CHAPTER VI
SUMMARY OF FINDINGS AND CONCLUSIONS

This chapter presents a summary of the main findings on each of the aspects covered in our analysis along with concluding remarks. Agriculture is the mainstay of a vast majority of population in India. The growing requirement of food for fast increasing population, raw material for expanding manufacturing industry, effective market for more and new industrial goods, substantial marketable, surplus to earn foreign exchange etc., are possible in India only when agricultural productivity is stepped up substantially. Improvement in agricultural productivity goes a long way in raising the standard of living of the population. Hence, the measurement of productivity is of great importance. But the imbalances in agricultural productivity from region to region, state to state and within the state at the district level are a matter of growing concern in the Indian economy, where some states become bread-baskets and other are lagging behind. Thus, the measurement of agricultural productivity should not only help in locating factors accounting for regional variations in agricultural production but also in identifying the methods to increase production
and productivity. The plan programmes have been mainly target-oriented. But in the very recent plans, the objective of reducing regional/state imbalances in agricultural growth and initiating the appropriate strategy for low productivity regions are highlighted. More than in any other sector, variations in agricultural productivity are pronounced, mostly due to acts of nature and differences in the use of inputs.

During the planning era in India, several developmental programmes have been initiated in order to reduce the regional variations in agricultural productivity and to attain self-sufficiency. However, many programmes have gone only to such states or regions with assured irrigation and other favourable factors. Consequently, high level of productivity has been achieved in such areas. In the dry regions which contribute nearly 42 per cent of the nation's food production, agriculture continues to depend on the vagaries of monsoon. Hence, low level of agricultural productivity and inter-district variations are significant features of the dry region. The variations in the growth trends of different crops in such region have to be critically examined, factors accounting for variations are generally to be analysed and the extent of contribution of
different inputs (factors) to productivity have to be assessed. This study is an attempt in this direction, with reference to four districts of the Rayalaseema region of Andhra Pradesh in India.

The main objectives of this study are:

1) to examine the inter-district variations in the growth rates of area, production and productivity of selected crops in Rayalaseema region;

2) to study the different factors accounting for variations in agricultural productivity;

3) to examine the extent of contribution of selected inputs to variations in productivity;

4) to examine the extent of crop failure and crop loss ratios in production and productivity of selected crops under study; and finally

5) to suggest measures for increasing productivity in less favourable areas so as to reduce the inter-district variations and achieve higher levels of agricultural productivity.
6.1 Profile of Rayalaseema Region:

The Rayalaseema region is one of the three regions of Andhra Pradesh, historically known as 'stalking ground of famines'. With frequent failure of both the north-east and south-west monsoons, the region is considered as one of the most backward areas and a part of famine zone in South India. This region comprises four districts viz., Kurnool, Chittoor, Cuddapah and Anantapur with inter-district disparities in natural and physical endowments. While Chittoor district occupies first place in receiving more average total rainfall between 1965-66 and 1984-85, Cuddapah, Kurnool and Anantapur district stood next to Chittoor district in that order (vide table 3.1). But the region's average rainfall of 672 mm is the lowest, in the three regions of Andhra Pradesh. Only about 19 per cent of the net sown area enjoys irrigation in this region. Among the four districts, Chittoor district stands first in the provision of irrigation through wells and tanks and the total irrigated area is also larger than that in other districts. Nearly 81 per cent of the cropped area is under rainfed cultivation. Consequently, dry crops like groundnut, jowar, bajra, redgram, horsegram etc., are grown in the region. The groundnut crop is extensively grown and it accounts for nearly one-third of the total cropped area in
Paddy cultivation is confined to a limited area through wells as a major source and canal irrigation is a secondary source in this region. Rice crop claims about 12 per cent of the total cropped area in the region. Within Rayalaseema region, the area under rice crop in Chittoor district accounts for 23 per cent which is highest and next in the order are Cuddapah, Kurnool and Anantapur districts. The area under food crops is more than 50 per cent in Rayalaseema region as a whole and in the four districts except Anantapur. But there has been a decreasing rate of area under food grains from 70 per cent in 1956-57 to 53.4 per cent in 1984-85 in the Rayalaseema region. Similarly, considerable decrease is also noticed in all the four districts of the region. The area under multiple or double cropping is negligible accounting for only 5.9 per cent to the total cropped area in this region.

Among the different sources of irrigation, wells constitute a major source accounting for about 44 per cent, canals 31 per cent and tanks only about 20 per cent of the total irrigated area in the region. Within the Rayalaseema region, a predominant source of canal irrigation in Kurnool and wells irrigation in Chittoor, Anantapur and Cuddapah districts are identified. It should be remembered that
the source of irrigation through wells and tanks is undependable because of uncertain rainfall causing instability to crop production. The Kurnool-Cuddapah canal benefits certain parts of both Kurnool & Cuddapah districts. The Tungabhadra High Level Canal provides assured irrigation to some parts of Anantapur district. Owing to lack of irrigation facilities and differences in natural endowments, inter-district differences in the land utilisation and different cropping patterns were noticed. For instance, the percentage of net area sown is highest in Kurnool district and Anantapur, Chittoor and Cuddapah districts stood in that order next to Kurnool.

Animal husbandry provides subsidiary occupation to mitigate the low income levels of small and marginal farmers of this region. Among the four districts, Anantapur is fairly rich in live-stock population. Chittoor and Kurnool districts are well-known for cattle population and Anantapur and Cuddapah districts for sheep population. The stocks of goats and buffaloes population is also satisfactory in all the four districts of Rayalaseema region. This region lags behind in industrialisation with only 12.5 per cent of factories of the total factories in the State. It is observed that agricultural sector consumes 68.7 per cent of the total consumption of electricity whereas industrial sector only
8.6 per cent in this region. The profile reveals the predominance of agriculture with inter-district disparities in the natural and physical endowments of the region.

6.2 Growth Rates of Agriculture:

In Rayalaseema region, rice, jowar and bajra from cereals, redgram and horsegram from pulses and groundnut from oil seeds are predominant crops. Therefore for these crops the linear and compound growth rates of area, production and productivity are worked out for the four districts of Rayalaseema, three regions of Andhra Pradesh and the state of Andhra Pradesh as a whole, for three separate periods viz., (1) pre-Green Revolution (1956-57 to 1964-65); (2) Green Revolution Period (1965-66 to 1984-85); and (3) the whole period (1956-57 to 1984-85). The linear and compound growth rates of the crops under study are compared with those of the four districts of Rayalaseema, three regions of Andhra Pradesh and Andhra Pradesh as a whole and critically examined.

Within the period of 29 years from 1956-57 to 1984-85, there were inter-district and inter-regional variations in agricultural growth rates in regard to area, production and productivity of selected crops under study.
Within the Rayalaseema region, the linear and compound growth rates of area, production and productivity are positive only in Kurnool and Anantapur districts in respect of rice. But except area, production and productivity, growth rates of rice are also positive in Cuddapah and Chittoor districts. However, comparatively higher levels of linear growth rates of 1.36 per cent of area, 2.98 per cent of production and 2.22 per cent of productivity of rice were noticed in Kurnool district (vide table 4.2) among the four districts of the region. The corresponding percentages of average annual compound growth rates are 1.57, 3.50 and 2.19 (vide table 4.2). Similarly, within Andhra Pradesh, even though the linear and compound growth rates of area, production and productivity of rice are positive in all three regions, the higher levels of linear and compound growth rates are recorded in Telengana region. The linear growth rates of 1.38 per cent of area, 4.03 per cent of production and 2.93 per cent of productivity of rice recorded in Telengana region are greater than that of the state of Andhra Pradesh average growth rates of 0.86 per cent of area, 3.00 per cent of production and 2.24 per cent of productivity. The corresponding percentages of average annual compound growth rates are 1.30, 4.12 and 3.04 in Telengana and 0.86, 2.97 and 2.18 in Andhra Pradesh state as a whole. The reason for higher level of growth
rates accompanied by greater irrigation facilities through K.C. Canal and higher cropping intensity in Kurnool district and favourable soil and drainage conditions in Telengana region. And we have to bear in mind that Coastal Andhra region has higher irrigation facilities when compared to Rayalaseema and Telengana regions but the growth rates in regard to area, production and productivity of rice are below the average annual growth rates of Telengana and above the averages of Rayalaseema region. The reason is that, this region suffers from recurring floods and poor drainage.

The negative linear and compound growth rates registered in regard to the area of jowar, bajra, redgram and horsegram is due to the shift of land to other profitable crops like groundnut whose growth rates of area are positive in all four districts of Rayalaseema, three regions of Andhra Pradesh, and the state of Andhra Pradesh. The higher level of positive growth rates are noticed in regard to production and productivity of jowar and bajra in Cuddapah district, and horsegram and groundnut in Chittoor district.
6.3 Agricultural Growth Between Pre-Green Revolution and Green Revolution Periods:

The linear and compound growth rates of area, production and productivity in regard to rice in the Green Revolution period are low compared to that of the pre-Green Revolution period (except productivity in Cuddapah and Chittoor) in all the four districts of Rayalaseema and Rayalaseema region as a whole. Again, the negative linear and compound growth rates of area in regard to rice in all four districts is disappointing.

It is observed that rice is a purely irrigated crop and Rayalaseema region is largely confined to tanks and well irrigation which are rainfed. The uneven distribution of rain-fall, lack of assured irrigation, and recurring droughts in the 20-year Green Revolution period under study conducd to lower growth rates in the Green Revolution period.

In the three regions of Andhra Pradesh and Andhra Pradesh state as a whole, the linear and compound growth rates of production and productivity in regard to rice in the Green Revolution period are higher than those of the pre-Green Revolution period in Coastal Andhra region which
has an assured irrigation. The linear growth rates of production and productivity in regard to rice per annum are 3.52 and 0.81 per cent as in the pre-Green Revolution period as against to 3.93 and 3.20 per cent in Green Revolution period in Coastal Andhra region (vide table 4.6). The corresponding compound growth rates are 3.56 and 0.79 per cent in pre-Green Revolution period and 3.96 and 3.22 per cent in Green Revolution period (vide table 4.7). In regard to Groundnut area, production and productivity growth rates are negative in the pre-Green Revolution period in Rayalaseema region as against positive growth rates recorded in the Green Revolution period.

6.4 Co-efficient of Variation in Regard to Area, Production and Productivity of Principal Crops Under Study:

Apart from the wide disparities in agricultural growth rates among the four districts of Rayalaseema region, three regions of Andhra Pradesh, and Andhra Pradesh state as a whole, growth has been accompanied by instability. In the whole 29-year period within Rayalaseema, the coefficient of variation in regard to area of rice (24.9 per cent), jowar (26.0 per cent) and groundnut (27.8 per cent) in Anantapur district, bajra (37.3 per cent) and redgram (30.8 per cent) in Chittoor district, and horsegram (38.9 per cent) in Cuddapah district (vide table 4.8) are higher.
The higher levels of fluctuations in regard to production of rice in Kurnool district, jowar in Cuddapah district, bajra, redgram, horsegram and groundnut in Anantapur district are noticed. The productivity co-efficient of variations is higher in regard to rice in Kurnool, jowar and bajra in Cuddapah, redgram and groundnut in Anantapur, and horsegram in Chittoor district. This suggests that for a wet crop like rice, higher level of fluctuations in regard to area in Anantapur, production and productivity in Kurnool are disappointing. Among the three regions higher levels of fluctuations registered in regard to area, production and productivity of rice in Telengana region are greater than those of Coastal Andhra and Rayalaseema regions and Andhra Pradesh state as a whole.

In the Green Revolution period the coefficient of variations in regard to area, production and productivity of rice and productivity of groundnut in Kurnool district and only productivity of groundnut in Anantapur district are less than during the pre-Green Revolution Period. The remaining dry crops under study recorded higher degree of fluctuations in the Green Revolution period than in the pre-Green Revolution period within the Rayalaseema region. Similarly, in all three regions of Andhra Pradesh and
Andhra Pradesh as a whole the coefficient of variations in regard to area, production and productivity of the all dry crops is greater in the Green Revolution period than in the pre-Green Revolution period. It may be remembered that higher degree of coefficient of variations in regard to area, production and productivity of dry crops under study is due to the influence of different cropping patterns.

6.5 Factors Accounting for Inter-District Variations in Agricultural Productivity:

In spite of growth in agricultural production and productivity during the planning era in Andhra Pradesh, there have been wide variations in agricultural productivity between district to district and region to region. Though several factors, such as Natural and Physical, Institutional, Economic and Technological, account for variations in the agricultural productivity, this analysis is confined to selected factors viz., rainfall, irrigation, fertilizer consumption and agricultural credit. And it has been hypothesized that 'Inter-district variations in agricultural yields are explainable in terms of inter-district differences in respect of (a) rainfall, (b) irrigation, (c) fertilizer consumption and (d) agricultural credit'. For instance, the average rainfall recorded in the Rayalaseema region at the district-level during 1956-57 and 1984-85, showed that
the highest rainfall is recorded in Kurnool district (i.e., 913 mm) followed by Cuddapah (905 mm), Chittoor (741 mm) and Anantapur (887 mm) districts during 1956-57, whereas during 1984-85 Chittoor district was at the top in which the recorded rainfall was 778 mm followed by Cuddapah, Kurnool and Anantapur districts. In the analysis it is observed that the lowest rainfall was recorded in Anantapur district during 1956-57, 1960-61, 1970-71, 1980-81 and 1984-85. Within Andhra Pradesh the highest rainfall was recorded in Coastal Andhra region, in the corresponding years, except in 1956-57 during which Telengana region recorded the highest rainfall. Thus, low level of rainfall is noticed only in Rayalaseema region in the corresponding years in Andhra Pradesh.

In the level of irrigation there were marked inter-district variations within Rayalaseema. It is evident that Chittoor district stood at the top with 41.5 per cent of gross irrigated area to total cropped area, followed by Cuddapah (31.3 per cent), Kurnool (15.7 per cent) and Anantapur (15.0 per cent) districts during 1984-85. Similarly, within Andhra Pradesh, Coastal Andhra region stood first with 54.8 per cent of gross irrigated area followed by Rayalaseema (33.4 per cent) and Telengana (27.0 per cent) regions during 1984-85. However, within Rayalaseema
region the level of irrigation is extended from 5.6 per cent to 15.7 per cent in Kurnool, 12.2 per cent to 15.0 per cent in Anantapur, 27.5 per cent to 31.3 per cent in Cuddapah districts. There was a decline in Chittoor district from 43.5 per cent to 41.5 per cent to its total cropped area between 1956-57 and 1984-85. But in Rayalaseema as a whole considerable progress has been made in the level of irrigation i.e., from 16.4 per cent to 33.4 per cent during 1956-57 and 1984-85 which stands below the level of Coastal Andhra region within Andhra Pradesh. Thus, the level of irrigation is fluctuating from year to year, and within the year from district to district, and so on.

Even in the level of consumption of Chemical fertilizers, there were also inter-district variations observed during 1971-72 and 1984-85. It is seen that Kurnool district was at the top having consumed 8.04 per cent, 5.63 per cent, 5.94 per cent, 7.60 per cent and 4.08 per cent of total fertilizers consumed in Andhra Pradesh during 1973-74, 1976-77, 1980-81, 1982-83 and 1984-85. Low level of fertilizer consumption during the corresponding years was noticed in Anantapur district among the other districts of Rayalaseema region. Thus, Rayalaseema region as a whole consumed only 10.16 per cent (i.e., 99.6 thousand tonnes)
of total fertilizers consumed in Andhra Pradesh state as a whole during 1984-85. With regard to agricultural credit deployed by both the commercial and co-operative banks, under short and medium term loans, the quantum of credit also varied from district to district within a year. It is observed that the amount of credit advanced was highest i.e., Rs.71.49 and Rs.203.17 lakhs in Chittoor district during 1965-66 and 1975-76, Rs.232.09 lakhs and Rs.617.99 lakhs in Anantapur district during 1980-81 and 1984-85, and in Kurnool district Rs.170.39 lakhs during 1970-71. Thus during 1984-85 the total credit distributed in Rayalaseema region is 88.0 per cent of the total credit advanced in Andhra Pradesh State.

To test the hypothesis that the inter-district differences in yields are explainable in terms of inter-district differences in the level of rainfall, irrigation, fertilizer consumption and agricultural credit, the rank correlation co-efficient observed between foodgrain yields and the level of each (average of 1965-66 to 1984-85) individual factor are 0.343 for rainfall, 0.857 for irrigation, 0.634 for fertilizer consumption and -0.010 for agricultural credit. Among these, the values of irrigation (0.857) and fertilizer consumption (0.634) are closely associated with
yields and statistically significant. Thus, we may infer that the differences in the level of irrigation and fertilizer consumption are mostly responsible for inter-district variations in agricultural productivity. However, rainfall and agricultural credit in combination with irrigation and fertilizer consumption would influence the productivity levels.

6.6 The Extent of Contribution of Selected Factors Accounting for Variations in Agricultural Productivity:

An attempt is made to examine the extent of contribution of selected inputs accounting for variations in productivity of different crops in all four districts of Rayalaseema, Rayalaseema region as a whole and in Andhra Pradesh during 1965-66 to 1984-85. By fitting multiple regression equation for rice and groundnut crops considering the productivity index of particular crop as dependent variable and important inputs like rainfall ($X_1$), irrigation ($X_2$), fertilizer consumption ($X_3$) and agricultural credit ($X_4$) as independent variables, the results have been critically examined.
In regard to rice, the inputs like rainfall, irrigation, fertilizer consumption and agricultural credit have explained 60 per cent of variations in rice productivity in Chittoor district, 53 per cent in Cuddapah district and 46 per cent in Kurnool district. But in Anantapur district only 19 per cent of variations in rice productivity is caused by the combined influence of the four inputs which is statistically not significant within Rayalaseema. It reveals that rice productivity in Anantapur district has been largely influenced of a variety of other inputs (factors). But in the Rayalaseema region as a whole and in the state of Andhra Pradesh, the four inputs together caused 52 and 75 per cent of variations in rice productivity respectively.

The regression co-efficient of irrigation in Kurnool district, agricultural credit in Cuddapah district, rainfall and agricultural credit in Chittoor district have high degree of correlation with productivity of rice whose values are statistically significant. The negative correlation which is statistically insignificant observed for rainfall in Cuddapah district is a consequence of heavy or uneven distribution of rainfall. Similarly, fertilizer consumption has insignificant negative correlation as observed in Andhra Pradesh state as a whole. However, the same inputs
exercised insignificant impact on variation in the productivity of groundnut as explained by 43 per cent in Kurnool, 19 per cent in Anantapur, 7 per cent in Cuddapah and 28 per cent in Chittoor districts and 38 per cent in Rayalaseema region as a whole and only 28 per cent in the state of Andhra Pradesh. It indicates that the productivity of groundnut is influenced by a variety of other factors largely in all the four districts of Rayalaseema, Rayalaseema region as a whole, and in Andhra Pradesh. It is considered that more than 90 per cent of the area under groundnut would be grown as a dry crop and the area irrigated for the same crop is negligible in the Rayalaseema region. Hence, rainfall is considered as one of the most important inputs for achieving higher level of yields of groundnut which regression coefficient is observed as statistically significant in the Rayalaseema region.

6.7 Impact of Rainfall on Production and Productivity of Dry Crops Under Study in Rayalaseema Region:

An attempt is made to examine the deviations from linear trend values of production and productivity of the five dry crops viz., jowar, bajra, redgram, horsegram and groundnut under study in relation to deviations from the normal rainfall district-wise in Rayalaseema, Rayalaseema region as a whole and the State of Andhra Pradesh. The
deviations from normal rainfall in the 29-year period under study ranged from +58.36 per cent to -28.48 per cent in Kurnool district, +35.11 per cent to -32.17 per cent in Anantapur district, +62.69 per cent to -38.45 per cent in Cuddapah district and +43.83 per cent to -37.29 per cent in Chittoor district and +37.5 per cent to -33.18 per cent in Rayalaseema as a whole and +33.70 per cent to -24.0 per cent in the state of Andhra Pradesh.

With a considerable fall in rainfall from normal during 1963-64, 1965-66, 1972-73, 1976-77 and 1980-81 in Kurnool district, in 1965-66, 1972-73 and 1980-81 in Anantapur district, in 1965-66, 1976-77 and 1980-81 in Cuddapah district and in 1965-66 and 1980-81 in Chittoor district have resulted a fall of production of all five crops. For instance, with a fall of 28.48 per cent of rain fall from normal, considerable fall in all five crops i.e., 3.92 per cent of jowar, 20.97 per cent of bajra, 35.65 per cent of redgram, 4.30 per cent of horsegram and 39.98 per cent of groundnut is noticed in Kurnool district during 1963-64. Similarly, in the Rayalaseema region as a whole and in Andhra Pradesh, a fall of 33.18 per cent and 24.0 per cent from the normal rainfall have caused a considerable decline in the production of all five crops.
In contrast to it, a rise in rainfall from the normal rainfall has resulted in a significant increase in the production trends of all five crops viz., jowar, bajra, redgram, horsegram and groundnut in the respective years in all the four districts and in Rayalaseema region as a whole and in the state of Andhra Pradesh. It is evident that a rise in rainfall from normal in Kurnool, Cuddapah, Chittoor districts during 1983-84 and in Anantapur district in 1981-82 witnessed, considerable rise in production of all the five crops.

6.8 Probability of Crop Failure and Crop Loss Ratios in Production and Productivity of Selected Crops Under Study:

During the 29-year period of our study, the probability of crop failure in general was higher both in production and productivity of all six crops under consideration in all four districts of Rayalaseema region, Rayalaseema region as a whole and in the state of Andhra Pradesh. However, understandably, the percentage of probability of crop failure in rice production and productivity is relatively lower as compared to that of other crops. 41.38 per cent of probability of crop failure of rice in Anantapur district and 24.14 per cent of productivity of rice in Cuddapah are higher than those of other districts of Rayalaseema.
Rayalaseema region as a whole and in Andhra Pradesh. It means that out of the 29-year period the crop failure was more than 10 per cent below the trend line in 12 years in Anantapur and 7 years in Cuddapah district.

The magnitude of crop-loss ratio both to production and productivity is minimum for rice crop rather than other crops under study. It is considered that rice is an irrigated crop. Hence the crop-loss ratio is relatively lower than that of dry crops under study. The percentage of crop-loss ratio in production is the highest in regard to rice, jowar, redgram, horsegram and groundnut in Anantapur district among the four districts in Rayalaseema. As far as productivity is concerned, the highest crop-loss ratio is noticed with regard to rice, bajra and groundnut in Kurnool, and jowar, redgram and horsegram in Anantapur districts. Thus in Rayalaseema region the highest crop-loss ratio is observed in the production of horsegram and productivity of redgram respectively.
6.9 **Suggestions:**

The above analysis reveals that there is an imperative need for the removal of inter-district/inter-regional variation in agricultural growth/productivity and for the increase of yield per unit of land in low productivity districts and regions, in order to attain balanced agricultural growth. Even though balanced agricultural productivity is an ideal, the imbalances can be reduced through an appropriate strategy for achieving higher rates of growth even in backward regions like Rayalaseema. The following major requisities become important for achieving higher levels of productivity.

**Extension of Irrigation Facilities and Water Management:**

Irrigation is the crucial input in increasing the inter-district variations and in attaining higher levels of agricultural productivity. Particularly, assured irrigation is the hub and centre of new agricultural technology. The extension of irrigation facilities to unirrigated lands will be helpful in attaining higher levels of yields and minimizing the inter-district variations in agricultural productivity even in backward regions. In the Rayalaseema region still 70 per cent of the area is sown under rainfed conditions and agriculture is not free
from the vagaries of monsoon. Hence, there is an immediate need for undertaking a thorough investigation of underground water resources in this region and for tapping the resources fully wherever possible. In Rayalaseema minor irrigation schemes should receive top most priority, particularly through wells and tanks as major sources. By improving well irrigation, complete exploitation of groundwater resources is possible, which will go to long way in increasing agricultural growth by way of reducing inter-district variations in productivity against uncertain weather. Further, provision of supply of borewell materials and the deepning of wells, equipments at concessional rates by the Government during the times of drought conditions would be useful to small farmers. But the extension of irrigation facilities and exploitation of irrigation potential are possible only under huge financial allocations by the Government in every successive Five Year Plan for backward regions. Again, regular supply of electric power for farm operations must be ensured.

Along with the programme of full exploitation of water resources, water management also should receive adequate attention. Through better water management, wastage of water at different stages, under well, tank and canal irrigation, needs to be avoided. Further, better water management will help contain water logging and consequent damages.
Appropriate Technology for Dry Areas:

As Rayalaseema region is considered as one of the dry tracts, dry land farming with appropriate technology is essential in order to improve agricultural growth and to correct regional income imbalances. The extension of the Green Revolution to dry arid tracts with new varieties coupled with a follow-up programme is suggested. Research should aim at evolving new and drought and disease resistant strains in cereals, pulses and cash crops and at popularising them.

In dry land farming the basic ingredient is the proper management of land, water and crop. Improved methods of moisture conservation, timelines of preparatory tillage and seeding operations, establishment of adequate crop stands, effective weed control, efficient fertilizer use, new cropping patterns and crop life saving technology would bring about increased production in dry areas. The new technology has made it possible to practise double or multiple cropping for dry areas which give up to 60 per cent increase in yield over a single crop system.
Evolving New High Yielding Varieties and Fertilizer Consumption:

Adoption of high yielding varieties constitutes the flucrum of the Green Revolution. But the potency of HYV in the real sense is not fully exploited in this region because they should be suitable for irrigated areas. The poor performance of pulses is due to lack of suitable high yielding variety seeds. The traditional variety of pulses are low yielding and longer in duration. Hence, there is need for the introduction of drought resistant high yielding seeds both in pulses and other cash crops to achieve higher levels of yields.

Adoption of HYV along with fertilizer consumption necessarily increases agricultural productivity. Due to uncertain rains, the cultivators are not sure of their crop returns and as such hesitate to take any risk of investment on fertilizers, in this region. Low yields with inter-district variations in agricultural productivity are caused mainly by the low dosage of fertilizer application. To convince the cultivators of the advantage of the use of fertilizers even to rainfed crops, fertilizers are proposed to be supplied on a subsidy basis to small and marginal farmers. If the recommended doses of fertilizers
are applied, the returns will be much nearer to the expectations and productivity variations will be minimized. But to realise the full potency of fertilizers, factors like cropping pattern, weather, irrigation, fertilizer costs, cash resources of the farmers, crop response, technological changes and managerial skills of the cultivators should be thoroughly understood and applied.

**Advance Guidance to Farmers:**

Farmers must be given forecast information relating to rains or drought and other meteorological changes in advance of the sowing time every year. Such information will enable the farm producers to select proper seeds and crops, adjust the irrigation facilities etc., with a view to minimising effects of drought on production and productivity of crops. This is helpful to small farmers whose resources are too limited to meet their investment requirements in the farm operations.
Integrated Pest Management Strategy:

The incidence of pest epidemics has been a major factor causing inter-district variations with low level productivity and production of crops. Application of recommended doses of pesticides at an appropriate time and the strict practice of routine pest and disease control measures will result in dramatic increase in yields. It is estimated that nearly 10 per cent of the total harvest is damaged every year due to attack of pests and diseases. Whereas in all dry land crops, the losses are as heavy as 50 per cent of the production. The consumption of inputs to that effect also goes waste. Hence, an integrated pest management strategy will have to be developed for each major crop at the national and regional level and the total pest attacked area must be covered under plant protection measures in order to minimize variations in agricultural productivity and to attain higher yield per hectare.
Live Stock Development as Subsidiary Occupation:

Since agriculture, the backbone of the economy of the Rayalaseema region, is precarious owing to the fact that it is the victim of the depredations of nature, animal husbandry has to be exploited as a subsidiary occupation to alleviate the tribulations of the peasantry. However, live-stock development is possible, if special attention is bestowed on pasture development. In the Rayalaseema region there is considerable waste land which may be used for pasture development. Improvement of grass lands is possible with a series of demonstrations of gross plots, wherein the modern technology in grass raining and maintance is demonstrated to the farmers. Mixed farming system with the combination of crop and livestocks will help the supplementary income of small and marginal farmers and this will go a long way in minimizing the ill-effects of drought on the one hand and reducing the income inequalities on the other.
Crop Insurance:

Crop insurance is an important device to meet risk and uncertainty in farming owing to wide fluctuations of monsoon. The dry land areas are generally caught in a vicious circle of high risk and low production and productivity. Crop insurance can act as a stabiliser of farm production and thereby farm incomes. It enables the farmers to substitute a regular annual premium cost for irregular losses. The small and marginal farmers need crop insurance scheme all the more urgently since they become the worst sufferers in case of crop failure in drought areas like Rayalaseema.

The thrust of the crop insurance policy may thus be directed towards all major crops grown in both dry and irrigated areas. The premium rates of crop insurance will have to be kept low in areas of low productivity and high fluctuations.
Credit and Other Incentives:

Modern farm technology is more expensive, and therefore adequate and timely supply of institutional credit covering all aspects of crop production, live-stock rearing, dairing, farm forestry, and sericulture is essential to inject appropriate capital inputs into agriculture for rapid growth. Restricted use of capital due to risk-aversion, capital rationing owing to poverty and inadequate supply of credit due to improper working of banking system especially in drought-prone areas, are responsible for low income and wide fluctuations in crop output. Adequate agricultural credit itself will reduce some of the risks in investment by providing means to obtain improved seed, fertilizer, pesticides, irrigation and improved farm equipment. The setting up of new bank branches at convenient areas and provision of liberal advances will certainly be useful to poor farmers. Further, the farm producer must be assured of remunerative price. It is possible only when efficient marketing system is established even at the village level.
Extension Services:

It will not be possible to diffuse the knowledge developed unless 'lab to land' programmes are launched with adequate and fully qualified staff. In modern agriculture, trained staff will act as a bridge between the researcher and the farmer. The adoption of new agricultural practices like water control, sowing of improved seed, spraying of pesticides, weedicides, fungicides, etc., is a skilled job which requires education and training through extension services. Hence extension staff and field assistants should assist and educate farmers to adopt new agricultural practices and bring research findings to the door steps of the farmers.
Grass Roots Planning:

Micro-level planning aimed at reducing the inter-distict variations in agricultural productivity is an urgent need of the hour for effecting balanced regional agricultural development. The strategy of agricultural development is to be directed towards raising productivity by extension of irrigation facilities through repairing and deepening of tanks and wells, fair sharing of canal water, by using better and adequate inputs, mechanised farming, timely credit supply. Marketing and research facilities besides growth centres can be effectively attended to, if planning begins at least at the Mandal level. However, since the soil and climatic conditions are highly heterogeneous, micro-level investigations would bring out more facts suggestive of better agricultural policy to increase output in agriculture and to reduce inter-district and inter-regional variations in agricultural growth within the Rayalaseema region and in the state of Andhra Pradesh.