Chapter Four
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For proper planning and policy formulation in the agricultural sector, it is of paramount importance to understand the behaviour of farmer's supply responsiveness. To consider adequately the role of agricultural sector in the development of an economy, of course, the responsiveness of that sector to various incentives must be known. Only with knowledge of this responsiveness can effects of various specific policies on agriculture and on over all growth responsibly be examined (Behrman 10).

Heady has noted that:

> the subject of farmers' responsiveness to economic variables has gained importance during the past few decades in both underdeveloped and developed economies. Developing economies need to understand the supply phenomena in order to implement policies for raising the output to a level which can provide for adequate human nutrition for the increasing population and also to promote general economic development. Even in developed countries, understanding of the supply phenomena is of crucial importance for controlling surplus, for raising farm incomes and resource productivity (Bhagat 2).

Since the response of farmers differ from state to state and even within the state, the knowledge of farmer's behaviour to different price changes is essential to make the price policy an effective instrument for inducing the desired changes in resource allocation to various crop enterprises in the different producing states and in different regions within the state.

Fluctuations in production or, in other words, area under different crops is a common phenomenon in the case of developing economies. These fluctuations in area could be due to the interplay of a host of factors - endogenous as well as exogenous. The problems, however remain as to which of these factors are and to what extent responsible for such sizable shifts in area allocation.

Agricultural producers must not only estimate what demand will be a year or more in the future but also predict what other farmers' reactions to the market are likely to be and they must respond as individuals rather than a coordinated group (Branson and Norvell 139).

Variations in soil, climatic and in human resources are of such importance that many aspects of agricultural development are specific to a particular country, region, district and ultimately, to an individual farm. Changes overtime in the availability and relative prices of productive factors are of great importance in influencing decisions concerning the choice of techniques of production and the combination of farm enterprises (Johnston and Mellor 582).

In fact, the supply responses of an individual farmer involve the attitudes and decision criteria of the farmer in chalking out his production in the light of

the anticipated returns from different crops. Normally, for a farmer, the crucial decisions relating to what crop and how much to grow on how much land with what inputs are essentially based on the expected relative profitability of each crop under different sets of inputs, ignoring for the moment the uncertainty element involved. Thus, the composition and structure of the farm output keep changing overtime as prices change.

Economic theory suggests that prices are important determinants of economic behaviour and rational farmer should sufficiently react to changes in prices of output (Narain 1). In an economist's view, prices are important determinants of economic behaviour (Dean 1).

In the short run, however, individual agricultural commodities respond very differently to price changes than does agricultural output as a whole (Cohen 116). It has been generally observed that output of a crop responds in the short-run to price incentives and in the long-run to technological improvements (Gulati 65).

Increased use of inputs allows agricultural sector to move up along production by increasing yield per unit area. Their utilisation also induces an upward shift in the production function to the extent the technological change is embodied in them (Ramesh 181).

Profits and prices give him a guideline as to what type of crop is to be grown, how much area is to be reserved for it and how much out of the total produce is to be brought to the market for sale at one time (Jat 31). These considerations are equally important for all farmers, whether big, medium or

small. It should also be noted that the role of the price mechanism in meeting the objective of allocation efficiency may be limited to a great extent by the physical, financial and institutional constraints prevailing in the backward economies (Bhagat 5).

A considerable body of literature has been developed in this field and at present, different opinions on supply response prevail. One view is that the farmers in underdeveloped countries are not responsive to the changes in relative prices, while the other view is that they are less responsive than those in the developed countries.

Mellor observes "there is little or no evidence that farmers in low income countries operate according to different set of guiding principles in making their managerial decisions than do farmers in high income countries" (*Increasing Agricultural Production in Early Stages of Economic Development* 39).

Falcon in his study concluded that:

> unless there is a thorough going reform in the services and facilities made available to farmers, higher prices alone can have little effect on increasing yield per acre. On the other hand, the acreage evidence suggests that farmers of the area will respond to economic incentives if given opportunities to do so (590).

In empirical research, the question as to how farmers respond to price incentives have been widely investigated. In a country like India, where the cropping patterns, types of soil and climatic conditions vary widely from one

region to another, no unique hypothesis could be formulated for the country as a whole. This emphasises the need for regional studies on supply response of different crops. The farmers may not respond to price alone. The farmers' decision to raise a crop in any season may be influenced by a complex group of factors like prices of competing crops, weather conditions, price rise and yield risk. It is, therefore, rather difficult to isolate the impact of the price factor on production or acreage.

Attempts to examine the effects of price on acreage change under a particular crop with reference to the price of only that crop are inadequate. The significance of a price change when other prices remain constant is different from what it would be when other prices also change (Narain 11). Farmers' sowing decisions are not influenced only by the post harvest prices of that crop in the preceding year, but also by the post harvest prices of crops which he can substitute for that particular crop (Gupta 67).

A high degree of year to year variability in the price of a commodity has a direct impact on the producer's income. Besides, there might occur acreage shifts in response to changes in relative prices of different products (Kainth 46).

Empirical works based on Indian agricultural data provide ample evidence of the rationality of Indian farmers in allocating resources to competing crops according to their changing relative prices (Swant 5-6).

In agriculture, it is very difficult to forecast the volume and quality of output. A cultivator may only plan the production of certain crop but the final

output considerably depend upon weather, disease, pests, flood and storm over which he has no control.

Besides, all production takes time. In agriculture, in particular the biological nature of production process makes for a considerable lag between production of inputs and outputs.

Thus, many different types of incentives might influence the farmer's decision to change his existing allocation pattern. Among the various incentives, increase in the prices of output may be the foremost to the extent that the production is market oriented. The analysis of growth trend of ginger in Kerala indicates that growth of area under ginger has been uneven among the districts. Whereas in Wynad area under ginger expanded significantly, in Ernakulam, it declined significantly and in Kerala as a whole area is more or less stagnant. Therefore, it is interesting to analyse the factors which have influenced the growth of area under ginger in Kerala and major producing districts.

Nerlovian adjustment lag model is used to analyse acreage response of ginger farmers and is based on the relation:

$$A_t = a_0 + a_1 p_{t-1} + V_t \quad .....(1)$$

Where A_t = Area under ginger

P_{t-1} = Lagged price

V_t = Error term.

a_0 and a_1 are the intercept and the slope of the function. Again, it is related with the actual average by assuming that in each period the actual area under crop is adjusted in proportion to the difference between the desired level

of area and actual area under the crop in question.

$$A_t - A_{t-1} = \gamma (A_t^* - A_{t-1}) \quad ....(2)$$

Where A_{t-1} = Area under the crop in year t-1

A_t^* = Desired area under the crop in year t-1

γ = Adjustment coefficient

Substituting the value of equation (1) into equation (2) and solving for A_t we get:

$$A_t = b_0 + b_1 p_{t-1} + b_2 A_{t-1} + U_t \quad ...(3)$$

Where $b_0 = a_0\gamma$, $b_1 = a_1\gamma$, $b_2 = 1 - \gamma$ and $U_t = \gamma V_t$

Equation (3) is the reduced form and its parameters can be estimated by the use of ordinary least squares.

Here, the output decisions of farmers are approximated in terms of planted area rather than yield. It is the discrepancy between planned and realised output and non availability of any kind of data about planned output except the acreage sown under a particular crop that led previous researchers to approximate planned output, to which the supply function actually refers, by acreage (Tyagi 19-20). Approximation of planned output in a production period by acreage is the only possible approximation within the limits prescribed by existing knowledge, the conditions of production and the available data (Nerlove *The Dynamics of Supply* 67). This is because the area planted is a better barometer of the farmer's planting and land allocation decisions. Further, area is subject to endogenous factors (ie., within the farmer's control) whereas yield

is influenced by several exogenous factors (ie., beyond the farmer's control like weather). It is, of course, true that a farmer can keep area constant and increase output by varying yield levels. Apart from exogenous factors which influence yield, time series data on inputs used by individual crops (ie., secondary data) are not available and hence area is taken as a proxy for output.

4.1. Acreage Response in Kerala

For estimation purpose, secondary time series data for different variables for the period 1973-74 to 1993-94 are used (Table B-1 in Appendix B). Turmeric is selected as a competing crop on the basis of the sample survey conducted as a part of the study. The functional form used in the present study is given below:

$$A_t = f(p_{t-1}, A_{t-1}, Y_{t-1}, TP_{t-1}, R_t)$$

Where A_t = Area under ginger in the year 't'

P_{t-1} = Price of ginger in the year t-1

A_{t-1} = Area under ginger in the year t-1

Y_{t-1} = Yield of ginger in the year t-1

Tp_{t-1} = Price of turmeric in the year t-1

R_t = Rainfall in the year t

The most widely used form of the equation in supply response studies is the linear form either in absolute terms or in logarithmic form. In the present study the linear form in absolute term is used.

Table 4.1

Results of Acreage Response Function of Ginger in Kerala (1973-74 to 1993-94)

Dependent Variable	Constant	Independent Variables					R^2	F
		P_{t-1}	A_{t-1}	Y_{t-1}	R_t	TP_{t-1}		
	**	**	*					
A_t	5011.9781	0.6797	0.5664	---	---	---	0.69	20.10
	(2.630)	(2.454)	(3.676)					
	**	***	*					
A_t	4864.1297	0.6434	0.5516	0.1485	---	---	0.69	12.69
	(2.280)	(1.827)	(3.075)	(0.175)				
	***	***	**					
A_t	5152.8436	0.6650	0.5440	0.1431	-0.0810	---	0.69	08.10
	(1.977)	(1.762)	(2.888)	(0.164)	(-0.206)			
	****	****	**					
A_t	5409.6548	0.6404	0.5375	0.0826	-0.0986	0.0663	0.69	06.76
	(1.719)	(1.525)	(2.705)	(0.084)	(-0.232)	(0.157)		

Note: * - Significant at 1% level ** - Significant at 5% level

- Significant at 10% level * - Significant at 20% level

Source: Computed from the data published by: 1) Spices Board, Kochi. 2) Directorate of Economics and Statistics, Trivandrum. 3) State Planning Board, Trivandrum.

The estimated equations are presented in Table 4.1. In all the acreage response equations of Kerala, the coefficient of determination is quite high (0.69). 'F' values are also significant in all the equations. Based on the compound growth rate, it is observed that the area under ginger has increased at a slow rate.

Among the variables used for the analysis, lagged values of price and area are significantly related to current area under ginger in all the four estimated equations.

The positive relationship between the area allocation and price movements shows the price consciousness and economic rationality on the part of the farmers.

The significant positive relationship between the current area and the lagged area indicates the gradual increase in area under ginger in Kerala.

The lagged yield has the expected sign though these coefficients are not statistically significant. The positive bearing of lagged yield on the area allocation supports the hypothesis that the higher yield received in the last year would induce the growers to increase area under ginger in the current year.

Rainfall and lagged turmeric price do not have the expected sign but their coefficients are not statistically significant.

The price of ginger is generally higher than the price of turmeric. Also with the availability of land, farmers tend to put more land under ginger. It may be the main reason for the insignificant relation between turmeric price and area under ginger.

Lagged values of price and area thus appear to be the major factors favouring ginger cultivation in Kerala.

4.2. Acreage Response in major producing districts

Acreage response analysis is conducted at state and district level and hence can throw light on the role of different factors in different regions which may not be possible if the analysis is at the state level only.

Two types of growth in ginger area are identified in selected districts - Wynad reporting positive and significant trend and Ernakulam with negative and nonsignificant trend.

4.2.1. Wynad District

For estimating acreage response in Wynad district, secondary time series data for different variables in Wynad for the period 1981-82 to 1993-94 (the period for which data is available) are used (Table B-2 in Appendix B).

The functional form used is given below:

$$A_t = f(P_{t-1}, A_{t-1}, Y_{t-1}, TP_{t-1}, R_t)$$

All the variables used for analysing the acreage response of ginger with respect to Kerala state are also used for analysing the data with respect to Wynad district.

The equations showing the farmers' response for allocation of land to

Table 4.2

Results of the Acreage Response Function of Ginger in Wynad District (1984-85 to 1993-94)

Dependent Variable	Constant	Independent Variables					R^2	F
		P_{t-1}	A_{t-1}	Y_{t-1}	R_t	TP_{t-1}		
			**					
A_t	1,554.5281	-0.0108	0.7137	---	---	---	0.61	5.53
	(0.963)	(-0.015)	(3.165)					
			**					
A_t	-1,182.5069	0.3214	0.6574	0.6036	---	---	0.65	3.76
	(-0.321)	(0.377)	(2.735)	(0.832)				
			****					
A_t	-1,598.4889	-0.4927	0.4265	0.3674	1.7099	---	0.75	3.65
	(-0.461)	(-0.491)	(1.505)	(0.523)	(1.347)			
			**			**		
A_t	1,094.3387	0.0781	1.1533	-0.0951	0.6180	-1.5894	0.92	9.13
	(0.463)	(0.118)	(3.787)	(-0.203)	(0.702)	(-2.942)		

Note: * - Significant at 1% level ** - Significant at 5% level

*** - Significant at 10% level **** - Significant at 20% level

Source: Computed from the data published by: 1) Directorate of Economics and Statistics, Trivandrum. 2) Directorate of Cocoa, Arecanut and Spices, Calicut. 3) State Planning Board, Trivandrum.

ginger in Wynad district are presented in Table 4.2.

The R^2 ranges between 0.61 and 0.92. 'F' values are also significant in all the equations.

The positive and significant relation between lagged area and current area explains the steady growth of area under ginger in Wynad.

The negative and significant relation between lagged turmeric price and current area under ginger indicates that a fall in turmeric price in the last year would induce the farmers to increase area under ginger in the current year.

Lagged price of ginger is negative in two equations, however the coefficient is not statistically significant.

Lagged yield has the expected sign in two equations, but their influence is not statistically significant.

The positive relation between rainfall and current area indicates that increased rainfall in Wynad is favouring ginger cultivation.

In general, lagged area and lagged turmeric price are the important variables influencing current area under ginger in Wynad district.

4.2.2. Ernakulam District

The acreage response in Ernakulam is estimated to the data for the period 1976-77 to 1993-94 and for a sub-period 1981-82 to 1993-94 (Table B-3 in Appendix B). This is in order to capture the influence of substitute crop, pineapple (data of pineapple is not available till 1981-82). In Ernakulam

district two crops are reported as substitute crop of ginger, ie., turmeric and pineapple.

Since the secondary time series data on pineapple price is not available, current area under pineapple is taken as a proxy of lagged price.

The functional form used is given below:

$A_t = f(P_{t-1}, A_{t-1}, Y_{t-1}, Tp_{t-1}, Ap_t, R_t)$

All the independent variable except AP_t are the same as those used to analyse the all Kerala data and data with respect to Wynad. AP_t measures the current area under pineapple in Ernakulam district. The inclusion of AP_t in the equation fitted for Ernakulam district increases the explanatory power of the function.

Among these variables used for the analysis current area under pine-apple is the only significant variable which is negatively related with current area under ginger (Table 4.3).

The lagged area is positively associated with current area in all equations except one but it is not statistically significant.

The lagged yield variable has the expected sign in all equations though these coefficients are not statistically significant.

The lagged price of ginger and rainfall do not have the expected sign but they have only an insignificant influence on current area under ginger.

The lagged price of turmeric has the negative sign in one equation but it is not statistically significant.

Table 4.3

Results of the Acreage Response Function of Ginger in Ernakulam District (1976-77 to 1993-94)

Dependent Variable	Constant	Independent Variables						R^2	F
		P_{t-1}	A_{t-1}	Y_{t-1}	R_t	TP_{t-1}	PA_t		
	**		****						
A_t	1,419.1702	-0.0487	0.3905	---	---	---	---	0.20	1.86
	(2.204)	(-0.426)	(1.578)						
	****								
A_t	1,155.7043	-0.0780	0.3239	0.1685	---	---	---	0.21	1.27
	(1.381)	(-0.598)	(1.136)	(0.512)					
	****								
A_t	1,412.5142	-0.0452	0.3523	0.1367	-0.1065	---	---	0.23	1.01
	(1.486)	(-0.315)	(1.194)	(0.402)	(-0.621)				
A_t	859.9748	0.0476	0.2628	0.3620	-0.0317	-0.1791	---	0.31	1.08
	(0.812)	(0.291)	(0.869)	(0.926)	(-0.174)	(-1.134)			
	****						***		
@ A_t	2,233.3523	-0.0361	-0.1693	0.2689	0.0122	0.1510	-0.7128	0.73	2.72
	(1.931)	(-0.323)	(-0.295)	(0.658)	(0.074)	(0.765)	(-2.375)		

Note: *- Significant at 1% level ** - Significant at 5% level

*** - Significant at 10% level **** - Significant at 20% level

@ - Estimated for the period 1981-82 to 1993-94.

Source: Computed from the data published by: 1) Directorate of Economics and Statistics, Trivandrum. 2) Spices Board, Kochi. 3) State Planning Board, Trivandrum.

Thus, in Ernakulam district current year pineapple area may be the most important factor influencing area under ginger. This explains the negative growth rate of area under ginger.

4.3. Conclusion.

The factors influencing area under ginger are different in different districts. Supply response analysis of Kerala reveals that lagged values of price and area are the key variables favouring the growth of ginger area. In Ernakulam where the area under ginger is declining, current area under pineapple is found to have affected ginger cultivation. It shows the comparative economic advantage of pineapple over ginger in Ernakulam district. In Wynad where there has been a significant expansion of area under ginger, the lagged values of area and turmeric price are the major factors favouring ginger cultivation. Thus price of ginger and comparative advantage of substitute crops are important variables, influencing the acreage responses of ginger. Therefore, measures for encouraging ginger cultivation should be oriented in the context of regional disparities.