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Diversification towards Horticultural Crops in Jammu and Kashmir: Micro-level Analysis of Economics and Non-Economic Factors[1]

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Abstract: *The macro-level models of analysis of diversification mainly focus on the price of crop as major determinant of changing land allocation. However price alone may not be the factor in decision making. At farm level there is difference in endowments, infrastructure development and access to markets, food security concerns and several other economic and non-economic factors that play a role in changing land allocation decision by farmers. So it becomes important to analyze the changing land allocation decisions at micro/farm level. In this context primary survey was undertaken to understand the dynamics of process of diversification at micro level and analyze the various factors that provide stimulus to the process of diversification and the role of various economic and non-economic factors in the decision making process of farmers in changing allocation of land from low value crops to high value horticulture crops.*

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I. Introduction

The decision making process relating to land allocation at macro-level was examined initially by Nerlove Model. The Nerlove (1958)Supply response models of changing land allocation among different crops due to change in economic values of crops emphasized the role of future price expectations of farmers in land allocating decisions. Later on the Nerlove Model with modifications was used in many studies to determine the farmers land allocation among different crops (Askari and Cummings, 1976, Sawant, 1978, De, 2005 Mythili, 2006). However, the macro-level models of analyzing land allocating decisions by farmer's have several limitations. These macro-level models mainly focus on the price of crop as major determinant of changing land allocation by farmers. However price alone may not be the factor in decision making. At farm level there is difference in endowments, infrastructure development and access to markets, food security concerns and several other economic and non-economic factors that play a role in changing land allocation decision by farmers. Another limitation is that a large number of horticultural and other high value crops are excluded from the analysis due to non-availability of reliable time series data on prices, costs and output. In addition the macro-level models assume that only one crop competes with other but many crops may be competing at any given time, the competing crops vary across regions and agro-climatic zones. Also the changing land allocation decisions vary across farmers who shift from food crops to high value commercial crops and those who shift from one commercial crop to another commercial crop. For farmers shifting area from food crops to commercial crops the food security may be the prime concern whereas for farmers shifting area from one commercial crop to another, price or income from the crop may be of more importance, the macro models do not analyze these factors.

Given these limitations of macro-level models, it becomes important to analyze the changing land allocation decisions at micro/farm level. Many micro-level studies have analyzed the land allocation decision on basis of probability distribution but are criticized on basis that farmers are seldom aware of probability of economic outcomes. Shackle (1949) emphasized that instead of probability of outcome farmers are more concerned with the consequences of his decision in future. The decision making of farmers is guided by the expectation of possible outcome of price, yield and income (Arrow, 1951, Binswanger, 1981). In this context primary survey was undertaken to understand the dynamics of process of diversification at micro level and analyze the various factors that provide stimulus to the process of diversification and the role of various economic and non-economic factors in the decision making process of farmers in changing allocation of land from low value crops to high value horticulture crops. The first section of the paper presents the typology and

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extent of diversification towards horticultural crops in the selected villages. This section is followed by section on agriculture diversification and food security, and relative significance of factors influencing diversification towards horticulture crops.

II. Overview of Selected Villages

A multi-stage purposive sampling was followed in order to select the district and villages. The Baramulla district was chosen on the basis of being representative in area and production of horticulture crops especially Apple. The district ranks first in area and production of Apple crop at national as well as state level. In 2013-14 the area under cultivation of Apple in the district was 24.66 thousand hectares and production was 328.04 thousand tonnes. The district has the highest proportion of area under horticulture crops and produces 28 percent of horticulture output of the state. Two villages were chosen on basis of cropping pattern, infrastructure development and distance from markets for inputs and outputs. The village I (Jahangirpora) has a mix cropping pattern. The village is at a distance of 20 kilometers from markets. Rice and Fruits are the two major crops, whereas rice is cultivated in low lying areas because of non-availability of irrigation in upper areas, Fruits cultivated in both upper-hill and low lying areas. Though Apple cultivation is generally many times profiteer than rice cultivation, why farmers still go for rice cultivation is an important question to answer. Another village II (Krankshivan) is selected Apple dominant and nearby to markets. Fifty samples are drawn from each village by stratified and proportional random sampling approach.

Farm Size and Typology of Diversification

The Sample size and area reallocation past 10 years in selected villages is presented in Table 1. From the table more number of sampled farmers has made area reallocation in Village II than in Village I. Notably in Village I marginal and small farmers have been reluctant in reallocating area whereas in Village II reallocation has taken place irrespective of farm size. Though the factors influencing area reallocation are different in two village, it is evident the number of farmers reallocating area and farm size are positively correlated.

Table 1: Sample Size and Area Reallocation in selected Villages in last 10 years

Villages		Village I		Village II	
Main Crop cultivated		Paddy and Apple		Apple	
Farm size	Unit	Sample Collected	No. of Farmers Reallocated Area	Sample Collected	No. of Farmers Reallocated Area
Marginal	≤ 5 Kn.	7	4	9	3*
Small	5- 15 Kn.	21	12	23	21
Medium	15-30 Kn	15	9	14	14
Large	>30 Kn.	7	7	4	4
Total		50	32	50	42

Source: Primary Data

**out of 9 samples collected from marginal farmer in village II, 6 farmers had no scope for further reallocation of land in past 10 years*

The typology of diversification by farm size for village I and village II is presented in Table 2 and Table 3 respectively.

Table 2: Typology of diversification by Farm Size in Village I

Variables	Indicator	Marginal	Small	Medium	Large
Initial Area under diversified crop (Kn)	A_o	2.7	112.5	65	142
Shift in area under diversified crop w.r.t. Initial Area (%)	$\frac{(A_1 - A_0)}{A_o}$	103.7	28.44	47.69	39.45
Shift in area under diversified crop w.r.t. Net Cultivated Area (%)	$\frac{(A_1 - A_0)}{A_n}$	17.5	27.71	16.49	19.18
Share of diversified crop area to total area after shift in cropping pattern	A_i/A_T	34.38	50.65	50	67.81
Share of diversified crop value to total value of output after shift in cropping pattern	Vo/Vt	50.72	59.54	63.66	82.58

Source: Primary Data

In village I with irrigation intensity of 45.96 and significant area under food grains marginal farmers have highest degree of shift in area w.r.t initial area under diversified crop. However the shift in area w.r.t net cultivated area is more or less similar across farm size. Notably the share of diversified crop area to the total area after area shift is increasing with the farm size in in both the villages, however the increase in share is more

prominent in village I. Also the farmers in village I have maintained higher level of subsistence (Table 4). This shows that concern for food security has direct impact on farm diversification. Despite the fact that horticulture crops are several times profiteer than food crops, farmers where irrigation facility is available for food crops, have maintained higher level of subsistence. The varying level of subsistence maintained by farmers in the two villages for the same crop (Apple) highlights food security concerns in the process of diversification.

Table 3: Typology of diversification by Farm Size in Village II

Variables	Indicator	Marginal	Small	Medium	Large
Initial Area under diversified crop (Kn)	A_o	6	120	232	93
Shift in area under diversified crop w.r.t. Initial Area (%)	$(A_t - Ao)$ Ao	100	50	31.47	60.22
Shift in area under diversified crop w.r.t. Net Cultivated Area (%)	$(A_t - A_o)$ A_n	42.86	25.42	22.46	36.13
Share of diversified crop area to total area after shift in cropping pattern	At/AT	85.71	76.27	93.85	96.12
Share of diversified crop value to total value of output after shift in cropping pattern	Vo/Vt	91.95	89.24	98.66	98.92

Source: Primary Data

Table 4: Level of Subsistence among the Horticultural Crop by Farm Size

Variables → / Farm size ↓	Unit	Village I	Village II
Marginal	≤ 5 Kn.	42	0
Small	5- 15 Kn.	53	15
Medium	15- 30 Kn.	50	0
Large	>30 Kn.	45	0

Source: Primary Data

Level of subsistence - Calculated as proportionate of area under subsistence crops to total cropped area
The Figures are in percentage, where N for each category is 50

Food Security and Farm Diversification

Though the Diversification towards horticulture crops increases the farm returns, but due to scarcity of land and poor income base farmers, particularly small and marginal farmers face a trade-off between income maximization and the food security. The higher returns from horticulture crops can improve the food security position of farmers but the variability of returns from horticulture crops and difficulty in timely availability of foodgarins may worsen the food security of farm households. The concern for food security could hinder the process of farm diversification from food crops to high value commercial crops and farmers might be forced into subsistence crop production (Jayne, 1994).

The state of Jammu and Kashmir is highly dependent on imports from neighboring states of Punjab and Haryana for its food requirements. The fruit growing valley of Kashmir has poor connectivity with rest of the states as there is only one National Highway that too is not easily accessible for almost six months of the year. The heavy snowfall and landslides on the Highway restrict the movement of vehicles in winter season. Also the railway connectivity is not through to the valley. As most parts of the state are hilly and terrain with little access, the public distribution system of distributing foodgrains is not efficient and reliable as households do not rely on government store for purchasing food requirements. Most of the households prefer to maintain adequate stock of foodgrains for winter season. Given these factors, the food security is of great significance particularly for farmers diversifying area to horticulture crops.

In this regard, several questions related to food security were asked to selected farmers. The objective is to assess the impact of food security concerns on farmer decision of reallocating area towards horticulture crops and various economic and non-economic factors that have influenced the area reallocation.

Table 5: Cropping Pattern Shift and Food Self-Sufficiency

Indicator		Village I	Village II
Pre-reallocation			
Proportionate area under subsistence crops to GCA		64	25
Whether farmer was food self-sufficient	YES	94	72
	NO	6	28
If No, Whether food grains were easily available in market	YES	0	0

	NO	100	100
Whether increase in prices reduce foodgrians consumption	YES	4	8
	NO	96	92
Post-reallocation			
Proportionate area under subsistence crops to GCA		48	5
Whether farmer is food self- sufficient	YES	92	12
	NO	8	88
If No, Whether food grains are easily available in market	YES	25	0
	NO	75	100
Whether increase in prices reduce foodgrians consumption	YES	6	14
	NO	94	86

Source: Primary Survey

Note: Figures are in percentage

The results are presented in Table 5 and are categorized as pre-reallocation- when the farmers had not reallocated area to horticulture crops and post-reallocation- when farmers had reallocated the area. The results indicated that the before shift in cropping pattern, the proportionate area under subsistence crops for selected farmers in village I and II were 64 and 25 percent respectively implying that Village II had already diversified from food crops to horticulture crops, Whereas Village I had larger area under subsistence crops. Post reallocation whereas Village II had almost completely specialized in horticulture crops, the extent of area under subsistence crops in village I reduced marginally from 64 percent to 48 percent. The difference in extent of diversification towards horticulture crops in two villages raises several questions on the factors influencing diversification and needs a careful examination. In village I with higher irrigation intensity, though the proportionate area of gross cropped area under food crops declined from 64 percent to 48 percent, the percentage of farmers being food self-sufficient had marginally reduced from 94 percent to 92 percent, indicating that farmers have given higher priority to food self-sufficiency over the higher returns from horticulture crops. The food security concern is mainly due to non-availability of food grains in market, as 75 percent of farmers who are not food self-sufficient reported difficulty in access and timely non-availability of foodgrains in market or through public distribution system (PDS) of foodgrains. The under developed markets and unreliable and inefficient and functioning of PDS is acting as the main hindrance in allocating more are towards horticulture crops. The consumption pattern in valley is more rigid as households don't change their consumption pattern in response to increase in price of foodgrains. More than 90 percent of farmers reported that they don't change their consumption with increase in price. Addressing the food security concerns by development of markets for foodgrains, availability of food grains and improvement in efficiency and functioning of PDS can act as catalyst for diversification towards horticulture crops. In case of Village II were only 5 percent of area is under subsistence crops and number of selected farmers being food self-sufficient has reduced from 72 percent to 12 percent, it should not be misinterpreted that there are no food security concerns. The farmers who have reallocated are to horticulture crops reported the problems in availability of foodgrains in market. Neither do they undermine the food security for higher income/returns from horticulture crops. The farmers reported that the lack of irrigation facilities for cultivating food crops has forced them to reallocate the area to horticulture crops mainly Apple. The apple crop does not require continuous irrigation facility like rice and normal seasonal rainfall are sufficient for its cultivation. Most of the farmers reported that three year successive drought like conditions from year 2001-03 forced the farmers to reallocate are towards Apple crops. The shortage of water for irrigation in subsequent years reduced the area under foodcrops. Though the farmers are getting higher returns from Apple crop, the diversification decision is forced by climatic conditions and the concern for food security has not been addressed.

Relative Significance of Factors in Diversification towards Horticulture crops

Though the farmers in Village I identified the food security concerns as major impediment and farmers in village II reported lack of irrigation for food crops as major factor in diversification towards fruit crops, there are several other economic and non-economics factors that play role in area reallocation of farm land. The horticulture crops especially Apple require huge resources as inputs such as fertilizer, pesticides, labour etc. and being relatively perishable incur high marketing and transportation costs. Besides the huge input resources there are higher price fluctuations and variability in returns to these crops. These economic and non-economic factors play crucial role in farmer's decisions and therefore it is vital to identify the relative significance of these factors in process of diversification. The Rank and weighted mean were used to identify the relative significance of factors. The farmers were asked about their relative preference of several factors influencing area reallocation and seven key variables were identified. The farmers were asked to rank these factors from 1 to 7 in descending order of preference and the most important factor ranked 1 gets the highest weight i,e 7 , the second most important factor ranked 2 and gets weight 6 and so on . Then the weighted mean was calculated to identify the relative importance of factors in farmer's decision.

The formula for Weighted Mean is, Weighted Mean = $\sum_{i=1}^{7} wiXi/n$
Where w_i is non-negative weights, x_i is number of responses for i^{th} factor and n is total number of respondent farmers, n = 50.
The results for the sampled farmers in two villages are presented in Table 6

Table 6: Relative importance of factors in diversification towards horticulture crops

Factors	Village I			Village II		
	Rank	Weight	Weighted Mean	Rank	Weight	Weighted Mean
Price	1	7	6.28	1	7	6.08
Labour	2	6	5.90	3	5	4.65
Credit	3	5	4.75	4	4	4.16
Infrastructure	4	4	3.80	6	2	2.20
Yield	5	3	3.40	5	3	3.05
Foodgrains availability	6	2	3.30	2	6	5.85
Irrigation availability	7	1	2.90	7	1	1.18

Source: Primary Survey
Infrastructure- market for inputs/produce, roads etc.

The results indicate that price/income from the crop is the most significant factor in allocating more land towards fruit crops in both the selected villages. However the rank and weight of other key factors vary between villages. Whereas labour availability and credit are of high significance for farmers in village I, the availability of food is ranked 6^{th} among the factors as most of the farmers have maintained the subsistence level of food production and therefore are less dependent on market for meeting their food requirements. However the easily and timely availability of food grains would have increased the pace of diversification towards horticulture crops.

In village II, availability of foodgrains ranked as 2^{nd} with a weight of 5.85, reflects the food security concerns of farmers. Though farmers have allocated higher area under horticulture crops and only 5 percent of area is under food crops, the area reallocation decisions are forced by lack of irrigation facilities. Had there been proper irrigation facilities farmers would have maintained subsistence level of food crops because of poor infrastructure and availability of foodgrains in market. However the Apple production being four to five times profiteer than food crops, the income from apple production outweighs the concern of food security as farmers in both villages ranked price/income as first with weight above six. Labour and credit are other two factors of high significance as horticulture crops are labour and resource intensive. It is to be noted that in both the villages the irrigation facility is given the least significance for area reallocation, primarily because of the fact the horticulture crops especially fruit crops are not irrigation intensive and require just normal rainfall or irrigation once in entire cropping season. Even some farmers reported adverse impact of water logging on apple cultivation.

Socio Economic Characteristics and area reallocation decision

As the horticulture crops are resource intensive, the socio-economic characteristics of farm households can influence the cropping pattern and area reallocation decision of farmers. The household availability of labour, farm size, other non-farm income source and number of dependent family members can influence the extent of area reallocation. In order to assess the influence of these factors on extent of farm diversification, the area reallocation by farmers is grouped into three categories Low, Medium and High level of shift in cropping pattern with respect to Net Cropped Area (NCA) and the results are presented in Table 7.

The results indicate that farmers with higher family size have made higher allocation towards horticulture crops. The higher family size means more domestic availability of labour. The number of dependent family members has negative correlation with extent of area allocation. The farmers with more number of dependents tend to maintain higher level of subsistence. The irrigation intensity and proportion of farm income to total income shows negative correlation with extent of farm allocation towards fruit crops. The farms with higher irrigation intensity tend to have more area under food crops due to food security concerns and farmers with higher percentage of income from farm face more risk in reallocating area to horticulture.

Table 7: Socio- economic conditions and cropping pattern by Apple growers

Level of shift in cropping Pattern	Low < 10% of NCA	Medium 10-25%of NCA	High>25% of NCA
Family size	7.23	7.60	8.07
No. of dependent	4.65	3.16	3.5
Farm size	18.23	19.19	19.93
Irrigation intensity*	45.07	30.13	22.10
Percentage of farm income/total income	67.24	64.22	60.31

Source: Primary Survey Data
NCA- Net Cropped Area
** Percentage of net irrigated area to net cropped area*

Factors influencing diversification towards Horticulture Crops

The farmer's decision of diversification towards Horticulture crops are influenced by a number of factors. Fruit crops being plantation crops deprive the land of alternative use and make the diversification decision irreversible. Whereas the diversification decision towards horticulture crops raises the concerns for food security of the farm household, the higher net income from crops would improve the food security position. However the high variability in returns out of fluctuation in prices could have adverse impact on food security of households thereby could impede the process of diversification towards high value crops (Nowshirvani, 1971).

In order to assess the influence of various factors in diversification towards horticulture crops the farmers who had made area reallocation were asked about the price and yield of both the substituted and high value crops. The relative prices and relative income are used to assess whether farmers are concerned of prices of crops or income from crop. The information on other potential factors is obtained through questionnaire and regression analysis is used to assess the factors influencing the diversification. Analyzing the responses of farmers it is observed that the area was shifted towards Apple crop from three crops Rice, Wheat and maize.

The specification of regression equation is following

$A_s = f (P_A/P_S ;\ I_A/I_S ; E_F ; I_{NI} ; F_{SZ} ; IR_{AV} ; FR_{SC} ;\ CONST)$

Where,

A_S- Area Shifted from low value crop to High value crop

P_A/P_S – Ratio of price of Apple crop to Price of Substituted Crop (Rs/Kg.)

I_A/I_S - Ratio of Income (gross returns per Kn) from Apple crop to Income from Substituted Crop. (Rs/ Kn.)

E_F – Education level of farmers (1 if $\geq 10^{th}$ standard; 0- if lower than 10^{th} standard)

I_{NI} – Annual Non-farm Income of farmers

F_{SZ} – Farm Size (in Kanal)

IR_{AV}- Irrigation availability (1- irrigation is available; 0- irrigation Not available)

FR_{SC} – Annual food requirements (in Rs.) of substituted crop at home.

CONST – Constant

The results of regression analysis are presented in Table 8. The model has R^2=0.784, implying that proportion of variations in dependent variable (Area Reallocated) explained by independent variables is 0.784. The adjusted R^2, that is R^2 penalized for addition of extraneous predictors, is 0.761.

The results show that relative price has negative coefficient and is insignificant whereas relative income is positive and statistically significant. This implies farmers in their decisions of land allocation don't consider prices but are concerned of aggregate gains from crops. Education level of farmers has negative coefficient implying the educated farmers prefer not to specialize in one crop but to keep their land allocation portfolio diversified to minimize the risk, but the variable is not statistically significant. The annual non-farm income has a positive coefficient and is significant at 5% level of significance. The non-farm source of income acts as cushion for farmers during the gestation period of Apple crop.

Table 8: Factors Affecting Diversification towards Horticulture Crops (Apple)

Area Shifted (Dependent Variable)	Coefficient	t-Values
Constant	-6.070	-5.415
Relative Price of crops	-0.337	-0.529
Relative Income from Crops	1.172	6.922*
Education level of farmers	-0.085	-0.171
Annual Non-farm Income	0.036	2.393**
Farm Size	0.164	7.298*
Irrigation availability	0.744	1.126
Annual Food Requirements	-0.012	4.015*

Source: Primary Survey Data

Note- R^2= 0.784; Adjusted R^2= 0.761; N=73

*- 1% level of significance; **- 5% level of significance

Moreover these crops are resource intensive and their prices and income fluctuate widely, the farmers are more concerned of non-farm income sources to meet any eventuality. Also the plantation crops like Apple deprive land of alternate uses; the off-farm income plays a vital role in farmers land allocation decisions. The variable Irrigation Availability is not significant as plantation crops especially Apple require just normal rainfall unlike food crops that require proper irrigation.

The Farm Size variable has positive coefficients whereas the annual food requirements variable has negative coefficient and both are significant at 1% level of significances. The two factors combine signify the farmers concern for food security in diversification decisions. The positive coefficient of farm size implies that area reallocation towards horticulture crops increase with farm size. The small and marginal farmers out of food security concerns are reluctant to reallocate area to horticulture crops where as large farmers keeping aside the area for foodgrains to meet their food requirements, reallocate more area towards horticulture crops. The same is reflected by the negative coefficient of Annual food requirements variable. The farmers with larger food requirements reallocate lesser area to horticulture crops. Though the horticulture crops especially Apple crops are three to four times more profitable than food crops, the food security concerns force the farmers for a mix of commercial and subsistence cropping pattern. While interacting with the farmers it was noticed that the concerns for food security arise out of timely non-availability of food grains in market and Government Food Supply stores. The farmers have sufficient income to buy the foodgrains in market but the poor infrastructure development, inefficiency of Public Distribution System (PDS) and geo-political conditions compel them to maintain food self-sufficiency at farm level and don't let them specialize in high value crops. The farmers thus forego the income from cultivating high value crops and are compelled for subsistence cropping pattern. The freely and timely availability of foodgrains in market can reduce the concerns for food security and farmers can allocate more area towards high value horticulture crops. Thus rural infrastructure development and proper functioning of PDS can accelerate the pace of diversification towards high value crops and can generate more income and employment.

III. Conclusion

The land allocation decisions at farm level are influenced by difference in endowments, infrastructure development and access to markets, food security concerns and several other economic and non-economic factors. Horticulture crops are resource intensive; the socio-economic characteristics of farm households can influence the cropping pattern and area reallocation decision of farmers. The household availability of labour, farm size, other non-farm income source and number of dependent family members influence the extent of area reallocation. Besides the huge input resources there are higher price fluctuations and variability in returns to these crops. These economic and non-economic factors play crucial role in farmer's decisions**.**

Although the Diversification towards horticulture crops increases the farm returns, but the scarcity of land and poor income base, farmer's particularly small and marginal farmers face a trade-off between income maximization and the food security. The higher returns from horticulture crops can improve the food security position of farmers but the variability of returns from horticulture crops and difficulty in timely availability of foodgarins may worsen the food security of farm households. The under developed markets and unreliable and inefficient and functioning of PDS is acting as the main hindrance in allocating more are towards horticulture crops. The concern for food security has direct impact on farm diversification, as despite the fact that horticulture crops are several times profiteers than food crops, farmers where irrigation facility is available for food crops, have maintained higher level of subsistence. The farmers thus forego the income from cultivating high value crops and are compelled for subsistence cropping pattern. The freely and timely availability of foodgrains in market can reduce the concerns for food security and farmers can allocate more area towards high value horticulture crops. Thus rural infrastructure development and proper functioning of PDS can accelerate the pace of diversification towards high value crops and can generate more income and employment.

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