CHAPTER V

SUMMARY OF FINDINGS AND SUGGESTIONS
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This chapter is intended mainly to present the summary of the study and suggestions. There are two major sources of water for irrigation. Surface and underground. Groundwater irrigation has been playing a significant role in agricultural development and it has richly contributed to food security. Groundwater irrigation has helped in commercialisation of farming through crop diversification. Groundwater is abstracted from dug wells, dug-cum-bore, shallow bore and deep bore wells. Artificial irrigation facilities protect the crops against failure of rains and make it possible double or multiple cropping. In the areas, where perennial rivers are absent, groundwater irrigation is looked upon as an essential tool of agricultural development. It introduces an element of stability into agriculture, brings the desired changes in cropping pattern and utilises the available inputs more effectively. The present study is taken up mainly to assess the role of groundwater in agricultural development. The study is primarily confined to Anantapur district – a drought prone area and is one of the four districts of Rayalaseema region of Andhra Pradesh State.

The objectives of the study are:

1. To know the importance of groundwater irrigation in agricultural development of Anantapur district;

2. To analyse the trends in production and productivity of principal crops and changes in cropping pattern in Anantapur district; and
3. To understand the problems of agriculturists and suggest measures for improving agriculture.

Both secondary and primary data were collected for the study. Secondary data relating to irrigation for several years was collected from different departments like Irrigation, Groundwater, Office of the Chief Planning Officer, Anantapur, Directorate of Economics and Statistics, Hyderabad, Mandal Revenue Offices and other published Journals, Reports etc. To collect primary data altogether six villages – two from each Revenue Division of Anantapur district were selected randomly. From each selected village 20 farmers having well irrigation facility are selected randomly and these 20 farmers cover all categories of farmers like S.Cs, S.Ts, B.Cs and O.Cs. The primary data relating to wells, extent of land, irrigation, cropping pattern, production and productivity, costs and benefits, problems and opinion of farmers on groundwater irrigation etc. was collected from the respondents with the help of a schedule by conducting interview with them. The information thus collected was classified, tabulated and finally analysed to know the facts. Altogether 120 farmers are selected from six villages and interviewed. Due care has been taken in collecting the required information.

The study made an attempt to analyse the situation of agriculture and the status of irrigation in Andhra Pradesh. More than two-third of state’s population directly depends on agriculture and allied activities for its livelihood and most of the industries are depending on agriculture for their inputs. But agriculture is dependent mainly on vagaries of monsoons. To mitigate uncertainty of monsoon
in agriculture protective irrigation appeared to be the solution. In Andhra Pradesh irrigation is found as a decisive factor in modernizing agriculture. It is learnt that there are regional imbalances in irrigation development in Andhra Pradesh.

In Andhra Pradesh the main sources of irrigation are Canals, Tanks and Wells. Total irrigated area by all sources increased from 23.56 lakh hectares in 1950-51 to 43.84 lakh hectares in 1999-2000. In 1950-51 canals served 54 per cent of total irrigated area, tanks 32 per cent and wells 13 per cent. But these percentages changed significantly by 1999-2000 as the percentage shares of canals and tanks declined to 37 and 15 respectively. While the percentage share of wells increased to 43.

It is understood that there is a change in cropping pattern over a period of time. For instance in 1952-53 the area under paddy accounted for 91 per cent of total irrigated land in Andhra Pradesh. But this percentage declined to 69 by 1999-2000. While the area under groundnut, sugarcane and other crops increased. The state of Andhra Pradesh receives maximum rainfall during southwest monsoon period followed by north-east monsoon period. The average rainfall of south-west monsoon varied from 475mm in 1987-88 to 994mm in 1988-89. The long-term average rainfall was estimated to be 949mm. The average annual rainfall ranged from 1343mm in 1989-90 to 734mm in 1979-80.

In 1999-2000 net irrigated area of Andhra Pradesh was 43.82 lakh hectares. Of this the share of canals was 37 per cent, wells 44 per cent, tanks 15 per cent and other sources 4 per cent. The distribution of irrigated area among three regions of
Andhra Pradesh reveals that large area i.e., 22-0 lakh hectares (50.21 per cent) was located in Coastal Andhra region, 15.69 lakh hectares (35.81 per cent) in Telangana region and 6.13 lakh hectares (13.99 per cent) in Rayalaseema region.

Land use statistics of Andhra Pradesh are also analysed. Total geographical area of Andhra Pradesh is 274.40 lakh hectares. In absolute terms land area under forests ranged from 52.05 lakh hectares in 1950-51 to 62.68 lakh hectares in 1990-91. In 1999-2000 the area under forests accounted for 22.6 per cent of geographical area. Net area sown varied from 38.07 per cent in 1950-51 to 40.5 per cent in 1998-99. It is observed that the percentage of net sown area fluctuated from time to time.

The principal crops of Andhra Pradesh are paddy, groundnut, jowar and cotton. The area under paddy rose from 22.04 lakh hectares in 1950-51 to 42.18 lakh hectares in 1988-89 and the same declined to 40.11 lakh hectares in 1999-2000. In percentage terms the land area under paddy accounted for 45.77 of total land area under food grains. The area under food grains ranged between 73.37 lakh hectares in 1950-51 to 94.81 lakh hectares in 1970-71. Among oil seed crops groundnut is an important one as it was grown over 22.20 lakh hectares in 1995-96.

Trends in the area under food crops and non-food crops reveal that there is a significant change in cropping pattern. Slowly non-food crops are replacing food crops as the percentage share of non-food crops in total cropped area increased from 21.95 in 1980-81 to 40.91 in 1995-96.
Production trends of principal crops in Andhra Pradesh are also analysed. Production of rice significantly increased from 22.73 lakh tonnes in 1950-51 to 104.02 lakh tonnes in 1999-2000 (nearly 4.5 times increase). Similarly total food grains production rose from 39.66 lakh tonnes to 138.40 lakh tonnes (3.5 times increase) during the same period. Groundnut production increased from 10.27 lakh tonnes in 1950-51 to a maximum level of 26.25 lakh tonnes in 1995-96. While the production of sugarcane recorded a significant growth over a period of time as its production rose from 4.71 tonnes in 1950-51 to 21.00 lakh tonnes in 1999-2000. It is also observed that the production levels of principal crops showed fluctuations and there is no continuous rise in the production level of any crop.

Trends in productivity of principal crops reveal that agriculture is characterized by low land and labour productivity. As regards rice, our major crop, productivity per hectare rose from 917 Kgs in 1950-51 to 2710 Kgs in 1999-2000. The productivity of groundnut varied from 774 Kgs in 1950-51 to 483 Kgs in 1995-96. Productivity of sugarcane increased from 6064 Kgs to 8499 Kgs during fifty years of time. In-case of cotton per hectare productivity was only 49 Kgs in 1950-51 but it reached to a level of 315 Kgs by 1993-94. Hence there is an increasing trend in land productivity, though productivity continues to be low judged by international standards. Thus agriculture has a long way to go before it can catch up with the top producing countries of the world. Anantapur district lies in Semi-arid region and falls in the rain shadow area of Western ghats. The
scanty, untimely and unevenly distributed rainfall results in frequent failures of crops causing acute scarcity of food for men and fodder for cattle. The rivers that flow across the district are rain-fed. Hence the district has limited scope for irrigation development. Wells, canals and tanks are the chief sources of irrigation in Anantapur district. Comparatively groundwater sources provide an irrigation facility to a large area and as such the importance of groundwater has been increasing due to meager surface water sources of irrigation.

In Anantapur district there is one major irrigation project namely Thunga Bhadra Project High Level canal (TBPHLC) which was constructed in two stages. The total expenditure incurred on this project was Rs.19.94 crores. An area of 51,771 hectares of land was brought under this project benefiting 157 villages of 19 Mandals in the district.

There are three medium irrigation projects Viz. Upper Pennar Project, Chennaraya Swamy Gudi Project and Bhairavanithippa project constructed between 1958 and 1961. An amount of Rs.422.67 crores was spent on these projects. An ayacut of 61,142 hectares was registered under these three projects. The ayacut under Upper Pennar Project is 4066 hectares and it benefits 13 villages of Kambadur (3), Ramagiri (3), Kanagana palli (3) and Rapthadu (4) mandals. The ayacut of Bhairavanithippa project is 4856 hectares distributed among 14 villages of Gummagatta (8) and Brahmasamudram (6) Mandals. Chennraya Swamy Gudi Project has an ayacut of only 444 hectares located in four villages of Nallacherulu Mandal. The cost of irrigation per hectare under major irrigation
project worked out to Rs.3835 while that under medium irrigation projects to Rs.4510.

Minor irrigation works include all groundwater tube wells, bore wells, dug wells, dug-cum bore wells and surface water development works such as storage tanks, lift irrigation projects etc. These projects do not cause such problems as water logging and salinity and provide irrigation facilities and employment opportunities to rural people. Occurrence of recurrent droughts, advent of high yielding varieties and the introduction of an incentive oriented agricultural price policy paved the way for extensive use of groundwater for irrigation. There are about 58458 wells in the district. As per G.E.C norms of 1993 the available groundwater resource is 1061.71 MCM and of which the present draft is 391.20 MCM leaving a balance groundwater potential of 670.51 MCM for further development in Anantapur district. Hence a total of 44855 open wells or 33526 bore wells in addition to the existing wells are feasible. Overexploitation of groundwater in certain areas has resulted in progressive lowering of the water levels causing failure of wells. In order to prevent the depletion of groundwater resources many remedial measures such as drip irrigation, rising of irrigable dry crops, construction of artificial recharge structures like percolation tanks and check dams were undertaken.

The rainfall data reveals that the rainfall in the district of Anantapur is scanty, uncertain and uneven in distribution. The average rainfall of the district is
523.28mm. Bad years (low rainfall years) occur continuously one after the other resulting in severe strain on water resources. It is also true that the average annual rainfall of 523.28mm is too meagre to support good agricultural system. To solve this problem water can be diverted from the Godavari, Manhanadi and other feasible resources. Another way of improving water resources is reducing the run-off and infiltration of rain water by constructing artificial water recharge structures.

Land use statistics reveal that the geographical area of the district is 19.13 lakh hectares and the area under forests is not more than 10 per cent of total geographical area. No significant changes were noticed in the area under forests. The percentage of net sown area ranged from 40.18 in 1986-87 to 52.58 in 1998-99. Area sown more than once was less than 2 per cent of the total geographical area. It implies that a small part of cultivable land has irrigation facilities. Another important fact is that there is need for rising the percentage of area under forests to one third of the geographical area of the district in order to have a good vegetation.

Both groundwater and surface water sources provide irrigation facilities to agriculture. Groundwater is being utilised for irrigation through dug wells, in well bores, bore wells and tube wells. Surface water sources include canals of major and medium irrigation projects, tanks and lift irrigation systems.
In 1998-99 the net irrigated area by all means was 1.48 lakh hectares which accounted for 14.71 per cent of net sown area during that year. That means 85.29 per cent of total cropped area in Anantapur district is under rain-fed conditions.

The study reveals that wells (groundwater) are the chief source of irrigation in Anantapur district. In 1998-99 as high as 66.23 per cent of net irrigated area was served by wells, 22.83 per cent by canals, 8.58 per cent by tanks and the remaining by other sources. The land area irrigated by wells varied from 32.02 per cent in 1960-61 to 79.69 per cent in 1997-98. The share of tanks in total irrigated area widely fluctuated and showed a declining trend. While the percentage of area irrigated by canals ranged from 14.57 to 35.94. Another interesting feature is that canals are not providing irrigation facilities to total area registered under them.

It is also observed that there are wide fluctuations in the area irrigated more than once. In absolute terms this area was 0.25 lakh hectares in 1960-61 and this declined to 0.06 lakh hectares in 1987-88 and reached a maximum level of 0.37 lakh hectares in 1998-99. As percentage to gross irrigated the irrigated area sown more than once varied from 4.2 in 1987-88 to 20.0 in 1998-99.

As per the study the important crops grown over irrigated area are rice, groundnut and sunflower. The distribution of irrigated land among different crops reveals that the farmers allocated 25 to 45 per cent of net irrigated land to grow rice, 20 per cent to groundnut and 9 to 15 per cent to sun flower. Hence rice is the
chief crop for which large irrigated area was allocated. It is also observed that the cropped area in rabi season declined compared to that of Kharif season. In rabi season the area under groundnut increased while that under Paddy declined. For instance in 1998-99 the area under paddy declined from 38998 hectares in Kharif to 27258 hectares in rabi season. Similarly the area under groundnut increased from 12917 hectares in Kharif to 26520 hectares in rabi season.

It is evident from the study that in Kharif season of 1999-2000 the area under food crops accounted for 62.20 per cent and that of non-food crops for 37.8 per cent. But in rabi season the area under food crops increased to 83.9 per cent and at the same time the share of non-food crops declined to 16.1 per cent during the same year. It indicates that large area of irrigated land was used to grow food crops in order to meet the food requirements of agriculturists and other people.

Production trends of principal crops reveal that among food crops the percentage share of paddy is high in all years. The production of rice ranged from 189 thousand tonnes in 1988-99 to 72 thousand tonnes in 1994-95. The other important crops are Jowar and ragi. The production levels of these crops showed a declining trend over a period of time. Groundnut production is relatively big in size. Its production increased from 135 thousand tonnes in 1980-81 to 988 thousand tonnes in 1995-96. Thus rice and groundnut are the chief crops whose shares in the total production of principal crops are large. For example in 1995-96
the share of rice and groundnut in the total production of principal crops accounted for 7.84 per cent and 87.05 per cent respectively.

The productivity trends of principal crops reveal that there are fluctuations in the yield levels of principal crops. The productivity of rice per hectare varied from 1887 Kgs in 1980-81 to 2567 Kgs in 1991-92. As it is noticed the yield per hectare of many crops is relatively low. The low levels of productivity point to the possibilities of increasing productivity by adopting right strategy and intensive efforts.

Prices of agricultural products (Food grains and non-food grains) play an important role in the economy. A steep hike in food prices raises the cost of living necessitating a rise in wages which in turn increases the cost of production. On the other hand a steep fall in agricultural prices makes agriculture unremunerative. When income is reduced the farmers have to borrow money from others to meet their needs. The demand for goods is reduced. This leads to poverty and unemployment.

It is observed that the prices of agricultural products increased over a period of time. For example the price of paddy per quintal increased from Rs.138 in 1981-82 to Rs.546 in 1998-99 registering a four-fold increase. The price of groundnut rose from Rs.330 to 1387 (3.3 times increase) during the same period. But the prices of some products fluctuated causing difficulties to the farmers and the poor.
From six villages a total of 120 farmers having well irrigation are selected for the study. That means 20 agriculturists from each village. Of the total selected farmers 51 (42.5 per cent) belong to backward classes, 41 (34 per cent) to open category, 21 (17.5 per cent) to the category of scheduled castes and the rest 7 (6 per cent) to scheduled tribes. As high as 62.5 per cent of total selected families are nuclear while the rest are joint families. As per the study all respondents are not literates. Nearly 50 per cent of them are literates. Out of 61 literates 37 are having elementary education, 16 secondary education and the remaining 8 higher education. All (120) respondents own 112 permanent houses, 22 semi-permanent houses and 30 thatched houses. On an average each permanent house costs Rs.112473, semi-permanent-house costs Rs.27000 and thatched house Rs.13100. The distribution of houses among the selected respondents reveals that majority of the farmers of Manirevu village are not having permanent houses. They own 11 permanent houses, 3 semi-permanent houses and 11 thatched houses. But in other villages more or less all farmers own permanent houses in addition to some semi-permanent and thatched houses.

It is evident from the study that some of the selected farmers are owning tractors and modern implements. Out of 120 farmers 8, from Chagallu village (2), Kudair (3) and Kodiginahalli (3), are having own tractors. About 28 agriculturists own sprayers especially for spraying pesticides. Hence as high as 70 per cent of them do not own neither tractors nor sprayers and other modern implements.
Normally these farmers take sprayers and other instruments including tractors on rent basis from others and complete their work.

Land holding particulars reveal that all the selected farmers own 1447 acres of land. Of this 59 per cent is under rain-fed and 41 per cent is irrigated land. On an average each respondent owns about 12 acres of land (dry + wet). The size of land holding differs from one farmer to another and from one village to another village. As far as total land is concerned the average size of land holding of each farmer varies from 7.45 acres in chagallu village to 19.85 acres in Kudair village. But the average area of irrigated land of each farmer is estimated at 4.79 acres. It implies that each well has to irrigate an area of 4.79 acres.

As it is already mentioned there are different types of wells. Of 120 selected wells 30 per cent are dug-cum bore wells and the remaining 70 per cent are surface bore wells. It is observed that when dug or open wells failed to yield water the in-well bores came into existence. Age-wise distribution of selected wells reveals that about 70 per cent of total wells were constructed during 1990-95 and the rest prior to 1990.

Size pattern of bore wells reveals that out of 120 as high as 60 borewells are in the size-class of 4-6 inches diameter, 55 in the size group of 6-8 inches diameter and the rest (5) fall in the size class of 2-4 inches diameter. Depth of bore wells differs from one village to another. The depth varies from 100 feet to 350 feet. There are 28 bore wells with the depth of 100-150 feet. Another 24 bore
wells are in the depth class of 150-200 feet. About 44 bore wells fall in the depth class of 200-300 feet and the depth of other 24 bore wells is more than 300 feet. As water table is going down the farmers are deepening their bore wells. Comparatively, the water table is low in the villages of Penukonda Revenue Division.

As it is observed majority of the bore wells supply water continuously for 7 to 10 hours a day. Out of 120 selected bore wells 46 (38 per cent) have the pump-sets with pipe size of less than two inches and 74 (62 per cent) have the pump-sets with pipe size of more than two inches diameter. Majority of the farmers expressed that the electric power is not supplied continuously in summer. Frequent power cuts and low voltage are the main problems which adversely affected the agriculture sector.

Almost all the farmers have installed electric motors. The H.P. of motor differs from one motor to another. There are 56 (47 per cent) motors with the H.P. of less than 6 and 64 (53 per cent) motors with the H.P. of more than 6 H.P. The cost of each motor of less than 6 H.P varied from Rs.22000 to Rs.25000 and that of the motors with more than 6 H.P. was between Rs.32000 and Rs.35000. The average annual cost of maintenance of each well with motor of less than 6 H.P. was estimated to be between Rs.2100 and Rs.2400. For the wells with motors of more than 6 H.P. the same varied between Rs.3200 and Rs.4000 a year.
The study also reveals that as high as 98.3 per cent of total respondents followed traditional methods of irrigation and only 1.7 per cent of them adopted modern irrigation methods like sprinkler and drip systems. These systems are in use especially to water fruit gardens and mulberry plants.

According to the study some bore wells are drilled side by side. There should be a minimum distance between one bore well to another one. There are about 40 bore wells and the distance among those wells is less than 50 metres. In the case of another 35 bore wells the distance varies from 50 to 100 metres. When the distance is short between two wells normally the bore well with less depth will run dry and that with deep depth will continue to provide water for irrigation.

It is observed that about 66 respondents have arranged pipelines in their fields in order to prevent loss of water and to provide proper irrigation facilities to tail end and middle end areas of the fields.

It is interesting to note that majority of the selected farmers raised crops in both Kharif and rabi seasons. But some farmers have raised crops even in summer season with the help of groundwater. Another interesting feature is that the irrigated cropped area under selected wells shown a declining trend from Kharif to rabi and from rabi to summer. For instance in the Kharif season of 1998-99 all the selected farmers grew crops over 575 acres of land. But this cropped area is declined considerably in rabi and summer seasons and it was recorded at 381 acres and 241 acres respectively. This position is common in all villages selected for
the study. It was due to shortage of groundwater, frequent cuts in power supply, willingness of the farmers to keep the land fallow for some time and incapability of certain farmers to grow crops in all seasons.

Distribution of gross area in 1997-98 among different crops revealed that paddy was the chief crop which was grown over 33.5 per cent of gross cropped area under all selected bore wells. Groundnut was another important crop as its share in gross cropped area stood at 22.6 per cent. Sunflower was grown over 18.8 per cent of gross cropped area. In addition to seasonal crops some farmers have grown fruit gardens like orange, guava, pomegranate etc., with the help of well irrigation and the area under fruit gardens accounted for 15.3 per cent.

It is evident from the study that in case of paddy and groundnut a portion of total product was kept for self-consumption and the rest was sold out. The selected agriculturists who have grown paddy in 331 acres of land produced 4928 quintals of paddy in 1997-98. Out of the total output they sold 2790 quintals of paddy and received a return of Rs.27,10,400. Per acre return of paddy was estimated at Rs.8189.

All the selected farmers grew groundnut over 223 acres of land and produced 1070 Quintals of groundnut. The productivity of groundnut per acre was 5 Quintals. The quantity sold was 959 Quintals and the income received by the farmers was Rs.13,37,500. Per acre return was estimated to be Rs.5998. On an average each farmer received a sum of Rs.11,146. In the case of sunflower,
mulberry, fruits total quantity produced was sold. Nothing is left for self-consumption. Sunflower was grown over 186 acres of land by some selected farmers. These farmers produced 2444 quintals of sunflower seeds and got a return of Rs.31,77,200. On an average each acre of land under sunflower gave an income of Rs.17,082 in 1997-98. Some of the farmers also raised mulberry plants to produce cocoons. About 68 acres of land was under mulberry cultivation. With this they produced 98 quintals of cocoons and received an income of Rs.12,25,000. The average annual income from one acre of land under mulberry was worked out to Rs.18015. The fruit plants like guava, orange and pomogranate were also grown by some selected farmers and the average annual return from one acre of land under these crops was estimated to be Rs.58634, Rs.92640 and Rs.39,446 respectively.

It is learnt that the entire land was under rain-fed conditions before the construction of wells. Out of 575 acres of land under all selected wells nearly 92 per cent of it was put to agricultural uses with the help of seasonal rains. About 8 per cent of total land was not used for growing crops as it was kept under fallow. Crops were grown only in Kharif season.

It is also evident from the study that almost all the selected farmers applied fertilizers like D.A.P., Urea, Nitrate, Super phosphate, Potash etc. to their fields. Pesticides were also used to protect the plants from different diseases. In Chagallu village the average cost of fertilizer per acre was Rs.308 and that of pesticide was
Rs.189. These figures change from village to village and from year to year. Because the quantity and the cost of fertilizers and pesticides largely depend on the nature of crops grown and the economic stability of the farmers. All these facts reveal that the farmers have realised the importance of chemical fertilizers and pesticides in the production of different agricultural products.

Different inputs are necessary to produce agricultural products. All the selected farmers used more or less the same inputs to grow paddy. The cost of inputs differ from one farmer to another and from one village to another. Per acre cost of production of paddy in Kharif ranged from Rs.3120 in Kodiginahalli village to Rs.3667 in Kudair. While the cost of production of groundnut per acre varied from Rs.2500 to Rs.3250. It is noticed that per acre cost of production of principal crops changes from one season to another. But the decrease or the increase in cost of production of principal crops in different seasons varies slightly.

As per the study majority of the respondents borrowed money from different sources such as RRBs, Co-operative Banks, Syndicate Bank and Moneylenders for land development, purchase of motor and pumpset, bullock carts, milch animals, construction of sheds and houses and for growing crops. Of the total respondents 39 approached RRBs, 42 Co-operative Banks, 32 Moneylenders and only 76 Syndicate Bank for loans. The respondents of six villages borrowed a total amount of Rs. 31,69,000 from the above mentioned
sources. Of the total loan amount extended to respondents the share of RRBs was 24 per cent, Co-operative Banks 44 per cent, Moneylenders 29 per cent and Syndicate Bank nearly 3 per cent.

As high as 92 percent of total respondents expressed that the availability of water in their wells was sufficient to grow crops especially in Kharif season. But in rabi and summer seasons crops were not grown in the total extent of area under selected wells due to shortage of water.

All the respondents expressed that the water of their wells was suitable for growing crops in all seasons. An enquiry has also been made in respect of surplus water available in selected wells. Out of 120 selected wells surplus water is available in 35 wells located at Kudair, D. Cherlopalli and Manirevu villages. But these farmers have not supplied surplus water to the fields of others. However, two farmers supplied water to other farmers free of cost.

In other villages namely Edulaballapuram and Kodigenahalli villages there are about nine farmers with surplus water in their wells and have supplied water to other farmers on rent basis and earned an amount of Rs. 49,050 a year.

All the selected respondents are of the opinion that wells are more useful for agricultural development. They opted bore wells for irrigation mainly for three reasons (1) bore wells are easy to maintain (2) to raise commercial crops and (3) failure of dug wells and lack of other water sources for irrigation. Out of 120 selected farmers 103 (85.8 per cent) report that there is shortage of electric power
supply. Shortage is severe in rabi and summer seasons. Due to this the total extent of land under wells was not put to agriculture uses in rabi and summer seasons. About 50 per cent of respondents reveal that market facilities are inadequate. All these conditions discourage farmers to grow certain crops. They are not getting remunerative prices for their products.

Suggestions

By examining the land relations, size of holdings, agricultural techniques, irrigation facilities, indebtedness, production and productivity trends, cropping pattern etc., the following suggestions have been made to overcome certain problems associated with irrigated agriculture and groundwater irrigation and to improve the economic conditions of agriculturists.

Since rainfall is scanty, uncertain and uneven in distribution prospects of agricultural developments are meager. All artificial irrigation systems irrigate about 15 per cent of cultivable land in Anantapur district. Thus the irrigated area should be enhanced by all means in order to mitigate drought conditions. Water table is going down year after year. It is evident from the study that almost all the dug wells failed to provide water for irrigation and were replaced by in-well-bores and afterwards surface bore wells came into existence. The bore wells have been drilled up to a depth of 300-350 feet in some areas. In order to rise water table and conserve water sufficient artificial recharge structures should be taken up. These
works would help the farmers to get sufficient water for irrigation and to increase agricultural production.

It is also necessary to increase the area under forests say from 10 to 30 per cent of geographical area or at least to protect the existing forests in order to have good vegetation, to maintain ecological balance and to get sufficient rains. Efforts must also be made to bring wastelands and fallow lands under cultivation so that cropped area can be increased.

Farmers should be educated properly about modern irrigation systems, efficient water management and full utilization of land etc., Some bore wells were drilled side by side and the distance between one bore well to another is short resulting in failure of certain wells in providing water for irrigation. Hence farmers should be advised not follow this procedure. Another observation that the cropped area under selected wells significantly declined in rabi and summer seasons compared to that of kharif season. This is due to shortage of water and improper cropping pattern. It is, therefore, necessary to adopt suitable cropping pattern for rabi and summer seasons. Farmers also should realize the importance of scarce water and have to grow irrigable dry crops instead of wet crops especially in rabi and summer seasons. This would certainly help the farmers to increase cropped area in rabi and summer seasons.

Inputs like power, qualitative HYV seeds, fertilizers and pesticides should be made available sufficiently and timely. Almost all the selected farmers
expressed that the supply of electric power during rabi and summer seasons was not continuos and there were frequent power cuts and that to power was supplied with low voltage. Thus it is a major problem for agriculture development. Hence electric power should be supplied with suitable voltage continuously for 10-12 hours a day. As all the farmers have installed electric motors to lift groundwater electric power is essential.

Indebtedness is common legacy of farmers. Majority of the farmers continued to depend on moneylenders for full filling their credit requirements to a large extent and thus became victims of exploitation by the latter. Organized financial institutions have to fulfill all credit requirements of farmers and reduce the importance of moneylenders.

Majority of the farmers expressed that marketing facilities were inadequate. They sold their products in private markets but they did not approach regulated markets. Thus it is necessary that marketing facilities should be promoted to ensure remunerative prices for agricultural commodities. Proper implementation of crop-insurance scheme is necessary to cover the risks in agriculture. It is also necessary to ensure proper warehousing and advice on day-to-day problems confronted by the farmers in carrying out agricultural activities. The results of Agricultural Research should reach the farmers.

To have assured irrigation facilities groundwater resources should be improved through the construction of artificial water recharge structures.
Remunerative prices should be ensured for agricultural commodities by providing adequate marketing facilities. These two measures are very essential to increase the yield per acre and to improve the income levels of the farmers.