Hence, Garlic was most profitable crop which was more and double of profit earned from tomato, beans and peas crops. The large cultivators received higher profit from all crops in comparison to small farmers.

Production constraints faced by farmers: An opinion survey was conducted to know the sowing and preharvesting problems faced by farmers. A detailed results of the opinion survey has been presented in Table 6. It has been seen from the table that in case of problems relating to production of cash crops, quality seed not available was recorded top most problem by the farmers with average weighted rank score of 4.47 on an overall farm situation. The high cost of inputs and high incidence of pest and disease were rated at second and third place with respective average score of 3.94 and 3.56 on an all farm situation.

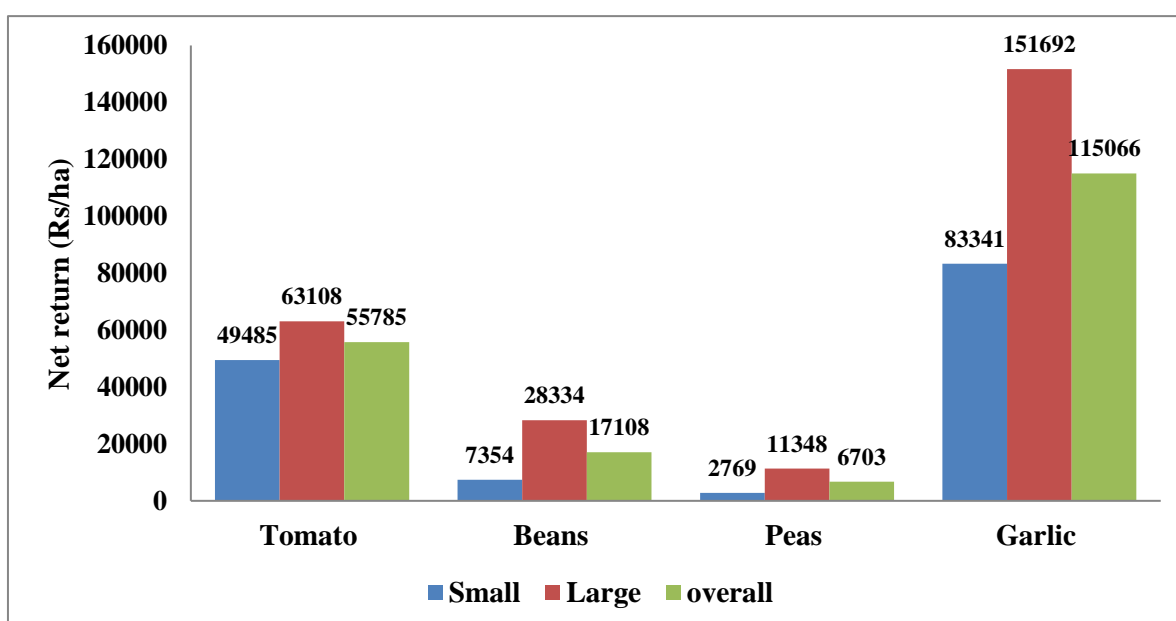


Fig. 1. Net returns from major cash crops (Rs/ha)

Table 3. Cost of cultivation of different cash crops on sample farms (Rs./ha)

Sr. No.	Particulars	Tomato			Beans			Peas			Garlic		
		Small	Large	Overall	Small	Large	Overall	Small	Large	Overall	Small	Large	Overall
A. Variable cost													
1	Seed	709 (2.34)	853 (2.20)	776 (2.26)	1103 (7.98)	1237 (7.20)	1165 (7.55)	450 (4.36)	550 (4.51)	497 (4.43)	4390 (18.87)	5767 (19.88)	5079 (19.43)
2	Human labour	8016 (26.56)	10261 (26.51)	9064 (26.50)	2096 (15.14)	3372 (19.65)	2691 (17.44)	950 (9.19)	1000 (8.19)	973 (8.66)	4863 (20.91)	5994 (20.66)	5429 (20.77)
3	Bullock & machine labour	204 (0.68)	241 (0.62)	221 (0.66)	300 (2.17)	382 (2.23)	338 (2.19)	150 (1.45)	190 (1.56)	168 (1.49)	160 (0.68)	179 (0.62)	170 (0.65)
4	Staking material	2600 (8.62)	3500 (9.04)	3020 (8.84)	-	-	-	800 (7.74)	900 (7.38)	847 (7.53)	-	-	-
5	Farm Yard Manure	5421 (17.96)	7142 (18.45)	6224 (18.19)	2546 (18.40)	2767 (16.12)	2649 (17.17)	850 (8.23)	950 (7.78)	897 (7.97)	3546 (15.25)	4196 (14.46)	3871 (14.82)
6	Irrigation charges	840 (2.78)	940 (2.43)	887 (2.59)	435 (3.14)	465 (2.72)	449 (2.91)	420 (4.06)	470 (3.85)	443 (3.94)	420 (1.81)	470 (1.62)	445 (1.70)
7	Chemical fertilizers	2017 (6.68)	2630 (6.79)	2304 (6.74)	335 (2.42)	476 (2.77)	400 (2.59)	260 (2.52)	300 (2.46)	278 (2.48)	1503 (6.46)	2076 (7.16)	1790 (6.85)
8	Insecticide and fungicide	3961 (13.14)	5291 (13.68)	4581 (13.40)	1050 (7.58)	1185 (6.91)	1113 (7.21)	470 (4.56)	560 (4.59)	512 (4.55)	2063 (8.87)	2624 (9.05)	2344 (8.97)
9	Interest on working capital	506 (1.68)	667 (1.73)	581 (1.69)	75 (0.54)	95 (0.55)	84 (0.54)	80 (0.77)	100 (0.82)	89 (0.79)	413 (1.77)	520 (1.79)	467 (1.78)
	Sub-Total	24274 (80.44)	31525 (81.45)	27658 (80.87)	7940 (57.37)	9979 (58.15)	8888 (57.60)	4430 (42.88)	5020 (41.14)	4705 (41.84)	17358 (74.63)	21826 (75.24)	19592 (74.97)
B. Fixed Cost													
1	Interest on Fixed Capital @6% p.a	978 (3.24)	662 (1.71)	820 (2.39)	978 (7.06)	662 (3.86)	820 (5.31)	978 (9.46)	662 (5.42)	820 (7.29)	978 (4.20)	662 (2.28)	820 (3.14)
2	Depreciation on tools, equipments and farm building @ 10 % p.a	2223 (7.37)	1577 (4.07)	1900 (5.57)	2223 (16.06)	1577 (9.19)	1900 (12.32)	2223 (21.53)	1577 (12.93)	1900 (16.89)	2223 (9.56)	1577 (5.44)	1900 (7.27)

Sr. No.	Particulars	Tomato			Beans			Peas			Garlic		
		Small	Large	Overall	Small	Large	Overall	Small	Large	Overall	Small	Large	Overall
3	Land Revenue cum Rental value of leased-in land	2700 (8.95)	4943 (12.77)	3822 (11.17)	2700 (19.51)	4943 (28.80)	3822 (24.77)	2700 (26.13)	4943 (40.51)	3822 (33.98)	2700 (11.61)	4943 (17.04)	3822 (14.62)
	Sub- Total	5901 (19.56)	7182 (18.55)	6542 (19.13)	5901 (42.63)	7182 (41.85)	6542 (42.40)	5901 (57.12)	7182 (58.86)	6542 (58.16)	5901 (25.37)	7182 (24.76)	6542 (25.03)
	C. Total Cost (A + B)	30175 (100)	38707 (100)	34200 (100)	13841 (100)	17161 (100)	15427 (100)	10331 (100)	12202 (100)	11247 (100)	23259 (100)	29008 (100)	26134 (100)

Note: Figures in parentheses are percentages
Source: Field survey, 2019-20

Table 4. Category wise costs and returns from different cash crops on sample farms (Rs./ha)

Sr. No.	Particulars	Tomato			Beans			Peas			Garlic		
		Small	Large	Overall	Small	Large	Overall	Small	Large	Overall	Small	Large	Overall
1	Total Cost	30175	38707	34200	13841	17161	15427	10331	12202	11247	23259	29008	26134
2	Gross Returns	79660	101815	89985	21195	45495	32535	13100	23550	17950	106600	180700	141200
3	Main product (qtl) Net Returns	22.76	29.09	25.71	4.71	10.11	7.23	2.62	4.71	3.59	10.66	18.07	14.12
	i) Over Variable Cost	55386	70290	62327	13255	35516	23647	8670	18530	13245	89242	158874	121608
	ii) Over Total Cost	49485	63108	55785	7354	28334	17108	2769	11348	6703	83341	151692	115066
4	Output: Input ratio	2.64	2.63	2.63	1.53	2.65	2.11	1.26	1.93	1.59	4.58	6.23	5.41
5	Cost of production (Rs/qtl)	1326	1330	1330	2938	1697	2134	3943	2590	3132	2182	1605	1850

Source: Field survey, 2019-20

Table 5. Comparison of net returns obtained from major cash crops

Sr. No.	Crops	Farm size (Rs./ha)		Overall
		Small	Large	
1	Tomato	49485	63108	55785
2	Beans	7354	28334	17108
3	Peas	2769	11348	6703
4	Garlic	83341	151692	115066

Source: Field survey, 2019-20

Table 6. Production problems faced by farmers: Weighted Rank

Sr. No.	Problems	Farm Size				Overall	Rank
		Small	Rank	Large	Rank		
1	Quality seed not available	4.91	2	3.98	2	4.47	1
2	High cost of inputs (seed, fertilizers, pesticides, etc.)	4.18	4	3.67	4	3.94	2
3	Non availability of fertilizer on time	1.96	7	2.38	6	2.16	5
4	High incidence of pest and disease	3.76	5	3.33	5	3.56	3
5	Irrigation not available in time	2.82	6	2.27	7	2.56	4
6	Non availability of labor for operations	1.84	8	2.22	8	2.02	6
7	Non availability of credit	1.76	9	1.69	9	1.73	7

Source: Field survey, 2019-20

4. CONCLUSION AND POLICY IMPLICATIONS

The study was conducted to four major cash crops of the district, namely, garlic, tomato, beans and peas. These three crops shared more than 50 % of the gross cropped area on sample farms in the study area. Tomato emerged as main cash crops in the study area with its percentage share of 19.64% in the gross cropped area while garlic (14.28%), beans (8.94%) and peas (7.14%) were the second, third and fourth major cash crops in the study area.

To sum up the cost of cultivation (Rs./ha) was highest for tomato compared to garlic, beans and peas crop. Thakur (1994) had also reported that the total costs were highest for tomato. Garlic emerged as most profitable cash crop in study area for both category of farmers i.e. large and small farms with the overall output-input ratio of 5.41, followed by tomato (2.22), beans (2.11) and peas (1.59). Per hectare net return was found to be highest for garlic crop (Rs.115066/ha) when compared to tomato (Rs.55785/ha), beans (Rs.17108/ha) and lowest by peas (Rs.6703/ha) crops. Contrary, Kumar et al. (2002) have observed that peas gave a higher net return over variable costs. As garlic, beans and peas crops are grown together in rabi season and tomato crop alone in kharif season, they three (tomato + beans + peas) were not meeting out the net returns obtained from garlic crop alone, as the

combined net return (tomato + beans + peas) obtained from the same piece of land is Rs.79596, while garlic alone gave Rs. 115066/ha. on overall basis. With respect to adoption of policies towards increasing farm production and to minimise operational costs, the availability of high yielding variety seeds may enhanced at reasonable prices to farmers throughout the year so as to lower per hectare cost of cultivation which leads to increase in production and yield. There is a needs to adopt the progressive approaches in order to regulate the prices of inputs like seed, fertilizers, insecticides etc., thereby enhance the farmers' net return and income.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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