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Micro-Level Decision for Area Shift in Favour of High-Value Crops: A Case of Horticultural Crops[1]

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Abstract

Area shift towards horticultural crops is vital for increasing farm income, productivity and overall employment in the agricultural sector. Several economic (price and income) and non-economic (food-security concerns) factors influence farmers' decisions at the farm level. This paper has examined the role of both price and income, along with the role of food-security goals, in the decision-making of farmers regarding shift from low-value crops (food crops) to high-value commercial crops (horticultural crops). It has been shown that higher food requirements at home inhibit the extent of crop substitution decision of the farmers. However, farmers are less responsive to the changes in the prices of food grains (in terms of changing their consumption) as higher income from high-value crops provide adequate money to purchase food crops from the market. Relative income (not the relative price) of the crops has been found to explain the crop-substitution decisions of the farmers. The farmers have been reported to calculate the aggregate gain from the crop rather calculating only the price of the crop, while making the decision to shift. Their capacity to generate higher productivity along with better market prospects have been recorded to explain farmers' decision to shift area.

Introduction

The performance of agriculture sector in the Indian economy in recent years has not been quite satisfactory because of deceleration in the growth rate of agricultural output (Chand, 2005). Not surprisingly, most farmers have made their intention clear about disliking the agriculture sector and hence, given an option, want to quit agriculture. However, this partial sad state of agriculture, which calls for a change, is supplemented by the structural changes in the economy. The sustained economic growth, rising per capita income and growing urbanization have caused a shift in the consumption patterns in favour of high-value crops like fruits and vegetables from staple food crops such as rice, wheat and coarse cereals (Joshi, 2005). During the past few years, demand for these high-value crops has grown much faster than that for food grains. The share of high-value crops in the total expenditure on food increased from 34 per cent in 1983 to 44 per cent in 1999-2000 in the rural areas, and from 55 per cent to 63 per cent in the urban areas (Kumar and Mruthyunjaya, 2002). With this backdrop, diversification towards horticultural crops (area shift in favour of fruits and vegetables) has been suggested as a viable option to stabilize and raise farm income, enhance agricultural growth, and increase employment opportunities (Vyas, 1996; Joshi, 2005; Birthal *et al.*, 2007).

The shifting of land allocation decisions are generally analysed at the macro (state or district) level on the basis of distributive-lag models that capture the role of several economic and non-economic factors in the decision-making. Nerlove (1958) was the first to initiate a study on this aspect, where he endeavoured to find the role of farmers' expectation of future prices in shaping their decisions on the extent of land allocation to these crops. He devised a model relating the expected

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'normal' price to 'past-observed' prices. Later on, many studies used the Nerlovian model, with some modifications also, to investigate the importance of price of crop in shaping farmers' supply response behaviour (Krishna, 1963; Behrman, 1968; Askari and Cummings, 1976; De, 2005; Mythili, 2006). However, there are several limitations in analysing the changing land allocation decisions by using the macro level (state or district) data.

In macro-level studies, a large number of crops, especially high-value crops, including horticultural crops, are excluded from the analysis due to lack of reliable time series data on this crop group in India. In addition, the time series data under conditions of technological change and variable weather constitute a weak basis for estimating price response and hence, micro-level studies are required to analyse such decisions (Medellin *et al*., 1994). Another limitation of the macro-based models is identification of the competing crop. At any given time, not only two crops compete with each other for land, but there are possibilities of many crops competing for land. Also, diversification towards an annual crop and perennial crop differs due to the nature of these crops. The difference lies broadly in terms of the gestation period in production cycle of the crops. The decision of area allocation is flexible for the annual crop, in the sense that every year farmer can think of changing the area under the crop. But, in fruit crop, generally, there is a gestation period of at least 3-5 years initially in the production. The production cycle varies across fruits, but it is only after few years of plantation, when a farmer starts getting some production from the crop. The decision in such a case is inflexible[1], unlike vegetable crops, and it is not easy to switch the land to other crops in the same area, where plantation exists.

In addition, the group of crops that compete for land, at a point of time, varies across regions and farmers. But, the macro-level based analysis assumes the same groups of competing crops for the whole group of farmers/regions. In reality, due to the existence of heterogeneity in the agro-climatic characteristics, competing crop is expected to differ according to the farmers and regions. The supply response (changing land allocation among crops) would vary for the groups of farmers, who shift from food crops to a commercial crop versus the farmers, who shift from one commercial crop to another commercial crop. Price can be a vital component for the second group of farmers, whereas for the first group of farmers, who shift from a food crop, the concern for food security can also be an important factor, while considering land allocation decisions. This type of changing land allocation decisions should also be viewed from the income angle. However, the macro-level studies mainly concentrate on the price of crop as a major economic factor in shaping farmers' changing land allocation decision. Price alone may not be the only factor in decision-making due to heterogeneity in the resource and capital endowments of the farmers and difference in access to input and output markets by the farmers. Such a difference influences both the prices and productivity of the crop. It could be hypothesized that farmers with a relatively higher level of productivity may allocate more land even at low expected price. Hence, it is important to examine the link between both the price and income with the shifting cropping pattern decisions of the farmers. Deshpande and Chandrashekar (1982) though attempted to study the role of income in the farmers' decisions at the district level, heterogeneity in the cost across farms makes it more robust to study such decisions at the micro level, viz. farmer. In this paper, micro-level decision making of area shift towards selected horticultural crops, separately for a fruit (apple) and a vegetable (cauliflower), has been studied. The role of both price and income has been examined along with the role of food-security goals in the decision-making of farmers regarding area shift from low-value crops (food crops) to high-value crops (horticultural crops).

Sampling

The study was carried out in the Shimla district of Himachal Pradesh (*the Horticultural State of India*), where horticultural crops contribute more than 30 per cent to the total value of output in the agricultural sector. A multi-stage purposive sampling procedure was followed to select the block, villages and farmers. The selection of block was made on the basis of two criteria, viz. growth rate in area under horticultural crops and substitution from non-horticultural to horticultural crops. The Theog block emerged as a representative block, as it showed highest growth rates of area under horticultural crops and exhibited maximum substitution from non-horticultural to horticultural crops (Tables 1 and 2).

[1] Once land is put under plantation, it blocks land for cultivation of other crops in this land, at least for some years.

Table 1. Compound growth rates in area of major crop groups across blocks in Shimla: 1997-2006

Blocks	Agricultural crops*	Vegetables	Fruits	Horticultural crops**
Basantpur	-0.72	0.73	1.29	1.23
Chopal	-0.65	-2.62	0.99	-0.20
Mashobra	-0.73	3.52	1.39	2.18
Chiragaon	-0.63	3.67	1.58	2.63
Rampur	-0.59	-0.73	1.76	1.25
Narkanda	-2.02	2.81	1.16	1.38
Jubbal	-0.57	-3.15	0.85	0.34
Rohru	-1.81	1.32	1.31	1.31
Theog	-2.71	3.87	1.26	2.69
Shimla District	-1.00	2.00	1.24	1.45

Notes: Wheat and maize were the major agricultural crops in the region
*Agricultural crops constituted all food and non-food grain crops, excluding fruits and vegetables
**Horticultural crops constituted all fruit and vegetable crops.
Source: Directorate of Agriculture and Horticulture, Shimla, Himachal Pradesh

Table 2. Total area changed under horticultural crops across blocks in Shimla: 1997-2006

(area in ha)

Blocks	Vegetables	Fruits	Horticultural crops
Basantpur	25	176	201
Chopal	-193	427	234
Mashobra	416	338	754
Chiragaon	442	594	1036
Rampur	-18	682	664
Narkanda	181	691	872
Jubbal	-254	611	357
Rohru	383	674	1057
Theog	1953	588	2541
Shimla District	2935	4781	7716

Source: Directorate of Agriculture and Horticulture, Shimla, Himachal Pradesh

For villages, the sample was drawn from four villages (two villages each for fruits and vegetables) from this block, as these villages were representatives of shifts in cropping pattern towards fruits and vegetables, respectively[2]. A sample of 30 farm households (120 farmers in total) was drawn from each of these four villages following the stratified and proportional random sample approach[3] on the basis of farm-size distribution (Table 3). Apple (as fruit) and cauliflower (as vegetable) crops were chosen for the study on the basis of maximum shift of land towards these crops in the respective villages.

Typology of Diversification towards Horticultural Crops

The shift in cropping pattern was measured on the basis of the reference to the major change made by the farmers in terms of reallocating land from food crop to the chosen horticultural crop (apple and cauliflower)[4]. Though, past three year data on farmers' area allocation among crops was also taken, the same was not used for proxy for shift in cropping pattern towards horticultural crops. It was especially in the case of cauliflower as majority of the farmers were found not changing any area under the crop. In addition, in the case fruits, farmers' decision of allocating area

[2] The choice of village was based on the discussions with the Agricultural and Horticultural Development Officers of Theog block.

[3] Since interview with the farmers included recall method, many farmers were found to have given inadequate information. Hence, re-sampling was done after the completion of interview with farmers from the first list of 120. The model of stratified and proportional random sample approach was kept intact while re-sampling was designed. In total, 167 farmers were interviewed to cover the complete information from 120 farmers.

[4] We exercised caution regarding the decision of re-plantation and new plantation of apple crop, while conducting the interview, as it otherwise would not have captured the process of diversification by the farmers.

Table 3. Farm-size distribution and sampling from the selected villages

Farm size	Vegetables-dominated villages		Fruits-dominated villages	
	Village 1	Village II	Village 1II	Village IV
Marginal (< 1 ha)	35 (7)	43 (8)	17 (3)	11 (2)
Small (1-2 ha)	49 (11)	67 (12)	47 (9)	29 (6)
Semi-medium (2-4 ha)	37 (7)	48 (8)	63 (14)	51 (12)
Medium (4-10 ha)	13 (2)	16 (2)	15 (3)	30 (7)
Large (> 10 ha)	14 (3)	0(0)	6 (1)	14 (3)

Note: Figures within the parentheses are the number of samples collected from each village.
Villages I, II, III, IV are Govai, Sainj, Sandhu and Shilaru, respectively.
Source: Primary data

was generally inflexible and unidirectional in the short-run and it was not based on the year-to-year price response. Few years' data on area and price may not capture the area shift decisions of the farmers growing fruits, especially apple. The economic variables, which link successive time periods, are the attitudes and the expectations of the farmers, and the entrepreneurial decisions or acts, which are motivated by them. These attitudes, decisions, and acts influence the position (land allocation among crops) attained by the farm in a later period of time (Williams, 1951). Hence, to assess the decision-making process of farmers, the time of major change in cropping pattern by the farmers was used as a proxy to shift in area, which also had an influence on the prevailing pattern of crop-mix or allocation by the farmers.

The questionnaire covered various aspects relating to the area shift by the farmers. Initially, a seven-year picture (1999 - 2006)[5] was drawn and shown to the farmers and some of the questions asked were: When did you make a change in your cropping pattern from a food to the selected horticultural crop? When did you experience the major change in area towards horticultural crops? How much area was reallocated from a food crop to a horticultural crop? Whether the addition of area to horticultural crop was done by substitution of a food or other commercial crop or was it done by extensification of area under cultivation? When did you adopt a major change of area towards selected horticultural crop? What was the previous year price and yield? and What are price and yield thresholds/ levels that influence your decision to reallocate area in favour of horticultural crops?'

In the case of the sample farmers, it was noticed that the shift towards apple was made from two crops, viz. wheat and maize, whereas cauliflower growers had shifted area from one crop only, viz. wheat. The major change in the cropping pattern in favour of the selected horticultural crops happened in the years 2002 and 2003 and a majority of the farmers had shifted towards horticultural crops only once in the past seven years. Also, such shifts were affected by substitution of a food crop, with a few exceptions[6]. Both, the absolute and relative measures for shifting area in favour of horticultural crops were measured that included the extent of area changed from food crop to the selected horticultural crop, and this area change with respect to the initial area under selected horticultural crop and with respect to the net cultivated area of the farm.

The typology of shift from a low-value food crop to a high-value horticultural crop revealed that shift with respect to initial area was very high in cauliflower than apple, whereas shift with respect to net cultivated area was higher for apple[7] (Table 4). More than 100 per cent change with respect to initial area, in total, signified the importance of shift in cropping pattern towards high-value crops in these villages. It was found

[5] This period was selected on the basis of the discussions with Revenue Officer (Patwari) and head of the village in terms of diversification pattern in the selected villages.

[6] In the case of cauliflower, only one farmer had extended the area, whereas in the case of apple, there were two farmers that had extended the area for increasing the importance of the given crop in their cropping pattern mix.

[7] In the vegetable-dominated villages (villages I & II), cauliflower was the major crop, whereas in the fruit-dominated village (villages III & IV), apple was the major crop in the cropping pattern mix.

Table 4. Typology and extent of area shift towards horticultural crops

Variables	Indicator	Vegetable-dominated villages			Fruit-dominated villages			Aggregate
		Village I	Village II	Total	Village III	Village IV	Total	
Initial area (ha)		6.58	7.70	14.28	29.52	44.00	73.52	87.80
Shift in area under diversified crop (ha)	$A_{t1} - A_{t0}$	7.17	13.82	20.99	19.35	27.52	46.88	67.88
Shift in area under diversified crop w.r.t. initial area (%)	$\frac{(A_{t1} - A_{to})}{A_{to}}$	108.93	179.39	144.16	65.54	62.57	64.05	104.10
Shift in area under diversified crop w.r.t. net cultivated area (%)	$\frac{(A_{t1} - A_{to})}{NCA}$	24.50	31.33	27.91	33.71	35.94	34.82	31.37
Proportion of diversified crop area to total area after shift in cropping pattern	$(a_i/\Sigma A)$	54.21	49.95	46.47	67.18	70.05	68.85	54.25
Proportion of diversified crop value to total value after shift in cropping pattern	$(v_i/\Sigma V)$	65.12	74.41	68.45	71.63	81.66	73.08	70.39
Average number of crops produced in a year	Number of crops	4.10	4.30	4.20	3.10	3.57	3.33	3.76
Index of concentration	Herfindahl Index	0.69	0.70	0.689	0.38	0.43	0.41	0.557

$(A_{t-1} - A_{t0})$ = Difference in the area at the time of changing the area under the particular crop
$(a_i/\Sigma A)$ = Proportion of area (a) under particular crop (i) in the total cropped area (A)
$(v_i/\Sigma V)$ = Proportionate value (v) of a particular crop (i) in the total value of the farm output (V)
Source: Primary data

that cauliflower was of more importance in Govai (village I) than in Sainj (village II), and it was despite higher productivity of cauliflower in Govai as compared to Sainj, whereas Sainj has higher intensity of irrigation. It pointed towards the role of other economic, non-economic and financial factors in influencing area under cauliflower. In the case of apple, Shilaru (village IV) had relatively more importance of apple (both in terms of its proportion to aggregate area and aggregate value) than Sandhu (village III). It was primarily due to more area under bearing apple than non-bearing apple in the village IV as apple was adopted well-before in this village than the other village. However, shift towards apple in both the villages had led to higher level of specialization in apple cultivation, as was revealed by the number of crops produced in a year and by the Herfindahl index.

The results of the distribution of shift towards selected horticultural crops across different farm-sizes illustrated that in the case of cauliflower, it was the large farmers who dominated the extent of shift, followed by the marginal farmers (Table 5). This shows that marginal farmers were also able to diversify to a large extent, while maintaining relatively higher level of subsistence. Not much difference in extent of shift was noticed across farm sizes for apple growers. Even after reallocation of area, cauliflower growers showed higher level of spread (measured by Herfindahl Index) as against the apple growers, who were getting highly specialized due to the shift in cropping pattern. It was interesting to note that the land-labour ratio went up with increase in the farm size (in both cauliflower and apple), pointing towards the increased scarcity of own labour with increase in area under horticultural crops. Big farmers were likely to be more dependants on the hired labour for shifting higher allocation of land to horticultural crops.

Socio-economic Factors across Different Extents of Shift towards Horticultural Crops

Socio-economic factors can exert significant influence on the typologies of shift in cropping pattern

Table 5. Typology of area shift towards horticultural crops across farm sizes

Farm size	Area under diversified crop before shift in cropping pattern (ha)	Area under diversified crop after shift in cropping pattern (ha)	Shift in area under diversified crop w.r.t. initial area (%)	Proportion of diversified crop area to total area (ha)	Level of concentration	Number of crops produced in a year	Land/ Labour ratio**
Indicator→	A_{t0}	$A_{t1} - A_{t0}$	$\frac{(A_{t1} - A_{to})}{A_{to}}$	$(a_i/\Sigma A)$	HI*		
Vegetable-dominated village							
Marginal	2.50	3.44	137.50	63.33	0.71	3.10	1.39
Small	6.69	7.25	108.41	57.67	0.73	4.04	2.00
Semi-medium	3.31	3.81	115.09	46.78	0.77	4.37	2.32
Medium	1.38	1.63	118.18	30.20	0.65	5.00	3.76
Large	1.50	6.25	416.67	49.61	0.78	5.00	5.51
Fruit-dominated village							
Marginal	2.00	2.88	65.71	96.62	0.43	2.00	2.08
Small	2.32	8.25	55.93	97.98	0.37	2.54	2.74
Semi-medium	3.76	22.00	74.26	94.06	0.49	3.30	4.32
Medium	5.51	11.06	57.84	76.86	0.45	3.70	6.16
Large	10.25	5.63	54.88	91.90	0.56	3.89	6.32

Notes: * Herfindahl Index (HI)

** Land was the net cultivated area and labour was number of agricultural labourers at home

Source: Primary data

through their influence on resource availability and risk management abilities at the farm level. The results revealed that the farmers who had shifted a higher extent of area towards horticultural crops had a larger family size, and had more number of dependants, in the case of cauliflower but not in the case of apple (Table 6). Larger family size and more dependants at home had not deterred higher extent of shift by the cauliflower growers, unlike apple growers. It might be because of difference in the flexibility in decision-making. Apple growers were more cautious because their decision of changing cropping pattern in favour of apple was inflexible. Once the decision was taken regarding increase in the area under the crop, farmer had to wait for another 3-5 years for initial production and wait for another at least 4-5 years for initiating good returns from the crop. Whereas, for cauliflower growers, the decision of change in area allocation could be altered every year. It was noticed that in the case of cauliflower, farmers with higher level of irrigation were able to shift higher amount of area, unlike apple growers. Irrigation was important for growing cauliflower crop, which is a water-intensive crop, whereas, water was not a critical resource for producing apple. However, there was a similarity in the role of labour available at home in shifting area towards both apple and cauliflower crops. More labour at home (including children and wife) had indeed influenced the extent of shift in the cropping pattern. Both the crops were highly labour-intensive and availability of self-labour had helped farmers to take the decisions of shifting higher extent of area towards these crops.

Food-security Concerns in Diversification towards Horticultural Crops

One of the major features of the farming sector in developing countries is the co-existence of subsistence and commercial crop production by a large group of farmers. Concerns for household food-security could hinder higher shift in the cropping pattern (crop substitution) from food crop to commercial crop. But

Table 6. Socio-economic characteristics at different levels of shift in cropping pattern

Extent of cropping pattern shift		Family size (No.)	Number of dependants (No.)	Farm size (ha)	Irrigation intensity*	Land/ Labour	Annual non-farm income (Rs)
Cauliflower	Low	5.88	2.17	2.34	61.27	0.20	90673
	Medium	6.82	2.10	3.16	61.50	0.23	85484
	High	7.20	2.80	3.14	82.94	0.18	83127
Apple	Low	7.12	2.25	5.56	22.29	0.39	96300
	Medium	6.28	1.78	4.92	9.35	0.47	63875
	High	6.05	1.70	4.11	8.45	0.38	91100

Notes: Extent of shift: For low (less than 10% shift in area under diversified crop w.r.t. net cropped area), medium (10-20% shift in area under diversified crop w.r.t. net cropped area) and high (more than 30% shift in area under diversified crop w.r.t. of net cropped area)

*Percentage of net irrigated area to net cropped area

Source: Primary data

at the same time, value of many of the commercial crops, especially horticultural crops is very high, which could improve the household food-security through higher net income. It could lead to an increase in the consumption level and standard of living of farm households. However, high fluctuations in the prices of horticultural crops could potentially prove detrimental to the food-security of these farm household. High variability in returns, higher cost of obtaining food from the market due to lack of infrastructure and overall low income might force the farmers to involve in more of subsistence crop production (Jayne, 1994; Nowshirvani, 1971).

Regarding, food security, it was revealed that the majority of farmers who diversified towards cauliflower were food-self-sufficient before shift in the cropping pattern, whereas it was not true for the farmers, who had diversified towards apple (Table 7). It could be mainly because of higher returns from apple than cauliflower crop. Also, the family size as well as the level of dependency ratio (number of non-working members at home) were larger for farmers growing cauliflower as compared to the apple growers, which probably also resulted in difference in the extent of shift in cropping pattern decisions of the farmers. However, both cauliflower and apple growers were found to be less responsive to the changes in prices of food grains (in terms of changing their consumption). Again, apple growers were found to be less concerned about changing food consumption due to fluctuations in the prices of food crops. It was primarily due to two reasons, viz. higher gross margin attached to these crops and easy access to informal credit from the local market at low interest rate. In the case of apple, the gross margin was so high that it could cover more than four-to-five year expenditure of farm and non-farm families, in general. For cauliflower, the prices did go very low sometimes, but this trend did not last for more than one year due to which they had higher expectations of getting good remuneration over the period of time. Easy access to credit allowed them to hedge against the loss created by either production or price decline in any given year. Farmers also mentioned another reason for this behaviour, viz. there was not only abundance of food crops in the state but their prices were also very low due to high production in the adjoining states (Punjab and Haryana). They had never faced any problem in obtaining food crops from the nearby market and that too at a low price.

Factors Affecting Micro-Level Decisions for Diversification towards Horticultural Crops

The micro-level decisions about shift of area in favour of high-value crop were analyzed in terms of the level of substitution of food crops (wheat/maize) by high-value crops (apple and cauliflower). The farmers were asked as to when they experienced the major change in the cropping pattern in favour of high-value crops (apple or cauliflower) and what was the extent of shift (or substitution) in terms of area and

Table 7. Cropping pattern shift and food self-sufficiency among horticultural crop growers

Particulars		Vegetables		Fruits	
		Village I	Village II	Village III	Village IV
Whether farmer shifted frombeing	Yes	63.33	66.66	13.33	30.00
food self-sufficient (%)	No	36.67	33.34	86.67	70.00
Whether increase in prices of food grains	Yes	19.33	23.33	13.33	16.67
reduces its consumption (%)	No	80.67	76.67	86.67	83.33
Level of subsistence beforeshift in cropping pattern* (%)		42.54	38.33	22.84	35.47
Level of subsistence aftershift in cropping pattern* (%)		24.26	29.49	5.33	6.22

Note: *Level of subsistence: Calculated as proportion of area under subsistence crops to total cropped area
Source: Primary data

from which crops. They were further asked to furnish details about the price and yield of both the crops (substituted and added) at the time of change, which influenced their decision to shift[8]. The rationale behind using price and yield, as expected by the farmers[9], was that prospective yield and price had some kind of motivating force, which could in the long-run affect the acreage planning of farmers (De, 2005). Since the farmers experience major changes in their cropping pattern in different periods, it is important to do price adjustment by deflating the price of the crops. Consumer Price Index-Agricultural Labourer (CPI-AL) measure was used for price adjustment (the price of the crops was deflated by CPI-AL in order to arrive at the real price). Information regarding their socio-economic status and other factors was obtained that included their education level, farm size, irrigation status, and food requirements (especially of a substituted crop). The regression method was used to gauge the factors affecting the extent of substitution by the farmers while considering both the economic and non-economic factors as explanatory factors. The relative price and relative income were used as explanatory variables to test whether farmers cared for only price or also the income (included price and yield) in their crop substitution decisions. The results were outlined separately for apple and cauliflower due to difference in the nature of these crops. The specification of the equation was as follows:

$$(A_{c_2} - A_{c_1}) = f\ (P_{c_1}/P_{c_2}\ ;\ I_{c_1}/I_{c_2}\ ;\ I_{NF}\ ;\ I_E\ ;\ Res_{(FS,\ IRRI)}\ ;\ Cons)$$

where,

$A_{c_2} - A_{c_1}$ is the shift of area from low-value crop (C_2) (wheat or maize) to high-value crop (C_1) (apple or cauliflower),

P_{c_1}/P_{c_2} is the ratio of the real prices of the crops C_1 and C_2 (at which farmer makes the area shift decision),

I_{c_1}/I_{c_2} is the ratio of the real income (gross returns per ha) of the crops C_1 and C_2 (at which farmer makes the area shift decision),

I_{NF} is the annual non-farm income (Rs),

I_E is the education level of farmers,

$Res_{(FS,\ IRRI)}$ denotes farm size (in ha) and irrigation (net irrigated area), and

Cons is the level of annual food requirement of substituted crop at home (in Rs).

The results revealed that the relative income from the crop was positive and statistically significant in explaining the crop substitution decisions of farmers (Table 8). The relative price variable came out to be insignificant and was even negative in the case of cauliflower. This showed that farmers, generally, calculate the aggregate gain from the crop in their

[8] In the short-run, changes in the price of crops may not bring about a significant change in acreage under crops due to the particular nature of agricultural production and land allocation of high-value crops is generally a long-term decision by the farmers, especially in the case of a fruit crop.

[9] According to Shackle (1949), farmers, while deciding about changing land allocation among crops are concerned with the consequences of the decision in future. Since, the outcome is not known at the time of taking the decision, a farmer has to restore to imagination of figure (expectation) about the possible outcome.

Table 8. Micro-level decision for area shift in favour of horticultural crops

Area shift as a dependant variable	In favour of cauliflower	In favour of apple
	Coefficient	Coefficient
Constant	-0.111 (.770)	0.624 (1.589)
Relative price (Rs/kg)	-0.620 (.518)	0.034 (.288)
Relative income (Output/ha)	0.481 (7.098)*	0.579 2.058)**
Education (years)	-0.037 (.980)	-0.233 (2.138)**
Farm size (ha)	0.610 (8.675)*	0.204 (1.379)
Irrigation intensity (net irrigated area/net cropped area)	0.107 (2.926)**	0.031 (0.269)
Non-Farm Income (Rs)	0.028 (0.771)	0.226 (2.022)**
Food crop (wheat/maize) requirements at home (Rs)	-0.123 (3.071)**	-0.011 (.095)

Notes: Competing crops for cauliflower: Wheat; For apple: Wheat & maize
Figures within the parentheses are t-values
Cauliflower R^2: 0.944, Adjusted R^2 :0.933, N=60
Apple R^2: 0.448, Adjusted R^2 :0.361,N=60
* and ** signify levels of significance at 1 per cent and 5 per cent, respectively
Source: Primary data

decision rather referring to only the price of the crop. Their capacity to generate higher productivity along with the better market prospects explained farmers' decision. In terms of importance of resources, irrigation and farm size were positive and statistically significant for cauliflower growers, whereas for apple growers, it was the non-farm income that came out to be positive and statistically significant. It might be because cauliflower is primarily a water/irrigation-intensive crop, unlike apple, and it is critical to have better irrigation to increase the allocation to this crop. Both the resources, viz. irrigation and farm size, affect the productivity of cauliflower and hence are important. Since there is a large gestation period in apple cultivation, farmers were more concerned about the availability of the non-farm income source during the whole course of time, while making decision of crop shift in favour of apple. Education turned out to be negatively significant for shifting decisions of apple growers.

The shift in favour of apple was linked with the increasing level of specialization in apple, because it being a perennial crop blocks land for cultivation of other crops. Educated farmers were concerned about the risk from the production of the crop and hence, preferred to have a higher level of diversity in their cropping pattern than being fully specialized in one crop. They were found to have more awareness about the trade-off between risk and income, whereas uneducated farmers concentrated more on income optimization than concerning about the risk situation. The food crop requirement (the food crop, which was substituted) had also affected the decision of substitution. It was negative in both the cases of apple and cauliflower, whereas, it was significant only for cauliflower growers. It meant that higher food requirements at home inhibited the extent of crop substitution decision of the farmers, especially in cauliflower. The returns from cauliflower were far low as compared to apple and once the apple growers got the bumper crop and good price, it could cover household food and farm expenditure for many years, which was unlikely in the case of cauliflower growers. Thus, cauliflower growers were more cautious in substituting food crop to high- value crop as compared to apple growers.

Conclusions

Both fruits and vegetables are high-value crops that promise huge gains in terms of output per ha, employment and farm income. However, there are differences in decision-making on diversification towards these crops by the farmers. These differences are in terms of degree of flexibility in crop, relative returns from the crops, and consequences of shift in cropping pattern on the allocation profile of the farmer (higher extent of shift by the apple growers is expected to make them specialize in apple-cultivation, unlike in the case of cauliflower crop). Some similarities and dissimilarities have been found in the decision-making towards apple and cauliflower by the farmers. Higher

food requirements at home inhibit crop substitution decision of the farmers growing vegetable crop. It is specifically because the returns from a vegetable crop (viz. cauliflower) have been found far less than a fruit crop (viz. apple). Once the apple growers get the bumper crop and good price, it covers household food and farm expenditure for many years, which is unlikely in the case of cauliflower growers. However, both cauliflower and apple growers are less responsive to the changes in prices of food grains (in terms of changing their consumption) as higher income from these high-value crops provide adequate money to them to purchase food crops from the market. Relative incomes of the crop have explained the crop substitution decisions of the farmers. This means that farmers calculate the aggregate gain from the crop rather calculating only the price of the crop, while making the decision to shift. Their capacity to generate higher productivity along with better market prospects has explained farmers' decision.

For cauliflower growers, resource availability at farm is more important for diversification decision, than apple growers, where it is the availability of additional income source that is vital. Interestingly, education has been found inversely related to the diversification decision towards apple, as these decisions are linked with increasing level of specialization in apple. Educated farmers have been found concerned about the risk from the production of the crop and hence, prefer to have higher level of diversity in their cropping pattern than being fully specialized in one crop.

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