LAND USE PATTERN –A MICRO REGIONAL STUDY

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Abstract

In drought prone Rayalaseema region agriculture is the major occupation of the people and is influencing the land use pattern. The study of farmers perception on land use and its planning has a considerable importance. To find out the farmers perception on the agricultural land use pattern in Chittoor district of Rayalaseema region, farmer's opinion on land use pattern and its related aspects have been collected. For this, a field survey was conducted through questionnaire with different parameters like total agriculture land, land under different crops, total cultivated area, area under food crops, area under commercial crops, land under fruit gardens, land under fallows, etc. In this connection 6 mandals have been selected for sample field survey. The sample mandals are selected on the basis of factors like mandals which are located in drought prone area, located in high rain fall receiving area, located in irrigation source area, located in fruit growing dominance and areas with high intensity of commercial cropping pattern. Apart from these factors, distribution of mandals based on nature of topography like plain, valley and plateau land forms were also taken in to account. To know the farmers perception on cropping pattern, 6 mandals have been selected for sample field survey. The study has indicated agricultural land use, cropped area, crops cultivated, shifting from traditional cropping system to commercial and cash crops in different farming communities. The results are analysed and summarised

Key Words: *Landuse**, holdings, commercial cropping**, mechanization, drought prone area**.*

Introduction:

Land use pattern for cropping   is representations of hierarchal association of different crops at a point of time in a particular area of unit. It also represents the relation of different important crops grown in a region in terms of their areal extent. In Chittoor district where agriculture is the chief occupation of the people, the study of farmer's perception on crop farming, agricultural land use and its planning has a considerable importance. Micro level study always stands for generalisation of regional agricultural land use patterns.

To find out the farmers perception on the cropping pattern in Chittoor district, farmer's opinion on cropping pattern (Agricultural Land use) and its related aspect have been collected. To know the farmers perception on land use pattern for cropping, 6 mandals have been selected for sample field survey.

The sample mandals are selected on the basis of factors like mandals which are located in drought prone area, located in high rain fall area, located in irrigation source area, located in fruit growing dominance and areas with high intensity of commercial cropping pattern. Apart from these factors, distribution of mandals based on nature of topography like plain, valley and plateau land forms were also taken in to account.

Objectives:

The following objectives are framed for the present study.

1. To examine farmers perception on land use for cropping pattern in the district.

2. To suggest various measures for up keeping and maintaining good agricultural Practices and cropping pattern in particular.

Hypothesis:

The following hypotheses are formulated as follows.

1. Irrigation and cropping patterns controls land utilization and cropping pattern.

2. Farmers are more interesting in commercial and short term crops rather than traditional and long   duration crops.

Study Area:

Chittoor district, the present study area lies in the southern most part of Andhra Pradesh state. It forms a part of the semi-arid as well as backward Rayalaseema region. Geographically, it is located between the 12º 37' and 14º 8' Northern latitudes and between the 78º 33' and 79º 55' Eastern longitudes.
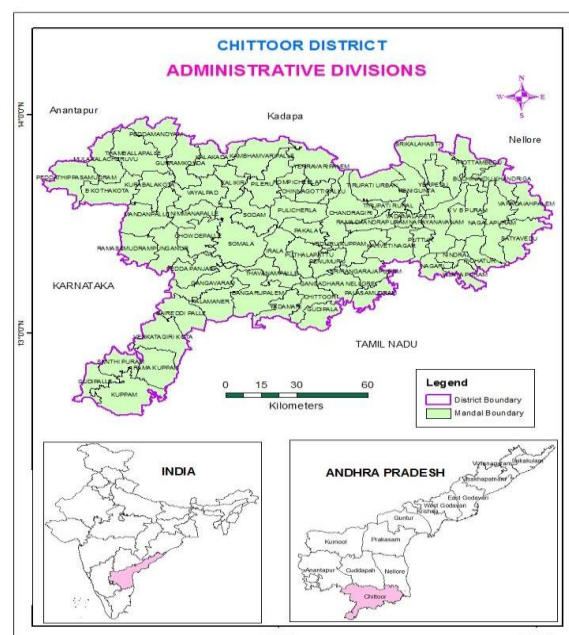

*Fig.*1 Location of Study area

Database:

For the present study, primary data is used. The secondary date is also used for selecting sample mandals and villages. To analyze the farmer's perception on cropping pattern, the sample villages are chosen randomly based on location and agricultural potentiality. In this respect, 6 mandals have been chosen and in each mandal minimum three and maximum five villages were taken into consideration for data collection with the well prepared questionnaire. Accordingly 600 samples were collected relating to cropping pattern by following social divisions such as Scheduled caste, Scheduled Tribes, Backward Caste and Other Caste farmers.

Methodology:

To trace land utilization for the cropping pattern and cultivation of different crops the following methodology is adopted. To find out the degree and intensity of cropping Pattern and cultivation of different crops, Land utilization and farmers perception primary data is used. The averages and percentages were calculated with suitable pictorial representation.

Analysis:

The sample mandals are selected based on different factors as discussed above, Srikalahasthi mandal is located in high rain fall receiving as well as this mandal has high potentiality in ground water resources. Nagari mandal comes under the high irrigation intensity (Arenior minor irrigation project). Somala mandal has identified as high fruit garden crop dominating mandal. Kurabalakota is located in drought prone area which accounted frequent rain failures and low rainfall occurrences. Palamaner mandal where dominated mixed farming and V.Kota mandal is located in narrow zone between Tamilnadu and Karnataka states. Moreover, this mandal is transforming from traditional cropping pattern to commercial pattern. In each mandal five sample villages are selected for house hold survey. The list of sample mandals and village wise samples are shown in the following table1.

As shown in the below table, in each mandal 100 samples were taken and distributed to all social groups such as SC (Scheduled Cast), ST (Scheduled Tribes), BC (Backward Cast), OC (Other Caste). Total samples collected were 600 of which 120 belongs to SC farmers (20pre cent), ST samples are 60 accounted for 10 per cent, BC samples are 189 which accounted for 30 per cent and OC samples are 240 which accounted for 40 per cent.

Total agricultural land of the sample farmers

The analysis revealed that 600 sample farmers belong to different community are having 2698.4 Acres of agriculture land. Out of this 344.45 acres (12.76%) belong to SC community, 109 acres (4.04%) belongs to ST community 867.65 acres (32.15%) belongs to BC community and 1377 Acres (51.04%) belong to OC community farmers respectively.

Table: 1 Sample mandals and villages

S.No.	NAME OF THE SAMPLE MANDAL	NAME OF THE SAMPLE VILLAGES	TOTAL SAMPLES				
			SC	ST	BC	OC	Total
1.	Nagari	Agraharam	19	10	14	3	46
		Adivikothur	-	-	-	37	37
		mittapalem	-	-	5	-	5
		mudipalle	-	-	4	-	4
		Nagarau kuppam	1	-	7	-	8
2.	Kurabalakota	kurabalakota	-	-	8	-	8
		Mudivedu	1	1	19	1	22
		Pichalavandla palle	4	9	-	-	13
		Tettu	10	-	-	16	26
		Angallu	5	-	3	23	31
3.	V.Kota	V. Kota	10	-	10	10	-
		Mudaramdoddi	-	05	-	10	-
		Padigalakuppam	5	-	10	10	-
		jounipalle	5	05	05	05	-
		Pattrapalle	-	-	05	05	-
4.	Somala	Surayyaiahgaripalle	4	-	16	-	20
		Gannavaripalle	16	6	-	-	22
		somala	-	-	04	14	18
		kandur	-	-	10	10	20
		Irikipenta	-	4		16	20
5.	Palamaner	Kolamasana palle	5	2	8	5	20
		Pengarakunta	5	-	3	6	14
		Samudra palle	3	-	3	2	8
		Baireddi palle	4	8	7	23	42
		Kurmol	3	-	9	4	16
6.	Srikalahasthi	Pullareddi Khandriga	5	2	8	7	22
		Rachagunneri	5	-	10	7	22
		Ramalinga Puram	5	1	5	8	19
		Ramanuja Palle	5	2	2	10	19
		A R Agraharam	-	5	5	8	18
Total			120	60	180	240	600

Table: 2 Total agricultural land of the sample farmers in acres

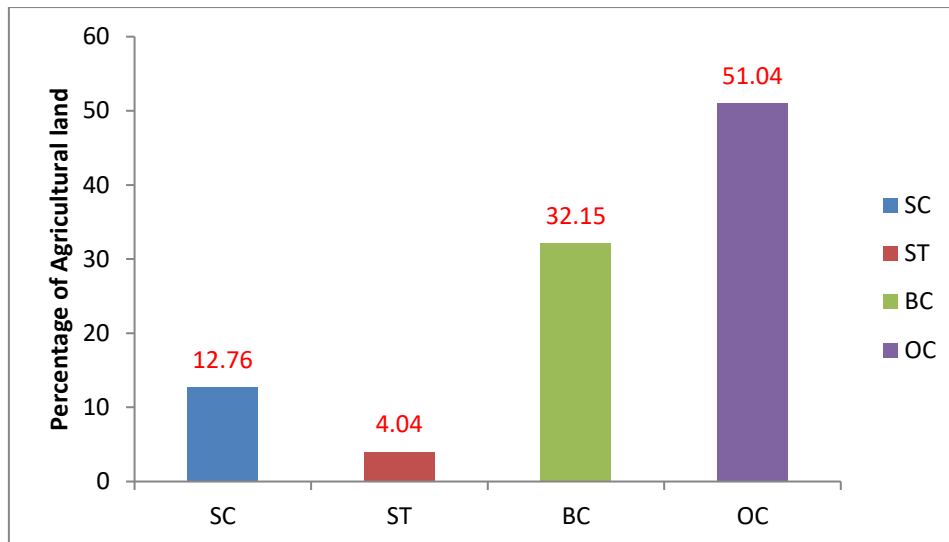| S.No.	Name of the sample mandal	SC	ST	BC	OC	Total
1	Nagari	71.00	2.00	207.50	106.50	387.00
2	Palamaner	58.50	14.50	104.00.	245.75	422.75
3	V.Kota	65.95	28.00	172.45	356.05	622.45
4	Kurabalakota	49.25	28.50	137.50	177.50	392.75
5	Somala	47.75	15.00	90.20	229.50	382.00
6	Srikalahasthi	52.00	21.00	156.00	262.00	491.00
	Total	344.45	109.00	867.65	1377.30	2698.40
	Per cent	12.76	4.04	32.15	51.04	100

Fig. 2 Total agricultural land of the sample farmers in acres

The above mentioned information is clearly indicates that ST community farmers representing the lowest per cent of agricultural land fallowed by SC, BC, OC, community farmers respectively. It can be stated that, OC community farmers are represented with more agricultural land than SC, ST farmers. However B.C. community farmers represented considerable agricultural land.

Community wise sample agricultural holdings:

It is interesting to state that, in ST community sample farmers, 92 per cent of the land is under less than 5 acres categories only 8 per cent of land holdings of ST community farmers comes under 5-10 acres category, and no ST Farmer comes under remaining category of land holdings. ST community sample farmers share in total agricultural land of sample farmers is only 4 per cent. In SC community 87 per cent of that farmers land is under less than 5 acres category. Only 13 per cent farmers are having agriculture land which comes under 5-10 acres category. No SC farmers come under remaining category of land holdings. The share of the SC farmers among the total sample farmers is only 13 per cent.

With respect to BC community farmers, 56 per cent farmers comes under less than 5 acres category, 25per cent under 5-10 acres, 16% under 10-15 acres, 1% under 15-20 acres and 2% farmers comes under 20-25 category respectively. No BC farmer comes under more than 25 acres category. The share of the BC community sample farmers in total agricultural land is 32 per cent.

As far as OC community farmers representation, 42 per cent of farmers comes under less than 5 acres category, 35 per cent farmers represented 5-10 acres, 17 per cent farmers

represented 10-15 acres category, and in 15-20 acres, 20-25 acres and more than 25 acres categories has 2 per cent of farmers in each category respectively. The share of OC community farmer's agricultural land is 51 per cent.

With respect to all community farmers, 60 per cent of farmers comes under less than 5 acres category, 25 per cent of farmers comes under 5-10 acres category, 11.50 per cent farmers comes under 10-15 acres category and only 1.2 per cent, and 0.8 per cent farmers comes under 15-20 acres 20-25 acres and more than 25 per cent acres categories of agricultural holding respectively.

Table: 3 Community wise agricultural holdings in acres

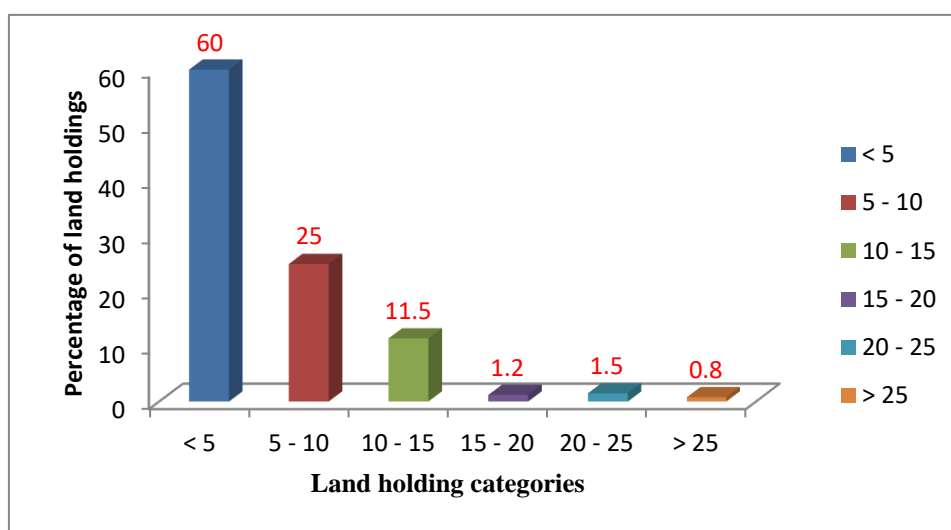| Land holding size	SC	%	ST	%	BC	%	OC	%	Total	%
>5	105	87	55	92	100	56	100	42	360	60
5-10	15	13	05	08	45	25	85	35	150	25
10-15	-	-	-	-	29	16	40	17	69	11.5
15-20	-	-	-	-	02	1	5	2	07	1.2
20-25	-	-	-	-	04	2	5	2	09	1.5
<25	-	-	-	-	-	-	5	2	05	0.8
Total	120	100	60	100	180	100	240	100	600	100

Fig. 3 Community wise size of agricultural land holdings (in per cent)

The above analysis clearly indicates that, SC and ST community farmers are having very small size holdings and less amount of agricultural land with comparison to BC and OC farmers. However, BC farmers also represented moderate amount of land holdings and whereas OC community farmers are having high per cent in large size holdings when compared to others. Out of the total agricultural land the share of OC category farmer is very high (51%) comparatively other community farmers. So it can be concluded that, SC and ST farmers having very low share of agricultural land and also low range of agricultural holdings.

Total cropped area of the sample farmers:

As a part of analysis land under different crops is also calculated by considering different farming communities. Community wise, 89 per cent land is cropped by SC farmers, 79 per cent land is cropped by ST farmers, 93 per cent of land by BC farmers and 95 per cent of OC farmers land is under crops. There is a very vast gap among shares of the agricultural land of the different community farmers. They represented community wise 13 per cent by SC, 4 per cent by ST farmers, 32 per cent share by the BC farmers and 51 per cent share by OC farmers. The above analysis clearly indicated that though percentage of agricultural land is low among SC, ST, BC farmers their share of cropped land percentage is high due to developmental activities taken by the government and most of the land is cultivated under rain fed dry crop during south western monsoon period.

Table: 4 Community wise total crop land under different crops in acres in percent

S.No.	Community	Paddy	Ground nut	Mango	Sugar cane	Vegetables	Ragi	Jowar	Mulberry	Other crops	Total
1	SC	26	17	27	7	10	8	3	-	2	100
2	ST	12	58	12	-	-	6	6	-	6	100
3	BC	25	31	25	12	6	0.4	0.4	-	-	100
4	OC	22	15	31	15	6	0.8	1	8	0.9	100
Total		23	22	28	13	6	2	1	4	0.9	

Community wise land under different crops:

To find out community wise cultivation under different crops, analysis is made. On an average all community farmers have been cultivating nine crops including other crops. The crops cultivated sample farmers listed as paddy, groundnut, mango, Sugarcane, vegetables, ragi, jowar, mulberry and others. However, ST farmers have found in cultivation of 6 crops only.

Under paddy crop total sample farmers represented 590 acres out of total cropped area. Which is accounted for 23 per cent of the total cropped area, it is to indicate that 26 per cent of SC farmers land, 12 per cent of ST farmers land, 25 per cent of the BC farmers land and 23 per cent of the OC farmers land is under paddy crop. With regard to groundnut cultivation out of total cropped area 553 acres are under groundnut cultivation. Community wise, groundnut share is represented as 17 Per cent of SC cropped area 58 per cent of ST cropped area 31 per cent of the BC cropped area and 15 per cent of OC farmers cropped area is under groundnut cultivation.

Under mango cultivations, 695 acres land is identified as under mango gardens out of total cropped area of sample farmers. Community wise Land under mango crop indicating as 27 per cent of SC farmers cultivated area, 12 per cent of ST farmers cultivated area, 25 per cent of BC farmers cultivated area and 28 per cent of OC farmers cultivated area is under mango cultivation.

With regard to sugarcane cultivation, 320 acres is under practice. Community wise per cent of sugarcane cultivation has indicated as, 7 per cent of SC farmers cropped area 12 per cent BC farmers cropped area and 15 per cent of OC farmers cropped area is under sugarcane cultivation and no ST farmer is cultivated sugarcane. On an average 13 per cent of land of total cropped area of all farmers is under sugarcane cultivation.

The another crop practiced by sample farmers is vegetables. Vegetables cultivated in150 acres out of total cropped area by the sample farmers. Community wise 10 per cent of cropped area of SC farmers, 61 per cent of cropped area by BC farmers and 6 per cent of OC farmers cropped area is under vegetables. No ST share of farmers is cultivated vegetables.

Under Ragi cultivation 45 acres are indentified out of total sample cropped area. Community wise 8 per cent of SC cropped area, 6 per cent of ST cropped area 0.5 per cent of BC cropped area and one per cent of OC farmer's area is under ragi cultivation. In Jower cultivation 28 acres were identified out of total cropped area of the sample farmers. 3 per cent of SC farmers cropped area 5 per cent of ST farmers cultivated area, 0.5 per cent of BC farmers cropped area is under jower cultivation.

As far as Mulberry cultivation is concerned, 100 acres are under cultivation. It is interesting to state that only OC farmers are practicing Mulberry cultivation and 8 per cent of total cropped area of OC farmers is under mulberry cultivation. Mulberry cultivation is required suitable climate which can be noticed in south western part of the district

(Santhipuram mandal), moreover it requires high capital investment, long practicing activities and different market facilities. Therefore SC, ST and marginal farmers cannot come forward to cultivation mulberry as a crop.

Apart from above discussed crops, it is to mention that sample farmers are also cultivating some other crops like flowers, small onions, pulses, grams, etc, which have been treated as other crops for the analysis. Under other crops 23 acres are found.

Community wise land under food crops

As a part of farmer's perception land use for agricultural cropping pattern, an analysis is made on community wise land under food crops and commercial crops. Out of total cropped area by the sample farmers 661 acres land is cultivated under food crop known as paddy, Ragi, Jower, which is accounted for 26 per cent in total cropped area. Community wise SC farmers cultivated 38 per cent of land under food crops, ST farmers cultivated 25 per cent, BC farmers cultivated 26 per cent land and OC farmers cultivated 25 per cent of land under food crops.

Among the food crops, 89 per cent of land is under paddy cultivation and only 7 and 4 per cent of land under Ragi and Jower respectively. It resembles that the importance of paddy crop in food crops. In paddy cultivation SC farmers cultivated 69 per cent land, ST farmers 50 per cent land, BC farmers 90 per cent of land and OC farmers 94 per cent of land under paddy cultivation out of total food crops cultivation. In Ragi cultivation 22 per cent of SC farmers cultivated land, 25 per cent of ST farmers cultivated land, 1.4 per cent, of BC farmers cultivated respectively. In Jower cultivation SC farmers cultivated 9 per cent of land. ST farmers cultivated 25 per cent of land BC farmers cultivated 1.5 per cent land OC farmers cultivated 3 per cent of land respectively.

The above analysis reveals that, the share of food crops percentage in all community is less. However SC farmers contributed 38 per cent of land which has slight higher with comparison to other community farmers. It is also interesting to state that the share of paddy cultivation is very low among SC and ST farmers comparatively BC and OC farmers. In contrast to this, the share percentage of Ragi and Jower crops is high among SC and ST farmers, comparatively BC and OC farmers. It can be concluded that more per cent OC and BC farmers land is under principle crop (Paddy) rather than small millets (Ragi and Jower) which have low market facilities.

Table: 5 Community wise land under food crops in per cent

Community	Items	Paddy	%	Ragi	%	Jower	%	Total	%
SC	Total cropped area	80	69	25	22	10	9	115	38
	% of share	13	-	58	-	36	-	17	-
ST	Total cropped area	10	50	05	25	05	25	20	25
	% of share	02	-	12	-	18	-	03	-
BC	Total cropped area	200	97	03	15	03	1.5	206	26
	% of share	34	-	7	-	11	-	31	-
OC	Total cropped area	300	04	10	23	10	3	320	25
	% of share	51	-	23	-	36	-	49	-
Total	Total cropped area	590	89	43	7	28	4	661	100
	% of share	-	-	-	-	-	-	-	-
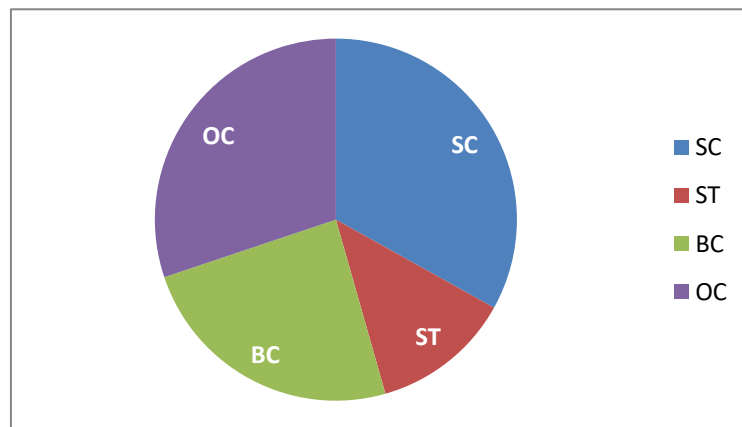
Fig. 4: Community wise land under food crops

7. Community wise land under commercial crops

Under commercial crops five crops like Groundnut, Mango, Sugarcane, Vegetables, and Mulberry are identified which are cultivating by the sample farmers. Out of the total cropped area of the sample famers, 74 per cent of cropped area is under commercial crops. Among commercial crops, Mango cultivation occupies first position which is accounted for 38 per cent followed by Groundnut (30%), Sugarcane (18%), Vegetables (9%) and Mulberry (5%).   Community wise per cent of land under commercial crops reveals that 62 per cent cultivated land of SC farmers, 75 per cent of cultivated land of ST, 74 per cent of cultivated land of BC farmers, 75 per cent of OC farmers cultivated land is under commercial crops, The per cent of land under commercial is high since subsistence type of agriculture has been transforming towards commercial crops.

Table: 6 Community wise land under commercial crops in acres

S.No	Items	M	%	G.N	%	S.C	%	Veg	%	Mal	%	Total	%
SC	Total cropped area	85	45	53	28	20	11	30	16	-		188	62
	% of Share	12		10		6		19		-		10	-
ST	Total cropped area	10	17	50	83					-		60	75
	% of Share	1		9						-		13	-
BC	Total cropped area	200	33	250	41	100	17	50	8			600	74
	% of Share	29		45		31		33				33	-
OC	Total cropped area	400	41	200	20.5	200	20.5	75	8	100	10	975	75
	% of Share	58.0		36		63		48		100		53	-
Total	Total cropped area	695	38	553	30	320	18	155	9	100	5	1823	100
	% of Share	100		100		100		100		100		100	

45 per cent of SC farmers, 17 per cent of ST farmers, 33 per cent of BC farmers and 41 per cent of OC farmers land is under Mango crop out of total land under commercial crops.
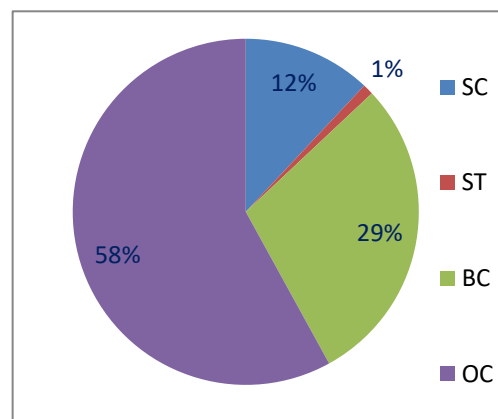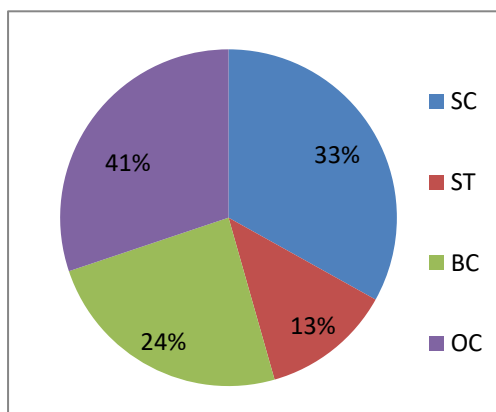
Fig. 5: Community wise distribution of land under Mango cultivation (in per cent).

Fig. 5 A: Community wise share of land under mango cultivation (in per cent).

In groundnut cultivation, community wise distribution having considerable variation which indicated as 28 per cent of SC farmers cropped area, 83 per cent of ST farmers cropped area 41 per cent of BC farmers cropped area and 20.5 per cent of OC farmers cropped area is under groundnut cultivation out of total cropped area under commercial crops.
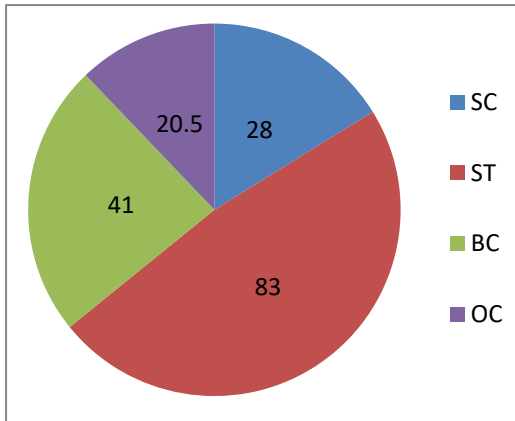
Fig.6: Community wise distribution of land under Groundnut cultivation (in per cent)
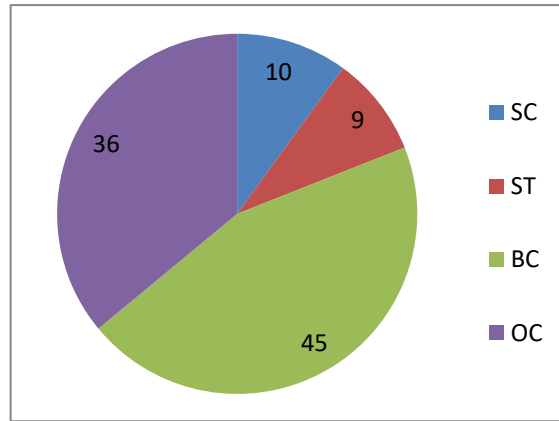

Fig. 6 A: Community wise share of land under Groundnut cultivation (in per cent)

Under Sugarcane cultivation ST farmers are not having any land. However the highest per cent of land under sugarcane cultivation is noticed in OC community farmers which accounted for 25 per cent fallowed by BC farmers (17%) and SC farmers (11%) respectively.

The above analysis with respect to SC farmers, clearly indicating that high share of land under sugarcane cultivation belongs to OC farmers and very low share belongs to SC farmers. Sugarcane cultivation involves huge amount of investment for arrangement of continues irrigation facilities, operational cost and harvester expenses. Hence small and marginal farmers could not offer more amount of investment, so per cent of share under sugarcane cultivation is low among the small and marginal farmers.
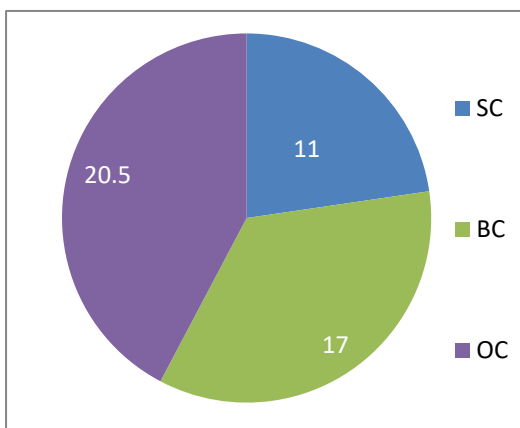

Fig.7: Community wise distribution of land Under Sugarcane cultivation (in per cent)
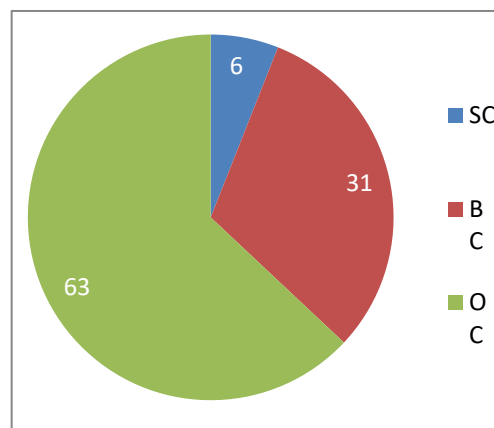

Fig .7 A: Community wise share of land Under Sugarcane cultivation (in per cent)

Vegetables cultivation is the other commercial crop cultivated by the sample farmers. Out of the sample farmers cropped area 155 acres land is under vegetables, which is accounted for 9 per cent. Community wise cultivated land under vegetables indicated as 16 per cent by SC farmers and 8 per cent by each BC and OC farmers. In this crop also no ST farmer land is under vegetables.

Cultivation of vegetables also requires huge amount of investment for providing irrigation facilities, cropping implements, pet control measures and marketing which small and marginal farmers (SC,ST) cannot offer.
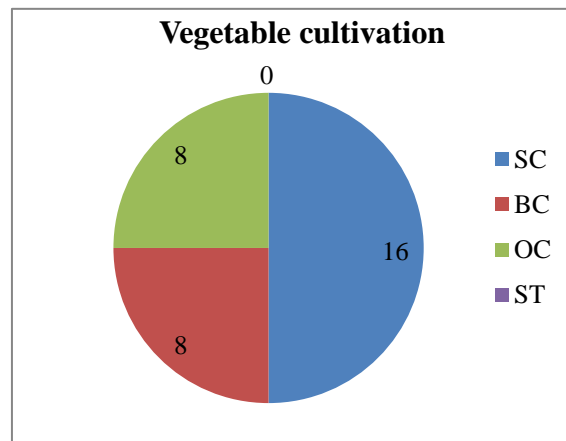

Fig. 8: Community wise distribution of land under vegetable cultivation in per cent

Mulberry is another commercial crop cultivated by sample farmers. It is to note that only OC farmers in Santhipuram mandal are cultivating mulberry in 100 acres which accounted for 10 per cent of the total OC sample farmer's commercial crops. The weather conditions of Santhipuram mandal are more suitable for the cultivation of mulberry crop and also good market facilities are found in Bangalore city which is located near to Santhipuram mandal.

The above analysis reveals that high per cent of commercial crops have been cultivated by the OC and BC farmers rather than SC and ST farmers. Because SC and ST farmers are having small holdings and low economic status etc., are the main reasons for concentration of food crops rather than the commercial crops.

Fruit crops are also a part of commercial crops which is explained in the above pages. However to find out the intensity of fruit crops alone a separate analysis is made for better understand on fruit crops. It is interesting to state that out of the total cropped area, all the sample farmers have been cultivating Mango as a fruit crop. Mango is cultivated in 695 acres

by the sample farmers which accounted 28 per cent of total cropped area and 38 per cent of total commercial crops.

 Apart from mango cultivation, some of the sample farmers are also cultivating papaya, Guava, Sapota, pomegranate etc, as fruit crops. But all these fruit crops are cultivated in very negligible area. Government encouragement for fruit gardens, implementing of modern irrigation techniques, frequent rain failures for cultivation of principle crops, severe labour problems, and reduction of cultivations in each family are the important responsible factors for remarkable increase in mango cultivation.

Table: 7 Community wise distribution of land under fruit crops

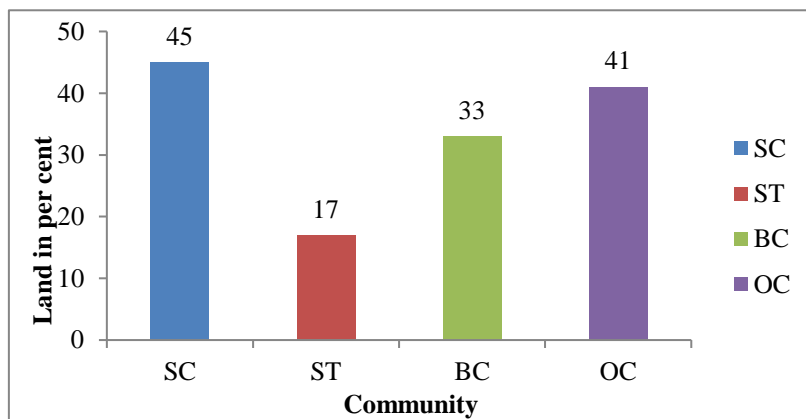| S.No.	Community	Land under fruits crop (in acres)	%
1	SC	85	45
2	ST	10	17
3	BC	200	33
4	OC	400	41
	Total	695	38

Fig. 9: Community wise distribution of land under fruit crops
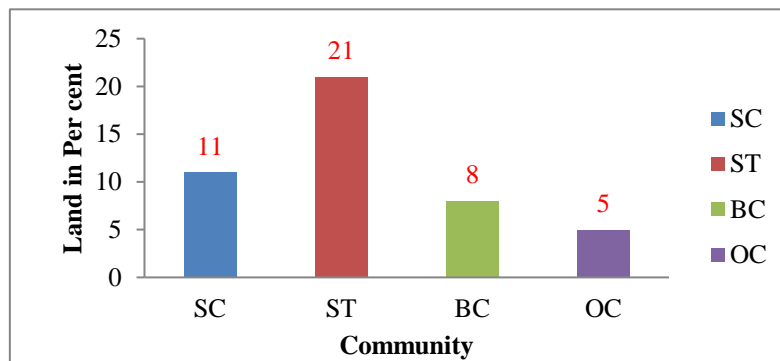
8. Community wise Fallow land

To find out the structure of agricultural operations based on social status, in first step cropped area has been calculated. In the next step, community wise the amount of fallow land is also cultivated.

Out of total agricultural land of all total sample farmers 189 acres of the land, which is accounted for 7 per cent is under current follows, Community wise the structure of fallow land represented as 11 per cent in SC farmers, 21 per cent in ST farmers, 8 per cent of BC farmers and 5 per cent among the OC farmers.

Table: 8 Community wise total fallow land in acres

S. No.	Community	Land under follow land	%
1	SC	37	11
2.	ST	23	21
3.	BC	59	8
4.	OC	70	5
Total		189	7

Fig .10: Community wise distribution of land under Fallow land (in per cent)

The highest amount of fallow land is noticed among ST farmers whereas lowest is noticed among OC farmers. The low economic status, small size of holdings and frequent rainfall failures are responsible for the high per cent of fallow land among ST and SC farmers.

Conclusions:

The analysis revealed that, less investment, easy to cultivation, high income, less investment less labour requirements are the important individual reasons for shifting of agriculture from subsistence to commercial cropping system. Therefore the hypothesis *"Farmers are more interesting in commercial crops rather than traditional and long period crops"* has been tested and accepted. In farmer opinion on advantage of agriculture, majority SC and ST farmers revealed income source as main advantage.

It is interesting to mention that, no sample farmer has poultry farm, but majority farmers rearing country chicks for domestic and local consumption. Majority of SC and ST farmers are rearing sheep and goats. However the percentage of raring Sheep and Goats is observed among BC farms.

Suggestions:

1. To maintain the irrigation potentiality, it should be made rain harvesting as an important social activity with the help of this social activity. The potentiality of ground water and surface water capacity would be positively influenced.

2. In different parts of the study area micro-Irrigation systems have been adopting mainly for plantation crops. This is time to transform towards modernization of irrigations techniques and use of irrigation technology for more number of crops in to principle crops.

3. Farmers are to be familiarized with techniques of irrigation and implementation.

4. Sustainable irrigation water consumption is to be encouraged among farmers rather than flooding fields / reckless use of water for fields.

5. By adapting measures to improve cropped area and forest cover, the economic status of the farmers and ecological imbalances can be maintained. This can lead to minimize desertification of western mandals of the study area.

6. Awareness programmers on water harvesting and optimum consumption to be arranged by the concerned authorities

7. It is suggested further micro study in the field of cropping pattern for sustainable agricultural development.

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