

INPUT USE PATTERN OF TEMPERATE FRUITS PRODUCTION IN HIMACHAL PRADESH A COMPARATIVE STUDY OF DIFFERENT FARM SIZE

Sikander Kumar* and Vishal Chauhan **

Agriculture is very important for the Indian economy and is the principal source of livelihood for most of the population of the country. It contributes significantly to the gross domestic product (GDP) of the nation's overall economy but the condition of the Indian agriculture sector is not good and faces many problems (Farmer's illiteracy, small and fragmented land-holdings, high cost of Agri-inputs, scarcity of capital, lack of machines and modern agricultural technologies) which requires more improvement, therefore, a study revealed the input use pattern of the different farm size in temperate fruits production which not only determines output but also farm cost of production and was discovered that per hectare application of fertilizers, manures, sprays and insecticides & pesticides in all crops production is highest among marginal farms hence is showing decreasing trends with increasing farm size and the possible reason for the same can be an expectation of high returns or landholdings. Above all holding of major farm implements is less among marginal farmers which plays a very key role in improving the performance of inputs and therefore improves farms resource efficiency which is one of the key concerns in the Indian agriculture sector.

Keywords: Farms Input Application, Resource use pattern, Resource endowment, Per Hectare cost.

INTRODUCTION

Factors of production viz, land, labour, capital and management when combined in proper proportion can help to achieve a higher level of efficiency in the farm business. Use of any resource beyond its capacity can result in its rapid depletion and deterioration which may cause severe damage to the sustainability of farming. Similarly, underutilization of resources or misutilization of resources may result in high cost of production and thus lower the efficiency of agriculture. Therefore, farm production is the result of a transformation of various resources such as human labour, bullock power, mechanical power, water for irrigation, seeds, manures and fertilizers, insecticides and pesticides and cultivation practices etc. As these all-factor inputs are costly and scarce, the case for their efficient use is self-evident.

A large number of studies was conducted by Tewari *et al.* (1974), Tasnuba Haque (2006), Kumar *et al.* (2011), Kireeti (2013), Singh (2013), Guleria *et al.* (2017), Singh *et al.* (2018) and Singh *et al.* (2020) regarding the role of different factor inputs in Agri production and revealed that productivity can be increased by increasing the levels of the variables like FYM, chemical fertilizers, human labour etc. Farm resource endowment and extent of their use on farms have a direct bearing in determining the overall level of crop production therefore from the present study one will try to examine the resource use pattern in the production of temperate fruits among the sample respondents which will reveal the extent and magnitude of various farm endowments prevailing on farms in

* Professor, Department of Economics, Himachal Pradesh University, Summer Hill, Shimla

** Former Research Scholar, Department of Economics, Himachal Pradesh University, Summer Hill, Shimla,
E-mail : vishal.chauhan333.vc@gmail.com

different size classes and is of great importance to make practical recommendations for planning aimed at a better allocation of existing resources.

MATERIALS AND METHODS

To found the answers to the framed objectives, the present study was conducted in Jubbal & Kotkhai Block of district Shimla which was divided into 10 different panchayats and thereafter two villages from every panchayat with 10 farming households of different categories (Marginal, Small & Medium) from each village has been randomly selected. However, the study is primarily based on primary data hence personal interview, face-to-face association with farmer respondents and observation method has been adopted to collect the relevant information and therefore analyse with the help of the simple tabular analysis based on means, percentage and frequency etc.

RESULTS AND DISCUSSION

Plantation Pattern

Plantation specifies the number of trees planted under different crops production which further determines the output of different crops therefore Table 1 reveals the plantation pattern in different farm holdings for different crops. By taking the overall situation concerning plantation per hectare it can be found that out of total plantation 819 plants per hectare, the maximum share is of Pears 25.53 percent followed by Apple 23.20 percent, Almond 22.01 percent, Apricot 15.64 percent and Cherry 13.61 percent.

**Table 1 : Tree Plantation Pattern among the Sample Households
(Standard Plantation per hectares)**

Sr. No.	Particulars	Marginal Farmers	Small Farmers	Medium Farmers	Overall Farmers
1.	Apple Trees Plantation	202.65	208.21	184.70	189.99
		(35.72)	(26.16)	(21.32)	(23.20)
2.	Almond Trees Plantation	105.88	159.74	195.29	180.26
		(18.66)	(20.07)	(22.54)	(22.01)
3.	Cherry Trees Plantation	65.00	98.48	127.30	111.46
		(11.46)	(12.37)	(14.69)	(13.61)
4.	Pears Trees Plantation	125.56	206.54	215.07	209.10
		(22.13)	(25.95)	(24.82)	(25.53)
5.	Apricot Trees Plantation	68.24	123.03	144.05	128.06
		(12.03)	(15.46)	(16.63)	(15.64)
6.	Total	567.32	796.00	866.42	818.88
		(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in table is percentage analysis of column total.

The size wise analysis reveals the all-crop plantation per hectare which is 567 plants on marginal holding, 796 plants on small and 866 plants on medium farms, shows the positive association with the size of the holding. The study also reveals the interesting feature that the share of total plantation

in the case of Apple crop is higher on marginal and small farmers categories as compare to Almond, Cherry, Apricot and Pears however in medium farms pears and almond tree plantation is highest and reason for the same is that these plants occupy less place as compare to apple crop and also has fair land occupancy in medium farm size as compare to other farm sizes.

Therefore, from the study, it is evident that pears and apple plantation is maximum in the study area mostly across all the farm size hence specifies commercial importance of the crops and also revealing increasing trends of per hectare tree plantation of all crops with an increase in farm size.

Use of Manures

In agriculture, farm manures are considered the backbone of cultivated soils. Farm manures is prepared normally from animal dung. Quality of dung is depending upon its proper management and plays a very significant role in determining the quality of the soil. The data regarding the use of farmyard manure per hectare is given in Table 2.

Table 2 : Use of Manures in Cultivation of Apple, Almond, Cherry, Pears, Apricot and All crops. (in Kg Per Hectare)

Sr. No.	Crops	Marginal Farmers	Small Farmers	Medium Farmers	Overall Farmers
1.	Apple	7381.17	6476.45	4460.69	4990.39
		(38.07)	(33.60)	(28.37)	(30.08)
2.	Almond	3176.47	3157.89	2802.94	2906.81
		(16.38)	(16.38)	(17.82)	(17.52)
3.	Cherry	2600.00	2327.27	2367.57	2386.99
		(13.41)	(12.07)	(15.06)	(14.39)
4.	Pears	3955.56	4707.69	3656.93	3831.40
		(20.40)	(24.42)	(23.25)	(23.09)
5.	Apricot	2376.47	2606.06	2437.84	2474.19
		(12.26)	(13.52)	(15.50)	(14.91)
6.	Total	19389.66	19275.37	15725.97	16589.77
		(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in table is percentage analysis of column total.

It can be seen from the Table that by taking the overall position, on an average, 16,589.77 kg manure has been consumed per hectare in the case of all crops out of which the majority share being that of Apple 4,990.39 kg followed by Pears 3,831.40 kg, Almond 2,906.81 kg, Apricot 2,474.19 kg and Cherry 2,386.99 kg. Therefore, it can be seen that Apple and Pears are occupying 50 percent of total manure share and plays a very big role in determining the quality of fruit and plant. It is mostly applied to the field in winters and hence its availability in good quality for all the crops. In the cultivation of all crops, the total consumption of manures is worked out to be 19390, 19275 and 15726 on marginal, small and medium-size categories respectively. As between farms for all crops in different size classes, there is also a clear trend in respect of this item to be declining with the farm

size. In the lower size class, the consumption of manures is high, however, it is comparatively low on small and medium farm size in all crops. The quantity of manures used per hectare is limited by the availability of family labour and the number of the livestock.

Therefore, from the study one can see the declining trend in manures application with the size of holding in the study area and the possible reason for the same is decreasing trend of domestication of livestock with an increase in holding size hence leading to low manures per hectare.

Use of Fertilizers

The single most important requirement for higher yields in any country is good soil fertility. It is essential in both temperate and tropical climates and irrigated or rain-fed cultivation. That is why chemical fertilizer had been the cornerstone of the green revolution strategy. It was and still is regarded as one of the most crucial requisites for the region since increased fruit production depends heavily on the enhancement of yields and there, in turn, depends on improved soil fertility. The use of plant nutrients along with the improved or high yielding plant varieties is the hallmark of progressive horticulture. It can also be taken as an indicator of the motivation of farmers to maximize income. However, the level and efficiency of fertilizer application is affected by farmer's perception of risks, expectations of return on cash expenses incurred for its purchase and above all the management practices and information which too must be acquired and refined by experience.

Table 3 : Use of Fertilizers in the Cultivation of Apple, Almond, Cherry, Pears, Apricot and All crops

(in kg Per Hectare)

Sr. No.	Crops	Marginal Farmers	Small Farmers	Medium Farmers	Overall Farmers
1.	Apple	807.17	794.75	684.24	711.24
		(17.09)	(18.02)	(19.85)	(18.83)
2.	Almond	1000.00	881.58	650.74	727.75
		(21.18)	(19.99)	(18.88)	(19.26)
3.	Cherry	1000.00	909.09	722.97	808.94
		(21.18)	(20.62)	(20.97)	(21.41)
4.	Pears	944.44	884.62	673.36	719.48
		(20.00)	(20.06)	(19.53)	(19.04)
5.	Apricot	970.59	939.39	716.22	810.48
		(20.55)	(21.30)	(20.77)	(21.45)
6.	Total	4722.21	4409.43	3447.53	3777.89
		(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in table is percentage analysis of column total.

Though the availability of fertilizer is not a serious problem in the study area but variation in the application of fertilizer had been observed and this variation is mainly because of variation in the available farm resources, financial position and managerial ability of the individual farmers as reflected from the Table 3. It is apparent from the table that per hectare application of fertilizer is

estimated to be 3,777.89 kilograms. Higher application of fertilizer is noticed on marginal farmers followed by small and medium farmers. It is recorded 4,722.21, 4,409.43 and 3,447.53 kilograms for marginal, small and medium farms respectively. The overall application of fertilizer in the production of Apple, Almond, Cherry, Pears and Apricot is worked out to be 711.24, 727.75, 808.94, 719.48, 810.48 kilograms per hectare respectively.

It can be seen from the table that the consumption of fertilizer per hectare is substantially higher on marginal farms than the other two farm size category and revealing decreasing trends with an increase in farm size. Thus, it can be concluded that the higher application of fertilizer on marginal farms may be attributed to their financial position, the expectation of high returns per hectare, landholdings etc., apart from their access to the institutions dealing with fertilizer supplies.

Use of Insecticides and Pesticides

The use of insecticides and pesticides is required in the horticulture as crops are more prone to insect's attack which causes harm, not to the fruit but also the plant. Different types of insects attack the crops in different stage right from the plant's roots to the matured fruit ready to harvest.

Table 4 : Use of Insecticides & Pesticides in the cultivation of Apple, Almond, Cherry, Pears, Apricot and All crops

(in Rs. Per Hectare)

Sr. No.	Crops	Marginal Farmers	Small Farmers	Medium Farmers	Overall Farmers
1	Apple	1105.83	1070.39	980.10	1003.55
		(5.86)	(8.03)	(10.39)	(9.05)
2	Almond	4441.18	2968.42	1623.53	2141.88
		(23.55)	(22.26)	(17.22)	(19.32)
3	Cherry	4550.00	3418.18	2841.22	3218.29
		(24.13)	(25.64)	(30.13)	(29.03)
4	Pears	4319.44	2457.69	1144.53	1509.16
		(22.91)	(18.43)	(12.14)	(13.61)
5	Apricot	4441.18	3418.18	2841.22	3214.11
		(23.55)	(25.64)	(30.13)	(28.99)
6	Total	18857.63	13332.87	9430.59	11087.00
		(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in table is percentage analysis of column total.

It is apparent from the Table 4 that overall per hectare expenses of insecticides and pesticides is estimated to be Rs11,087.00 of which maximum is being done in Cherry Rs.3,218.00 followed by Apricot Rs.3,214.00, Almonds Rs.2,141.00, Pears Rs.1,509.00 and Apples Rs.1,003.00. The size wise analysis reveals that money spent on insecticides and pesticides on marginal, small and medium holdings is Rs18,857.63, Rs.13,332.87 and Rs.9,430.59 which is showing the inverse relationship with the size of the holding.

Therefore, the study, it is revealing the trends of increasing use of insecticide and pesticides in

marginal farms as compare to small and medium farms and revealing decreasing trends with an increase in farm size which could have rational of less landholding or excess use of insecticides & Pesticides.

Use of Spraying (Fungicides & Insecticides)

Sprays are very necessary and essential for the growth of horticulture crops. As production of all the crops are commercial therefore the objective of a farmer is to save the crops from all kinds of fungal and insects attack. All these attacks have a potential to destroy the whole crop which can bring huge losses to farmer, therefore, it recommended by the department of horticulture a schedule spray to be followed by every farmer for saving their farms from these attacks. Table 5 reveals that out of overall money spend per hectare on sprays is Rs.58,076.65 of which maximum share spend on Apple Rs.20,091.46 followed by Pears Rs.11,693.17, Almond Rs. 9,182.98, Apricot Rs.8,637.90 and Cherry Rs.8,471.14.

Table 5 : Sprays Pattern in Cultivation of Apple, Almond, Cherry, Pears, Apricot and All crops

(in Rs. Per Hectare)

Sr. No.	Crops	Marginal Farmers	Small Farmers	Medium Farmers	Overall Farmers
1.	Apples	19910.76	20935.46	19901.62	20091.46
		(30.99)	(33.91)	(35.74)	(34.59)
2.	Almond	10635.29	10072.37	8752.94	9182.98
		(16.55)	(16.31)	(15.72)	(15.81)
3.	Cherry	10768.75	9396.97	7561.49	8471.14
		(16.76)	(15.22)	(13.58)	(14.59)
4.	Pears	13005.56	11574.04	11629.56	11693.17
		(20.24)	(18.75)	(20.88)	(20.13)
5.	Apricot	9929.41	9762.12	7839.86	8637.90
		(15.45)	(15.81)	(14.08)	(14.87)
6.	Total	64249.77	61740.96	55685.47	58076.65
		(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in table is percentage analysis of column total.

From the size wise analysis point of view marginal, small and medium farmers spend Rs.64,249.77, Rs.61,740.96, Rs.55,685.47 on sprays per hectare which shows the decreasing trend with the increase in the size of holdings.

Therefore, study reveals that per hectare use of sprays is highest in marginal farms in all crops production and possible reason for the same is landholding or excessive use of inputs and also it was found that apple crop shows the maximum amount of money spend on sprays per hectare across all the size of holding compares to all other crops.

The Use of Farm Implements

Farm implements are very important for the farmers as all the input application exercise could not be economically possible without the availability of such implements as it not only increases efficiency but also save the time. The ownership of implements on farms is presented in Table 6, to begin with, the information regarding major implements regarding overall farmers it can be observed that the average number of spraying machines is highest followed by grass cutting, grading and other. In terms of minor implements carrets, drums, Sickels, earth digger (Kassi) comprise the maximum number of average holding in overall farmers.

Table 6 : Average Pattern of Household Agricultural Implements among the Sample Households (Per Holding)

Sr. No.	Items	Marginal Farmers	Small Farmers	Medium Farmers	Overall Farmers
1.	Major Implements				
i.	Grass Cutting Machine	0.03	0.20	0.46	0.30
ii	Soil Tillers	0.03	0.05	0.20	0.12
iii.	Spraying Machines	0.83	1.17	1.69	1.36
iv.	Grading Machine	0.00	0.07	0.38	0.21
v.	Wood Cutting Machines	0.03	0.13	0.32	0.21
2.	Minor Implements				
i.	Hoes (Phawara)	1.03	1.33	1.83	1.52
ii.	Spades (Belcha Straight from corner)	1.10	1.55	2.03	1.70
iii.	Sickels (Drati) & Drat	4.93	8.92	13.25	10.29
iv.	Axes (Kuladi)	0.80	1.27	1.76	1.42
v.	Earth digger (kassi)	4.53	9.50	14.91	11.21
vi.	Shovel (belcha)	0.95	1.30	1.75	1.46
vii.	Iron Rod	0.55	1.05	1.37	1.11
viii.	Prunning & Grafting Knives	0.93	1.62	2.81	2.08
ix.	Ladder	0.28	1.02	1.69	1.21
x.	Kiltas	5.38	9.33	15.00	11.38
xi.	Stepping Machine	1.08	1.63	2.53	1.97
xii.	Carrates	8.78	21.00	46.63	31.37
xiii.	Drums	4.90	8.93	17.16	12.24
3.	Total Farmers	40	60	100	200

From size-wise analysis, it can be seen from the table that in major implements average holding of implements is less on marginal farms as compare to small and medium farms. It can also be observed from the table that there is an increasing tendency of all the minor implements possessed by the farmers with the farm size. When it comes to major implements in different farm size, we had observed that holding of spraying machines with 0.83, 1.17 and 1.69 is maximum with marginal, small and medium farmers however minor implements are concern holding of carrates with 8.78,

21.00 and 46.63 is maximum with marginal, small and medium farmers. However, in the case of grading machines in major implements, marginal farmers had zero machine as compare to small and medium farmers with 0.07,0.38.

Therefore, from the study, it was revealed that average holding of agriculture implements is increasing with the increase in farm size and reason for the same can be land holding however when one look towards the holding of major implements the position of marginal farmers is very weak with zero holdings of grading machines which specifies the role of finances also.

CONCLUSION & POLICY IMPLICATIONS

Farming like any other business has limited resources whose success depends upon its rational allocation & utilization, therefore, input use pattern of the farmers in the study area tries to reveals the picture of resource utilization which further determines the production cost and resource efficiency of the orchard and from the study it can be concluded that inputs per hectare applications are more in marginal farms in most of the farm inputs (manures, fertilizers, insecticides & pesticides, sprays) as compare to small and medium farms which therefore increases the per hectare cost. However, on the other hand, the holding of major farm implements is very less with marginal farmers which plays a very important role in influence the resource efficiency hence determining the profits of marginal firms which therefore leads to following policy implications:

- As Fertilizers, Insecticides & pesticides are important farm inputs but an excess of its use decreases production and increases cost therefore it is suggested to the marginal farmers to make rational use of such inputs.
- Manures plays a very important role in the resource efficiency, therefore, recommend medium farms to increase the per hectare manure application as it will improve their soil quality and increase productivity.
- It is recommended to the marginal farmers to improve their major implements holding as it will improve their resource efficiency which therefore can reduce the per hectare cost of production and improves the productivity.
- Government should also provide financial support to the marginal farmers for buying major farm implement as they are very costly and not in the budget of the farmers.

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