CHAPTER - VII

INTER-REGIONAL VARIATIONS IN AGRICULTURAL PRODUCTIVITY

7.1 Introduction

The labour productivity varies from one country to another country, one state to another state, one district to another district and lastly from one crop to another crop. This labour productivity also varies from one region to another region. This variation in the labour productivity is because of sharp variations in the constituent components of labour productivity, viz., yield, cropping intensity and land-man ratio. Low labour productivity is mainly because of high land-man ratio which in turn is due to factors like the demographic addition to the labour force, lack of employment avenues in the rural non-agricultural sector, and lack of adequate population control measures. (Suresh Kumar, D and Rama Swamy, C., 1993).

Further, irrigation is one of the most crucial inputs in agricultural production. The success of agriculture depends mainly as how timely and adequately the water requirements be met (Sengupta Nirmal., 1985). Also irrigation makes it possible to grow more than one crop where are is grown and at least one where nothing is possible. Irrigation promotes better cropping pattern (Agarwal, A.N., 1980). Hence two different regions of Kadapa district - one representing High irrigation intensity and another representing Low irrigation intensity are considered to examine the influence of irrigation intensity various components of labour productivity.

Thus the present investigation was taken up with the following objectives :

1. To estimate the labour productivity across various crops.
2. To examine the various factors influencing variation in the constituent components of labour productivity across regions.

Labour productivity can be decomposed as

Labour productivity = yield x cropping intensity x land-man ratio.

The overall yield in a region is conditioned by agro-climatic, socio-economic, institutional and bio-technological factors. The use of fertilizers and HYV seeds are important in explaining inter-regional variations in yield. Cropping pattern in a region has been identified as the important factor that influence inter-regional variations in aggregate yield.

The second component cropping intensity is determined by several factors, the most important being availability of water from rainfall or man made irrigation sources. The level of cropping intensity is high in a region with high percentage of net sown area. Availability of water also plays a crucial role in the level of cropping intensity. The physical limits imposed by the adopted crop pattern during the crop year determines the level of cropping intensity.

The third most important component of labour productivity is land-man ratio which is determined by the net sown area and labour force engaged in crop production. Generally, the settlement of population in a region could be a function of its natural endowments, cropping pattern, development of irrigation facilities and introduction of machinery etc.

A simultaneous system model has been used to explain the components of labour productivity.

The specified model includes four endogenous variables (Y_1 to Y_4) and seven exogenous variables (X_1 to X_7). It has three structural equations followed by an identity. All the equations are specified in log-linear form. The yield equation (1) specified to include land-man ratio (LMR), which is an endogenous variable along with fertilizers per hectare (FERT), gross

irrigation (GROIRR) and cropping pattern index (CRPTI) which are exogenous. All these variables, both endogenous and exogenous are expected to influence the yield positively. The second equation (2) is the cropping intensity (CROPINT) equation. The variables included in this specification are land-man ratio (LMR) cropping pattern index (CRPTI) net irrigation (NETIRR) and irrigation intensity (IRRINT). Except land-man ratio (LMR), all other variables are exogenous. All the explanatory variables are expected to exert positive influence on the cropping intensity. The third equation in the specified model is land-man ratio (LMR) equation. The equation is formulated to include cropping intensity (CROPINT) along with net irrigation (NETIRR), tractor per hectare (TRACTOR) and the gross cropped area (GROCRA). All the explanatory variables except tractor are expected to increase the land-man ratio (LMR), while the variable tractor is expected to reduce the land-man ratio (LMR).

The last equation is the identity essentially equating the labour productivity (LABPROD) with aggregate yield, cropping intensity and the reciprocal of land-man ratio. Thus the structural equations (1) to (3) along with the identity equation constitute a simultaneous equations system which is expanded to explain components of labour productivity in theoretically meaningful inter-related context.

In the present investigation, the three major crops in Kadapa District viz., paddy, groundnut and sunflower are studied and analyzed separately. And lastly total crop was also analyzed. For the study two different regions were selected on the basis of irrigation intensity. One representing High Irrigation Intensity (Situation-1) and another Low Irrigation Intensity (Situation-2). The study was conducted in Kadapa District.

The following variables viz., aggregate yield, cropping intensity, land-man ratio, labour productivity, fertilizers, gross irrigation, net irrigation, cropping pattern index, gross cropped area, net sown area, irrigation intensity and tractor power are used for the present analysis.

7.2 Paddy crop

The estimates of the simultaneous model for paddy crop are presented in table 7.1.

In situation-1 all the factors viz. the land-man ratio (LMR), fertilizers (FERT), gross irrigation (GROIRR) and cropping pattern index (CRPTI) have significant influence on the aggregate yield. On the other hand, for situation-2, the factors fertilizers (FERT) and cropping pattern index (CRPTI) are the other significant factors influencing the aggregate yield. In all-situations, the factors fertilizesrs (FERT), gross irrigation (GROIRR) and cropping pattern index (CRPTI) have significant influence on aggregate yield. Whereas the factor land-man ratio (MLR) has no significant influence on aggregate yield.

It is observed from 3 SLS estimates that in situation-1, the factors land-man ratio (LMR), cropping pattern index (CRPTI) and irrigation intensity (IRRINT) are significantly influencing the level of cropping intensity. In Situation-2, the coefficients of the factors land-man ratio (LMR), cropping pattern index (CRPTI), net irrigation (NETIRR) and irrigation intensity (IRRINT) are positive but not significant. On all-situations, the factors cropping pattern index (CRPTI) and irrigation intensity (IRRINT) are significantly influencing the level of cropping intensity.

Table7.1:Estimates of 3SLS Simultaneous Equation Model - Paddy Crop

Equation	Variables	Situation-1	Situation-2	All
YIELD	MLR	0.3613* * (3.60)	0.1076 (0.67)	0.1436 (1.78)
	FERT	0.3114* (2.48)	0.5458* * (3.19)	0.2673** (3.64)
	GROIRR	0.7364** (5.65)	0.8756 (1.62)	0.8310** (9.23)
	CRPTI	1.4776** (17.42)	1.9583** (7.29)	1.1863** (8.37)
	CONSTANT	0.0725	3.5184	1.9870
CROPINT	MLR	0.3247** (3.80)	0.0111 (0.11)	0.4128 (0.31)
	CRPTI	0.2230** (2.96)	0.2952 (1.47)	0.3281** (3.03)
	NETIRR	0.1606 (1.25)	0.0111 (0.03)	0.2417 (0.90)
	IRRINT	0.7433** (4.63)	0.7234 (1.78)	0.9972** (17.68)
	CONSTANT	1.6227	0.0298	0.9930
LMR	CROPINT	0.4738* (2.63)	0.0609 (0.21)	0.5002* (2.25)
	NETIRR	0.1478 (1.06)	0.1012 (0.39)	0.6706** (3.15)
	TRACTOR	0.2222 (1.72)	-0.2165 (1.66)	-0.0344 (0.52)
	GROCRA	0.3969** (3.52)	0.4732 (1.56)	0.2675 (1.25)
	CONSTANT	1.6219	3.3371	4.7817

Note : *Figures in the parentheses indicates estimated 't' values.*

** Indicates 5% level of significance*

*** Indicates 1% level of significance*

The third component of labour productivity is land-man ratio (LMR). The 3SLS estimates of land-man ratio (LMR) shows that in situation-1, the cropping intensity (CROPINT) and gross cropped area (GROCRA) are the significant factors influencing land-man ratio (LMR). Whereas in situation-2, no factor has significant influence on land-man ratio (LMR).

7.3 Groundnut Crop

From the 3SLS estimates of groundnut crop (Table 7.2) the factors land-man ratio (LMR), fertilizers (FERT) gross irrigation (GROIRR) and cropping pattern index (CRPTI) are the factors influencing the aggregate yield on both the situations 1 and 2. In situation-1, the gross irrigation (GROIRR) is found to have negative significant effect on yield indicating that higher rainfall may lead to reduction in yield. In situation-2, the factor fertilizers (FERT) has negative significant influence on aggregate yield. This indicates that the excessive utilization of fertilizers (FERT) may lead to less yield.

The estimates of the cropping intensity equation shows that in situation-1, land-man ratio (LMR) is the only factor which has significant influence on the level of cropping intensity. Whereas in situation-2, land-man ratio (LMR), cropping pattern index (CRPTI) and irrigation intensity (IRRINT) are the factors significantly influencing the level of cropping intensity. On all situations, the factors net irrigation (NETIRR) and irrigation intensity (IRRINT) are significantly influencing the level of cropping intensity.

Table 7.2 : Estimates of 3SLS Simultaneous Equation Model - Groundnut Crop

Equation	Variables	Situation-1	Situation-2	All
YIELD	MLR	0.4022** (4.07)	0.1913** (7.56)	0.5758* (2.35)
	FERT	0.3981** (3.61)	-1.2938** (51.00)	0.2874** (2.97)
	GROIRR	-0.5638** (3.60)	3.8693** (22.29)	-0.7864** (10.00)
	CRPTI	1.0915** (21.75)	1.7357** (43.23)	1.1400** (8.13)
	CONSTANT	0.9185	3.7900	2.0185
CROPINT	MLR	0.1945* (2.20)	0.1874* (3.31)	0.2391 (1.88)
	CRPTI	0.0332 (0.51)	0.4159** (5.10)	0.5155 (0.07)
	NETIRR	0.0362 (0.22)	0.3536 (1.13)	0.4830* (2.27)
	IRRINT	0.3065 (1.58)	0.7135** (11.61)	0.9296** (5.41)
	CONSTANT	3.9340	0.9185	-0.0381
LMR	CROPINT	1.9638** (4.79)	8.7751** (9.08)	0.2214 (0.71)
	NETIRR	0.5496* (2.45)	9.7130** (9.61)	0.6024* (2.42)
	TRACTOR	0.4132 (1.91)	-5.1789** (9.57)	-0.4042* (2.20)
	GROCRA	0.0217 (0.13)	3.2041** (10.32)	1.3942** (5.28)
	CONSTANT	8.9580	0.2432	3.7252

Note : Figures in the parentheses indicates estimated 't' values.

** Indicates 5% level of significance*

*** Indicates 1% level of significance*

From the 3SLS estimated results, in situation-1, the factors tractor power (TRACTOR) and gross cropped area (GROCRA) have no significant positive influence on land-man ratio (LMR). While, the other factors cropping intensity (CROPINT) and net irrigation (NETIRR) have significant influence on land-man ratio (LMR). For situation-2, the factors cropping intensity (CROPINT), net irrigation (NETIRR) and gross cropped area (GROCRA) have positive significant influence on land-man ratio while the factor tractor power (TRACTOR) has negative significant influence on land-man ratio (LMR), as expected. This implies that the use of more tractor power reduces the human labour absorption.

7.4 Sunflower Crop

In sunflower crop, the estimates of yield equations from table 7.3 confirm that in situation-1, the factors fertilizers (FERT) and cropping pattern index (CRPTI) have positive significant influence on aggregate yield. Whereas gross irrigation (GROIRR) has negative influence on aggregate yield. In situation-2, the factors land-man ratio (LMR) and cropping pattern index are significantly influencing aggregate yield. Whereas the gross irrigation (GROIRR) has negative influence on aggregate yield.

From the 3SLS estimates of cropping intensity equation, it is observed that the factors cropping pattern index and irrigation intensity have significant influence on the level of cropping intensity only in situation-2 and in overall situation. The factors land-man ratio (LMR) and net irrigation (NETIRR) showed positive and non-significant influence on the level of cropping intensity.

Table 7.3 : Estimates of 3SLS Simultaneous Equation Model-Sunflower Crop

Equation	Variables	Situation-1	Situation- 2	All
YIELD	MLR	0.1074 (0.87)	0.2563** (3.00)	0.1810 (1.84)
	FERT	0.2965* (2.05)	0.1258 (0.92)	0.2827** (3.06)
	GROIRR	-0.6454** (4.12)	-1.9686** (3.93)	-0.8118** (5.26)
	CRPTI	1.0877** (11.52)	0.7667** (4.78)	1.3785** (6.08)
	CONSTANT	1.8696	6.1352	0.8945
CROPINT	MLR	0.0027 (0.02)	0.0611 (1.04)	0.0048 (0.18)
	CRPTI	0.1056 (0.78)	0.3845** (3.58)	0.4311** (6.84)
	NETIRR	0.4452 (1.86)	0.0878 (0.29)	0.0153 (0.33)
	IRRINT	0.3249 (1.09)	0.6553** (7.05)	0.8069** (10.70)
	CONSTANT	3.1083	0.2195	-1.0139
LMR	CROPINT	0.3195 (1.20)	2.2768* (2.06)	0.3604 (1.24)
	NETIRR	0.3919 (1.47)	1.9880 (1.64)	0.2944 (1.33)
	TRACTOR	0.7801 (1.84)	0.8714* (2.24)	0.1352 (0.87)
	GROCRA	0.3179 (1.58)	1.8367** (3.72)	1.4015** (4.74)
	CONSTANT	1.5320	8.3978	3.6298

Note : Figures in the parentheses indicates estimated 't' values.

** Indicates 5% level of significance*

*** Indicates 1% level of significance*

The third component of labour productivity is the land-man ratio (LMR). Estimated results of 3SLS shows that cropping intensity, tractor power and gross cropped area are the major influencing factors on land-man ratio (LMR) in situation-2. Whereas in situation-1, no factor has significant influence on land-man ratio (LMR). In all situations, the factor gross cropped area (GROCRA) has significant influence on land-man ratio (LMR), while the other factors cropping intensity (CROPINT), net irrigation (NETIRR) and tractor power (TRACTOR) have no significant influence on land-man ratio (LMR).

7.5 Whole Farm

The overall yield in a region is conditioned by the agro-climatic, socio-economic, institutional factors. From the 3SLS estimates, the fertilizers (FERT) and cropping pattern index (CRPTI) are the major significant factors influencing the aggregate yield on both situations 1 & 2. Among these two factors, the cropping pattern index (CRPTI) is found to be the most prominent factor on both the situations 1 & 2. Further; in situation-1, the land-man ratio (LMR) has also significant influence on aggregate yield. It is also observed that on both the situations 1 & 2, the gross irrigation (GROIRR) factor has significant negative influence on the aggregate yield. It indicates loss in yield due to heavy rainfall.

The level of cropping intensity in a region is conditioned mainly by the availability of water either in the form of rainfall/ irrigation sources. From the 3SLS estimates, the only factor irrigation intensity (IRRINT) is significantly influencing the level of cropping intensity on both the situations 1 & 2.

Table 7.4 : Estimates of 3SLS Simultaneous Equation Model – Whole Farm

Equation	Variables	Situation-1	Situation- 2	All
YIELD	MLR	0.4341** (5.59)	0.1633 (1.71)	0.2580** (4.98)
	FERT	0.5085** (4.48)	0.6524** (5.20)	0.6826** (9.04)
	GROIRR	-0.5245** (4.83)	-1.4232** (2.72)	-0.7309** (9.57)
	CRPTI	1.1696** (15.72)	0.9482** (8.32)	0.8420** (5.66)
	CONSTANT	-0.2715	1.1514	0.3945
CROPINT	MLR	0.0382 (0.93)	0.1128 (1.46)	0.2184 (1.10)
	CRPTI	0.0409 (0.63)	0.1263 (1.06)	0.2740 (0.42)
	NETIRR	0.0365 (0.38)	0.4280 (0.94)	0.2128 (0.42)
	IRRINT	0.5358** (4.14)	1.1354* (2.28)	0.9453** (18.19)
	CONSTANT	2.3576	1.8236	0.0986
LMR	CROPINT	0.0852 (0.36)	0.3757 (1.11)	0.4762 (1.49)
	NETIRR	0.5315** (2.97)	0.2129 (0.69)	0.6248 (0.89)
	TRACTOR	0.7799** (7.38)	0.1092 (0.57)	0.6933** (6.59)
	GROCRA	0.0976 (0.68)	0.4066 (1.81)	0.7652* (2.57)
	CONSTANT	3.3177	0.6137	0.7502

Note : Figures in the parentheses indicates estimated 't' values.

** Indicates 5% level of significance*

*** Indicates 1% level of significance*

Estimated results of 3SLS for land-man ratio equation shows that net irrigation (NETIRR) and tractor power (TRACTOR) are the only significant factors influencing the land-man ratio (LMR) in situation-1. Whereas in situation-2, no factor has significant influence. In overall situation, the factors tractor power (TRACTOR) and gross cropped area (GROCRA) are significantly influencing land-man ratio (LMR).

7.6 Conclusions

It is evident from the analysis that the land-man ratio, fertilizers, cropping pattern index are the major factors influencing variations in yield. Irrigation intensity is found to have significant influence on crop pattern index over different crops. Cropping intensity and gross cropped area are the dominant factors explaining variations in the land-man ratio across situations. Tractor power shows significant negative influence on the land-man ratio.

Labour productivity and the various factors explaining variations in the constituent components of labour productivity varied across the situations and crops. Hence separate policies have to the formulated for high and low productivity situations to reduce the regional variations. Increase in net sown area and net irrigated area, development of major and minor irrigation projects and increased use of yield augmenting inputs like HYV seeds, fertilizers will augment labour productivity.