

A Study on the Development of Agriculture and Changing Cropping Pattern

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Abstract

In studying the various facets of agriculture, the first and the foremost thing to know about is regarding the pattern crops, the production of various crops, and the productivity of land and the inputs in respect of these crops. A recent development of considerable importance is the emergence of foodgrains surpluses. A variety of crops are grown in India. The single most important element in crop production strategy in the post-green revolution period is improved agricultural technology. This technology is in the form of high yielding plant varieties, intensive cultivation, greater use of fertilizers, increased irrigation and better techniques for ploughing, harvesting and plant protection. High yielding varieties have been developed for a number of crops but their impact on production, productivity and costs varies across crops and regions. The success of the state water policy will depend entirely on the development and maintenance of general consensus and commitments to its underlying principles and objectives.

Key Words: *Agricultural Yield, Rainfall, Irrigation, Cropping pattern, Agricultural Productivity, Kharif, Rabi, Mixed Cropping*

1. INTRODUCTION

Technological changes of mid-sixties, irrigation bias of new technology causing shift, of land away from dry crops in favour of irrigated crops and the associated policy of price support system as well as market intervention by the Government for certain crops have resulted in distortions in cropping pattern. Changes in cropping pattern is determined by factors like agro-climatic conditions, technological, infrastructural and institutional environment and profitability signals.

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Tractorization and other labour-saving

mechanical devices have altered this picture. Several other factors can also be listed, but generally speaking, there are basically three factors that determine the level of cropping patterns and thus the cropping intensity.

Firstly, Supply of energy in the form of human labour, animal labour and mechanical device. Secondly, supply of water in the form of rainfall or irrigation and its distribution over the crop year, and thirdly the physical limits imposed by the adopted cropping pattern on the duration of cropping activities during a particular crop year. The above discussion is indicative of the changes in cropping pattern. Cropping intensity will put more pressure on energy demand in the form of human, bullock, mechanical and fertilizers and pesticides.

2. REVIEW OF LITERATURE

In this regard one can concentrate the existing literature available with respect to cropping pattern and cropping intensity.

One of the interesting study in this regard is by *Mruthyunjaya and Praduman Kumar (1989)*, who extensively worked on cropping pattern changes in Indian agriculture, to examine the changes in input use, productivity, cost of production, profitability and employment in crops. He identified and explained the cropping pattern changes, by suggesting ways and means for controlling the imbalance in the cropping pattern and thereby widening the base for crop production in India.

Another interesting study in this context is by *Venkataramanan, L. S. and Prahladachar (1980)*. He analysed the growth rates in area, yield and output of major crops in six states, viz., Punjab (including Haryana), Rajasthan, Uttar Pradesh, Bihar, Maharashtra and Andhra Pradesh for the period 1950-51 to 1974-75 and examined the impact of growth rates of crops on cropping pattern in these states. This study also attempted, through 'decomposition method', to study the area, yield and cropping pattern effects on crop output growth in these states in the period under the reference.

Ranade. C. G. (1980), analysed effect of cropping pattern along with fertilizer and irrigation upon agricultural production. This study examined the effect of these factors upon agricultural output per hectare across 54 agroclimatic regions covering 16 major states for the pre-green revolution period from 1962 to 1965 and then for the post-green revolution period from 1970 to 1973. The results of this study showed that, comparison between Northern Punjab and Coastal Northern Tamil Nadu, for 1970-73, shows that even though the percent irrigated land was higher in the former region (73.62 %) than in the latter region (61.66%), the agricultural production per hectare productivity was higher in the latter region (Rs. 20303) than in the former (Rs. 1067).

One of the pioneering study by *Gulati, A. and Sharma, P.*, critically examines various studies on cropping pattern changes, direct and indirect employment intensity of different crops as well as their environmental effects etc. A cropping pattern which is oriented towards these objectives is defined as desirable cropping pattern.

The analysis suggests that studying cropping pattern changes purely from demand/supply point, of view could lead to adoption of a crop mix which has high economic cost. Pursuit of self-sufficiency in all commodities regardless of economic cost need to be reexamined. On the employment front, the study admits that direct impact of movement of cropping pattern towards more labour using crops may be rather limited especially in relation to area and yield effects. It indicates that domestic incentive structure is more favorable to wheat, rice, oil seeds and sugarcane.

Mann. S. (1989), who examined the Impact of Green Revolution programme in Indian agriculture by using two models, namely the logit model for the adoption of HYV wheat seeds and the second model is the linear regression model to estimate the percentage of land under HYV wheat for its users.

The data used in this study was based on the NCAER's, Additional Rural Income survey conducted for a period of three years during 1968-71.

Chadha. G. K and Sharma. R. K. (1982), as examined whether the Green Revolution has any relationship with farm size cropping intensity in Indian agriculture. The study examines the relationship separately for each of the 318 districts of India, spread over almost all states. The 1970/71 agricultural census reports for various states has been used extensively for this analysis.

Mahendra Dev. S. (1989), has analysed the variations in cropping intensity in Indian Agriculture. The main objectives of this study were to examine the factors influencing the regional variations in cropping intensity at different time points since the early sixties and to the temporal variations in cropping intensity for selected districts in Andhra Pradesh, Maharashtra and Tamil Nadu. The data used for this study is taken from National Sample Surveys.

Another interesting study is by *Sharma. J. L. (1990)*, who examined the inter-state disparities, in agricultural growth in India. The main objectives of this study are: to examine the inter-state disparities in agricultural growth, and to identify the factors responsible for these disparities. The data for the study was obtained from Statistical Abstract of India,

covering the period 1966-67 to 1987-88.

3. OBJECTIVE OF THE STUDY

The Objective of the study is to gauge the development of the agriculture in the light of irrigation and changing cropping pattern.

4. OUTCOME OF THE STUDY

The present study was based upon secondary data, which is collected from various government database. On the basis of the available data, the following major trends in the Cropping Pattern are as given below:

- (a) **Preponderance of Food Grain Crops :** The one feature in respect of cropping pattern that outstands any other is the very large area devoted to foodgrain crops. The relative position between foodgrain crops and non foodgrain is that the cropping pattern is very heavily tilted towards the farmer with the area under it as 65.1% of the gross cropped area. And this has been the position before, and since independence.
- (b) **Trend Towards Commercial Crops :** The second feature is that the trend towards an increase in the cultivated area under non food grain crops. This trend is seen both before and after independence. Sharp increase of area under certain crops. The third significant development is that a few crops have increased their share of cropped area to a large extent. It is in the case of food grain and non food grain crops. In case of food grain, the increase has been the largest in respect of wheat. The area under it has gone up by more than two and half times. As a result, the area under wheat was 7.4% of the total cropped area (131.9 million hect) in 1950-51, increased to nearly 14% in 2000-01. among non food grain crops, the largest increase in area took place in the case of sugarcane.
- (c) **Proponderant But Slow Growing Crops :** The fourth feature is that among individual crops, there are certain crops predominate much but the area under them has risen very

slowly. Among food grain group one such crop is rice, the staple food for the majority of Indians. It has under it the largest area. Among commercial crops, an important crop is cotton in whose case too, the growth in area is very small so that its rank position at present is almost as it was in the beginning at around 4% of the area under it.

5. EMERGING IMBALANCE

The fifth feature is the emergence of imbalance in the cropping pattern. In other words the cropping pattern has been changed. This is particularly in respect of important crops. For example area under the fast growing crops like wheat and to an extent paddy has continuously increased in some states at the cost of coarse cereals, millets, pulses and in some cases cotton. This has been caused by differences in the technological changes, in the spread of irrigation facilities in the governmental support and in the changes of relative prices between different crops in favour of certain crops. All these factors made wheat and paddy superior in profitability to other crops. Besides, there are certain factors determining cropping pattern. They are listed under the following broad heads.

- (a) **Physical Factors :** Natural conditions of a country are the most important factors affecting the cropping pattern of a country. Such things as soil, climate rainfall etc. determine the setting for agriculture. Certain kinds of soil and climate are suitable for some crops. As a result, only such particular crops are grown in those areas suit their natural conditions. For example, the soil and the heat of Punjab are very conducive for the growth of wheat. Ludhiana district in Punjab is eminently fit for the productions of rice. Similarly in places with low rainfall, jawar and bajra are grown of course, modern technology can to an extent change the cropping pattern. It can help in growing even those crops which natural conditions do not permit.
- (b) **Historical Factors :** The early settlement of man on land and the evolution of needs and capacity of population through time have

governed the types of crops grown and the lands ear marked for different crops. A small farmer owing the land, he cultivates as under Ryotwari system, naturally produces all that he can and gives priority to the production for his consumption. As against this land under Zamindari system may have a different cropping pattern.

- (c) **Social Factors :** Social factors such as density of population, customs, traditions, attitude towards material things, willingness and capacity for change etc, have an important bearing on the types of crop grown and the area devoted to different crops. Before the attainment of independence, the peasant in India was tradition bound and fatalistic in outlook. The result was that he carried on with the cropping pattern handed down from generation to generation. He could contemplate no change in it, much less do anything about it. After independence, however there has taken place some change in those connected with agriculture.
- (d) **Economic Factors :** Economic factors relate to such things as prices, income, size of land holdings, availability of agricultural inputs and manufactured goods. Not only the level of prices, but also changes in prices affect decisions as to what to grow and on how much of land. The crops that give the largest income will naturally be the ones to be cultivated. The size of operational holding is another crucial factor. A small farm produces little and the farmer generally gives first priority to the production of foodgrains for self consumption. In a big farm where large scale production is feasible, there is a tendency to devote a large proportion of land to commercial crops for market. Thus production of food grains predominates in small farm whereas commercial crops are grown mainly on big farms. The availability of various inputs of agriculture also affects the cropping pattern. If all these are easily available, a farmer can grow any crop that gives him the best results.

6. GOVERNMENT POLICY

Government policies affect cropping pattern in very important way. Policies relating to priorities given to various crops, export taxes, supply of credit, development of backward regions etc, determine the nature of crops and the area under them. The facilities which government makes available for the growth of certain crops and for the development pattern implied by these policies. During the second world war however, when the “grow more food” campaign were launched some changes in cropping pattern. Of all the factors, the most important at present are physical and economic, along with government policies.

7. IRRIGATION AND CROPPING PATTERN

Cropping pattern refers to the proportion of area under different crops at a point of time. A change in cropping pattern means a change in the proportion of area under different crops. Cropping pattern in India is determined by natural factors like climate, soil conditions and rainfall etc. although the impact of green revolution is uneven but it has led to new pattern. At the beginning of the century about 83 percent of land was put under food crops and about 17 percent under non food crops.

Table 1
Area Under Food Grains and Non Food Grains

Year	Area Under Food Grains	Area Under Non Food Grains	Total Area
1950-51	76.7	23.3	100.00
1960-61	75.7	24.3	100.00
1970-71	75.4	24.6	100.00
1980-81	75.0	25.0	100.00
1990-91	68.9	31.0	100.00
1995-96	64.9	35.1	100.00
2000-01	62.8	37.2	100.00
2001-02	60.3	39.7	100.00

Source: Various Plans.

(In Percent)

The table reveals that in 1950-51, 76.7% area was put under food grains and only 23.3% was under non food grains. In 1970-71, the area under food grains declined to 75.4% while the area under non food grains went upto 24.6%. further the area under food grains declined to 64.9% in 1995-96 and that of non food crops went upto 35.1%. further in 2001-02, area under food grains was 60.3% while it was 39.75 for non food grains. This shift in the allocation of are from food crops to non food crops reflect a change from subsistence cropping to commercial cropping.

**(a) The Kharif Season Cropping Pattern
The Rice Based Cropping Pattern :**

Rice is grown in the high rainfall area or in areas where supplemental irrigation is available to ensure good fields. If the rice has to depend solely on rainfall, it requires not less than 30 cm. per month of rainfall over the entire growing period. However, only 9 percent of the area in the country come in this category and it lies in the ea stern parts. Nearly 45% of the total rice area in India receives 30 cm. per month of rainfall during at least two months (July and August) of the south-westerly monsoon and much less during other months in contrast to these parts of the Eastern and Southern regions comprising Assam. However it has been observed that on all India basis nearly 805 of rice is soun during June-Sept season, In Uttar Pradesh rice is grown on 19% (4.6 m.ha). Of its croppd area and represents about 12.45 of the all India area under this.

(b) The Maize Based Cropping Patterns : The largest area under the Kharif maize is in Uttar Pradesh (1.4 M.ha) followed by Bihar (0.96 m.ha), Rajasthan (00.78 m.ha). Madhya Pradesh (0.58 m.ha) and Punjab (0.52 m.ha). On all India basis, about 12 cropping patterns have been identified. They have maize as th base. In the maize growing areas of Uttar Pradesh and Bihar, rice in Kharif and wheat in Rabi are the main alternative.

(c) The Bajra Based Cropping Patterns : Bajra is more drought resistant than several other casual and is generally preferred in low rainfall areas. The area under bajra in India is about 12.4 m.ha and Rajasthan (4.6 m.ha) shares about the two third area Maharashtra, Gujarat and Uttar Pradesh together have over 4.6 m.ha constituting an additional one third area under bajara, in India. On the all India basis, about 20 major cropping patterns have been identified with bajara. However, it may be observed that maize and bajara are grown mostly under identical environmental conditions and both have a wide spectrum adaptability in respect of rainfall, temperature and rainfall.

(d) The Groundnut Based Cropping Pattern: Groundnut is sown over an area of about 7.2 m.ha mostly in fine major groundnut producing states of Gujarat (24.4% area) and Andhara Pradesh (20.2%) Maharashtra (12.2%) Tamil Nadu (13.5%) Karnataka (12.0%). Fine other states Madhya Pradesh, Uttar Pradesh, Punjab, Rajasthan and Orissa together have about 17.3% of the total area under this. The rainfall in the groundnut area ranges from 20 to 30 cm per month in one of the monsoon months and much less in the other months. In some cases the rainfall is even less than 10 cm pr month during the growth of the areas.

(e) The Cotton Based Cropping Pattern : Cotton is grown over 7.6 m.ha in India. The cotton grown in Madhya Pradesh, Maharashtra, Karnataka and Andhara Pradesh, (4.8 m.ha is rained, whereas in Gujarat and Tamil Nadu (1.93 m.ha it receives partial irrigation 16 to 20 in the area. The area under cotton in Punjab, Haryana, Rajasthan and Uttar Pradsh (0.8 m.ha) gets adequate irrigation ranging from 71 to 97% of the area. These growing conditions together with the

species of cotton grown, determine the duration of the growth which may vary from about 5 to 9 months.

- (f) **The Rabi Season Cropping Pattern :** Among the rabi, wheat together with barely and oats, Jawar and gram area the main base among the rabi cropping patterns. Generally, wheat and gram area concentrated in the sub tropical region in northern India, wheareas the rabi Sorghum is grown mostly in the deccan. In several sugarcane growing areas, mono cropping is practiced and during the internal between the short duration seasonal crops are grown.

8. MIXED CROPPING

Mixtures are widely grown, especially during the Kharif season. Pulses and some oilseeds are grown with maize, jawar and bajra.

9. THE FUTURE OF CROPPING PATTERN

With the increased irrigated area is increasing and advances in agriculture science, most of the cropping patterns are giving way to intensine cropping. The development in minor irrigation works has especially provided the farms with opportunities to develop their crops all the year round with high yielding varieties. This intensive cropping will require an easy and ready availability of balanced crops and an appropriate price policy for inputs and agricultural produce. In Punjab, Haryana and Western U.P. rice has become an important crop in the Kharif. It is followed by wheat.

- (a) **Irrigation and Agricultural Productivity :** Systematic irrigation development has been carried out through successive five year plans, since 1951. by the end of 1996-97, 362 major, 1081 medium and labhs of minor irrigation projects and the modernization of 141 old projects has been carried. At the end of 1996-97, irrigation potential created was 90.8 m.ha against 22.6 m.ha in 1951. the expansion of irrigation system along with the increased use

of fertilizers, seeds of high yielding varieties, and modern agronomic practices have increased the production of major crops between 1950-51 and 1996-97 as shown in the table. The tabl indicates the production of major crops.

**Table 2
Production of Major Crops**

Crops	1950-51 (Year)	1996-97 (Year)
Rice	20.58 m.t.	081.31 m.t.
Wheat	06.46 m.t.	069.27 m.t.
Coarse Cereals	15.38 m.t.	034.28 m.t.
Pulses	08.41 m.t.	014.46 m.t.
All Food grains	50.82 m.t.	199.32 mt.
Oilseeds	05.16 m.t.	024.96 m.t.
Sugarcane	57.05 m.t.	277.25 m.t.
Cotton	03.04 bales of 170 kg.	14.25 bales of 170 kg.
Jute & Mesta	3.31 m. bales of 180 kg.	10.99 m. bales of 180 kg.

Source: Various Plans.

The agricultural growth has been marked by some healthy features.

One, there has been up trend in the agricultural production. The output grew at a compound rate of 2.7%. Since the beginning of planning in 1951-52. This growth rate is somewhat higher than the population growth.

Two, the output level has been an increasing one. The average level of output as measured by the average production for each plan period has been higher in every plan compared to the average of the preceding plan. This means that the up trend has been a sustained one on 5 year basis. In case of certain crops, mostly food grain crops like wheat, the increase in production have been very substantial indeed.

Three, there is now a little less instability in the agricultural output. This trend is emerging although as yet it is not very significant. This is evident from the

fact that the negative variations in the output of some crops have been little smaller than before.

Four, a considerable part of output increase is due to improvement in the productivity. This has been quite considerable in the case of certain crops like wheat, cotton, tea, potatoes etc.

Five, the output increases in some areas and in some crops have to an extent, resulted from the modernization of agriculture. The use of inputs like laboratory researched high yielding varieties of seeds, chemical fertilizers, pesticides etc. Modern machines like tractors, threshers etc., and new agricultural practices (like proper timing of sowing, harvesting, multiple cropping etc.)

(b) Agricultural Production Trends : Prior to independence, it may be noted that during the period 1901 to 1947, agricultural production declined. The population rose by 38% while the increase in cultivated area was to the extent of 18%. The annual output of foodgrains and pulses remained almost constant. It is given in the table.

Table 3
Productivity Trends in Agriculture

Particulars	1900-01	1947
Population Index	100	138
Cultivated Area	100	118
Index of Food Grains	100	101
Index of Non Food Grains	100	153
Index of All Crops	100	118

Source: Survey of India.

It can be concluded from the years, 1901 to 1947, agricultural production declined. The population rose by 38% while the increase in cultivated area was to the extent of 18%. The annual output of food grains and pulses remained almost constant. With the introduction of economic planning in 1950-51 and with the special emphasis on agricultural development. The stagnant agriculture was reversed as.

1. There was a steady rise in average yield per hectare.

2. There was a steady rise in area under cultivation.
3. Due to increase in area as well as increase in yield per hectare total production of all crops recorded a rising trend.

(c) Management of Irrigation Water : In order to realize fuller benefits from the investment made in irrigation sector, efficient management, scientific economical use, and conservation of harvested water is imperative. The present status has a substantial scope for qualitative improvements in this field. In this regard the following actions need to be taken.

- (a) The vast irrigation system of the state and some others are in need of restoration and rehabilitation. Modernization and updating of these channels is also needed to cater for future requirements.
- (b) “Conveyance management” needs to be improved specially because most of the system fed by run of the river schemes these systems should be provided with mechanism using appropriate technology to enable quick adjustments of supplies as per requirements dictated by water availability and the priorities at the field.
- (c) Checking unauthorized use by cutting of canals and other means.
- (d) “Field management” needs to be tackled on high priority to achieve most efficient use of water at the field level wherein equity in its dispensation and proper recovery of dues is ensured.

(d) The following Aspects Need to be Considered :

- (a) A thrust needs to be given to improvement of command area (such as leveling of field improvement and maintenance of water courses etc.).
- (b) Adoption of improved irrigation and agriculture practice using appropriate technology to ensure optimal use of water

for agriculture production. This should also aim at adoption of appropriate cropping pattern.

- (e) **Private Sector Participation :** Private sector participation should be encouraged in the various aspects of planning, development and management of the water resources projects for diverse uses, wherever feasible. Private sector participation may help in introducing innovative ideas, generating financial resources and introducing corporate management in improving service efficiency and accountability to users.

10. SCIENCE AND TECHNOLOGY

For effective and economical management of our water resources, the frontiers of knowledge need to be pushed forward in several directions by intensifying research efforts in various areas including the following :

- ❖ Assessment of Water resources.
- ❖ Ground water hydrology and recharge.
- ❖ Water quality.
- ❖ Prevention of water logging and soil salinity.
- ❖ Water harvesting.
- ❖ Evaporation and seepage losses.
- ❖ Crops and cropping pattern.
- ❖ Sedimentation of reservoirs.
- ❖ Safety and longevity of water related structures.
- ❖ Use of remote sensing techniques in development and management.
- ❖ Recycling and re-use.

11. UTTAR PRADESH AGRICULTURAL POLICY

Uttar Pradesh was the first state to launch 'Agricultural Policy' in 1999, even before the national agricultural policy announced in 2000. the main objectives of the policy are the following.

- (i) Encourage scientific agriculture.
- (ii) Develop appropriate eco-friendly

farming systems.

- (iii) Maintain ecological balance.
- (iv) Diversity existing agriculture towards high value crops.
- (v) Achieve an annual growth rate of 5.1 percent.

12. CONCLUSION

Agricultural performance of Uttar Pradesh is too dismal during the past two decades. The state is bestowed with rich natural resources. The available resources are mismanaged and injudiciously used due to excessive population pressure and absence of growth oriented policies. Public investment in agriculture is rapidly declining, which is swallowed by the mammoth amount of subsidies on irrigation, fertilizer, power and credit. Average size of landholdings are tiny (about 0.9 ha), fragmented and showing symptoms of degradation. The state is predominantly producing food grains. Rice and wheat are the principal foodgrain crops. Pulses and oilseeds are important. Agriculture in Uttar Pradesh is to be intensified by gradually removing supply side bottlenecks through well knitted institutional and policy reforms. Programmes and policies need to be turned to facilitate adoption of science based high tech agricultural to compete in domestic and global markets. In an era of liberalization and globalization, the state government must aggressively launch programmes to boost agricultural diversification and agro processing. Existing policies need to be reformed in the light of new economic regime. Investment in agriculture must be stepped up through resource mobilization. In view of the vital importance for human and animal life, for maintaining ecological balance and for economic developmental activities of all kinds, and considering its increasing scarcity, the planning and management of this resource and its optimal, economical and equitable use has become a matter of the utmost urgency. The success of the state water policy will depend entirely on the development and maintenance of general consensus and commitments to its underlying principles and objectives. ○

REFERENCES

1. Acharya S.S (2003): “Crop Diversification in Indian Agriculture”, *Agriculture Situation in India, August, Special Number*.
2. Arora V.P.S and Sharma J.S (1981): “Optimal Allocation of Fertiliser Nutrients Among Different Regions of U.P and its Impact on Cropping Patterns and Production Levels”, *Agriculture Situation in India, Vol.36, No.1*.
3. Balasubramanian.M (1963): “Economics of Cropping Pattern”, *Indian Journal of Agricultural Economics, Vol.18, No.1*.
4. Bastine, C.L and K.P. Palanisami (1994): “An Analysis of Growth Trends in Principal Crops in Kerala”, *Agriculture Situation in India, Vol.48, No.12*.
5. Bhalla G.S and Gurmail Singh (2000): *Recent Developments in Indian Agriculture- A District Level-Study*, Sterling Publishers.
6. Bhat G M, Dhar M K, Beig B A and Zutshi S N (1989): “Crop Concentration and Cropping Pattern in Jammu and Kashmir State”, *Agriculture Situation in India, Vol.43, No.11*.
7. Biswas.B.C. and Khambete.N.N.(1980): “Reorientation of the Cropping Pattern on the Basis of Probabilistic Moisture Availability Index”, *Indian Journal of Agricultural Economics, Vol.35, No.2*.
8. Chawdhari T.P.S, Desai D. K, Jindal K. K and De. B.K (1963): “Optimum Combination of Competitive Crops in the Intensive Cultivation Scheme Area- Delhi”, *Indian Journal of Agricultural Economics, Vol.18, No.1*.
9. Cheriyan, Omana (2004): “Changes in the Mode of Labour due to the shift in Land Use Pattern”, Discussion Paper No.81, Kerala Research Programme on Local Level Development, Centre for Development Studies, Thiruvananthapuram.
10. Dantwala.M.L. (1986): “Prices and Cropping Pattern”, *Economic and Political Weekly, Vol.21, No.16*.
11. Dashora, S.K; J.M. Dhaka and N.J.Agarwal (2000): “Growth in Production of Important Pulse Crops in Rajasthan”, *Agriculture Situation in India, Vol.52, No.8, November*.
12. De, Utpal Kumar (2003): “Changing Cropping Pattern System in Theory and Practice: An Economic Insight into the Agrarian West Bengal”, *Indian Journal of Agricultural Economics, Vol.58, No.1*.
13. ————— (2000): “Diversification of Crop in West Bengal: A Spatio- Temporal Analysis”, *Artha Vijnana, Vol.32, No.2*.
14. Desai B. M (1977): “Analysis of Cropping Pattern Farm Families, Surat District”, *Indian Journal of Agricultural Economics, Vol.32, No.1*.
15. Desai D. K (1963): “Economics of Cropping Pattern of Gujarat State”, *Indian Journal of Agricultural Economics, Vol.18, No.1*.
16. Desai R G (1998): *Agricultural Economics- Models, Problems and Policy Issues, First Edition*, Himalaya Publishing House.
17. Deshpande R.S et.al. (2004): “Crops and Cultivation”, *State of the Indian Farmer: A Millennium Study*, Ministry of Agriculture, Government of India and Academic Foundation, New Delhi.
18. Divakar Jha (1963): “Economics of Crop Pattern of Irrigated Farms in North Bihar”, *Indian Journal of Agricultural Economics, Vol.18, No.1*.
19. Dreze Jean and Amartya Sen (ed) (1999): *Indian Development- Selected Regional Perspective*, Oxford University Press.
20. Duckham, A.N and Masfield, G.B (1970): *Farming Systems of the World*, London: Chatto and Windus.
21. Gangadharan (1985): “Rice Research in India”, *Breeding*, in Jaiswal, P L (ed) New Delhi ICAR and

- Chandler, R.F Jr (1979): "Rice in the Tropics": A guide to the development of Natural programs, Colorado: West View.
22. George M.V (1965): "Impact of Relative Changes in Prices on the Cropping Pattern of Kerala", Indian Journal of Agricultural Economics, Vol.20, No.1.
 23. Goswami and Challa (2004): "Indian Land Use Scenario", Agricultural situation in India, Special Number.
 24. Goswami S N, Dubey P N, Sen T.K and Challa Q (2003): "Land Use Dynamics in Mizoram", Agriculture Situation in India, Vol.9, No.8.
 25. Gujarati D (1995): Basic Econometrics, 3rd Edition, McGraw- Hill International Editions.
 26. Gulati, Ashok and Tim Kelly (1999): Trade Liberalisation and Indian Agriculture , Oxford University Press.
 27. Gulati, Ashok and Sharma Pradeep.K (1990): "Employment, Foreign Exchange and Environment – Implications for Cropping Pattern", Economic and Political Weekly, Vol. 25, No.39.
 28. Gupta, Amiya. K(1963): "Inter-State Differences in Cropping Pattern and Productivity", Indian Journal of Agricultural Economics, Vol.18, No.1
 29. Haroon Jamal and Azad Zaman (1992): "Decomposition of Growth Trend in Agriculture: Another approach", Indian Journal of Regional Science, Vol.47, No.4, October- December.
 30. Majumdar, Kakkali and Partha Basu (2005): "Growth Decomposition of Foodgrains Output in West Bengal: A District Level Study", Indian Journal of Agricultural Economics, Vol.60, No.2, April- June.
 31. Kalamkar S Shrikant (2003): "Agricultural Development and Sources of Output Growth in Maharashtra State", Artha Vijnana, Vol.25, No.3-4.
 32. Kaul, J.L (1966): "Value of Productivity Growth of Some Important Crops in the Punjab", Indian Journal of Agricultural Economics, Vol.21, No.4, October-December.
 33. Koutsoyiannis A (1996): Theory of Econometrics – An Introductory Exposition of Econometric Methods, Second Edition, Macmillan Press Limited.
 34. Malya M Meenakshi (1963): "Urbanisation and Cropping Pattern", Indian Journal of Agricultural Economics, Vol.18, No.1.
 35. Mandal G. C and Ghosh Suresh K (1963): "Some Aspects of the Economics of Cropping Pattern: A Case Study of Condition in the District of Manghyr, Bihar", Indian Journal of Agricultural Economics, Vol.18, No.1.