ECONOMICS OF MAJOR FARMING SYSTEMS IN NORTH COASTAL ZONE OF ANDHRA PRADESH

K.N. Ravi Kumar, B. Bapuji Rao** and K. Sree Lakshmi***

North Coastal Zone (NCZ) is characterized by rainfed agriculture and fertile soils suitable for raising a wide variety of crops round the year. Majority of the area in this zone is largely rainfed with meager irrigation sources. Nearly 80% of the farmers in this zone was adversely affected by drought conditions in the past 3-4 years, thereby, resulting in low crop productivity. Moreover, the adoption of scientific technologies in the crop production is on a low scale because of large scale illiteracy, lack of awareness on the mode of adoption of modern technologies and primitive outlook of the farming community. Hence, the farmer's income is low and unstable than the maximum they can realize from the existing potentiality of the zone. Further, the diversification of agricultural activities is very low in this zone, which otherwise reduces the risk and help in stabilizing the farm income besides providing a source of employment throughout the year. Only 20% of the farming community in this zone are taking up allied activities of agriculture like poultry, sheep rearing and sericulture. Since agriculture among the farmers is mostly on rainfed condition, it is a highly risky proposition and it can be sustained by mixed farming – a type of farming that combines crop production with one/more enterprises of allied activities of agriculture. This mixed farming facilitates the farmers for better utilization of farm by-products, stabilizing the annual net income, effective utilization of family labour for longer periods in a year and reduces the risk in agri-business, thereby paves the way for sustainable agricultural production. This is especially true in case of small and medium farmers, as their low scale returns from sub-divided and fragmented land holdings can be increased and

* *Assistant Professor, Agril Economics, Agricultural College, Naira, Srikakulam Dt.- 532 185*

** *ECF Scheme, Regl. Agril. Research Station, Anakapalle – 531 001*

sustained through practicing farming systems approach. As the agriculture is mostly dominated by the small and medium farmers in this zone, the farming system approach should be given due attention, so as to sustain them in the farm business. With this background, this study has been taken up to suggest profitable cropping pattern and farming system, so as to sustain the welfare of small and medium farmers in agri-business. This study is useful to the farming community, extension workers, scientists and policy makers to arrive at the sustainable production systems under the current condition of factor-product prices. Keeping these aspects in view, the following specific objectives were coined for this study:

1. To study the most profitable cropping pattern of small and medium farmers in the study area.
2. To study the most profitable farming system of small and medium farmers in the study area.
3. To render useful suggestions so as to sustain the small and medium farmers in the agri-business.

Methodology

The study was conducted in Visakhapatnam and Srikakulam districts of NCZ of Andhra Pradesh as the investigators are working in these two districts. Two mandals viz., Anakapalle and Palakonda were selected purposively, as they are not only accessible but also had the representative features of NCZ. Moreover, a large number of small and medium farmers and different types of cropping patterns and farming systems were existing in these selected mandals. The different cropping patterns and farming systems were identified based on the discussions held with various departmental officers such as Agriculture, Animal Husbandry, Department of Sericulture, Srikakulam etc., and also with the progressive farmers in different parts of the selected districts. The discussions held at the Zonal Research and Extension Advisory Council Meetings of Regional Agricultural Research Station (RARS), Anakapalle were also helpful in identifying the major farming systems. To collect the requisite data from each mandal, two villages were selected at random. The

status report prepared by the scientists of RARS, Anakapalle for NCZ revealed that, there are predominance of both small and medium farms to an extent of 39.25% and 51.34% respectively. In each village, all the existing small and medium farmers were listed out and 10 small and 10 medium farmers were selected at random. Thus, 2 districts, 2 mandals, 4 villages, 40 small farmers and 40 medium farmers forms the sample base. A farmer with a land holding less than or equal to 2 acres is categorized as small farmer and the farmer with holding ranging between 2.1 acres to 5.0 acres is categorized as medium farmer. Paddy, sugarcane, maize and rice-fallow black gram are the major crops grown by the sample farmers. Among the sample farmers, 39 farmers (17 small and 20 medium) are practicing poultry, 23 farmers (12 small and 11 medium) sheep rearing and 20 farmers (11 small and 9 medium) sericulture enterprises. Budgeting technique was employed to assess the profitability of various crops and farming systems with selected enterprises. The data were collected taking allied enterprise as a base for studying farming systems approach through survey method for the year 2001-02 and the study was conducted during 2002-03.

Results and Discussion

Area, Production and Yield of Major crops cultivated by the sample farmers

The details pertaining to the area, production and yield of major crops cultivated by the sample farmers during the year 2000-01 are presented in Table-1. It is evident from the Table that, small and medium farms account for 59 acres and 143 acres of cultivated area respectively. Paddy is the major crop cultivated both by the small and medium farmers with an annual yield of 17q/acre and 20 q/acre respectively. In most of the paddy growing areas, sowing black gram as rice fallow crop is the common traditional practice. The black gram is sown as a relay crop to paddy. Sugar cane and maize crops also occupy a significant area in the selected sample farms. Both small and medium farmers are practicing sericulture enterprise and hence they diverted a portion of their cultivated land towards the cultivation of mulberry crop to an extent of two and nine acres respectively with assured irrigation facilities. The small farmers are maintaining 5030 poultry birds, 228 sheep

and 520 layers of silk worms and medium farmers 103000 poultry birds, 270 sheep and 2200 layers of silk worms in total in their respective production programmes.

Table-1: Area, Production, Yield of major crops and number of units of Allied Enterprises of the sample farmers. (2001-02)

Crop	Small Farmers			Medium Farmers		
	Area (acres)	Production (q)	Yield (q/acres)	Area (acres)	Production (q)	Yield (q/acre)
Paddy	30	510	17	71	1420	20
Sugar cane	15	6750	450	37	17945	485
Maize	12	411840	34320*	26	910000	35000
RFB**	17	34	2.0	41	92.25	2.25
Mulberry	2	1420	710	9	6750	750
TOTAL	**59**	-	-	**143**	-	-
Poultry@	5030	-	-	10300	-	-
Sheep#	228	-		270	-	-
Sericulture$	520	-	-	2200	-	-

Note : * : Cobs/acre, ** : Rice Fallow Black gram, @ : No. of birds, # : No. of Ram lambs, $: No. of layers.

Costs and Returns of major crops cultivated by the sample farmers

The details pertaining to the costs and returns of major crops cultivated by the small and medium farmers are presented in Table-2. It is clear from the Table that the net returns derived from all the selected crops were higher in medium farms when compared to small farms. This was mainly due to higher gross returns from these crops due to adoption of improved management practices by the medium farmers. But the disheartening aspect is that, even in medium farms, no efforts were made by the farmers towards cost reduction practices which otherwise further escalated their net returns. This implies that both the small and medium farmers were not aiming towards cost reduction, which is gaining more and more importance in the light of World Trade Agreement. Hence, the paradigm shift from productivity to profitability should be promoted among the tribal farmers for boosting their net returns.

Table-2: Costs and Returns of major crops cultivated by the sample farmers.

(Small, n=40), (Medium, n=40)

Crops	Cost of Cultivation (Rs/acre)		Gross Returns (Rs/acre)		Net Returns (Rs/acre)		B:C Ratio	
	Small	Medium	Small	Medium	Small	Medium	Small	Medium
Paddy	4160	4580	8480	10725	4320	6145	2.03	2.34
S. Cane	11240	12370	28600	34800	17360	22070	2.54	2.73
Maize	4740	4830	9250	10570	5990	7260	1.95	2.19
RFB*	820	1175	3210	4150	2390	2975	3.91	3.53

Note : * Rice Fallow Black gram

The group discussions held with the selected farmers in the study area revealed that the farmers are spending in excess than what is actually required for meeting the requisite expenses for cultivating the crops. The farmers are not using modern implements and machinery like tractor drawn ploughs, power tillers, seed drills etc., and they are depending mostly on hired cattle and implements. It is also interesting that, the farmers are spending more towards fertilizer application, that too more of urea fertilizer than the recommended levels. Moreover, the employment of excessive hired labour for land preparation, sowings, weedings, pesticides and fertilizer application escalated the cost of cultivation of selected crops (especially for paddy and sugar cane crops). The other disheartening aspect is that the farmers are totally neglecting the seed treatment practice for all the crops which show an adverse impact on crop production. The triangulation of the above observations with the local Agricultural Officers revealed the same picture. But, the interesting aspect is that the farmers in this area are applying pesticides at the recommended levels and they are showing enthusiasm towards the application of herbal pesticides. Hence, the farmers were suggested to reduce the excess expenditure towards land preparation, sowing of crops, fertilizer application, weedings, to employ more of family labour rather than hired labour and use more of organic manures in place of inorganic fertilizers. This is because of gaining

importance to the cost-effectiveness in production of agricultural crops, sustainable agriculture and increase in consumer's preferences to organically produced foods rather than inorganically produced foods.

Benefit cost ratios were worked out to study the profitability of selected crops for every rupee invested by the sample farmers. The study revealed that, both in small and medium farms, these ratios were higher for paddy and rice fallow black gram crops respectively. Hence, paddy followed by black gram is the most profitable cropping pattern if adopted on scientific scale. It is also evident from the results that, by cultivating two crops per year, the benefits can be maximized rather than adopting monoculture with sugar cane.

Farming Systems Approach

The following are the predominant farming systems identified among the sample farmers:

i. Agriculture + Poultry

ii. Agriculture + Sheep rearing

iii. Agriculture + Sericulture

i. Agriculture with Poultry

In this zone, the climatic conditions are quite suitable for poultry enterprise as extreme temperatures do not prevail in this zone. Hence, the farmers are showing much interest in this enterprise as there are good marketing outlets for eggs. The survey was conducted on the sample farmers to assess the costs and returns of a farming system with poultry and the details are shown in Table-3.

The Table-3 reveals that, the average cost of cultivation, gross returns and net returns of both crop enterprises and selected allied enterprise were higher for medium farmers when compared to small farmers. This implies that, the medium farmers are gaining much in raising poultry enterprise when compared to small farmers. The informal discussions held with the sample farmers

Table-3: Costs & Returns (Rs/Acre) of farming system with Poultry (Rs./Acre)

Crop/ Enter-prise	Small (n=17)				Medium (n=20)			
	Area (Acres)	COC	GR	NR	Area (Acres)	COC	GR	NR
Paddy	16	4220	8810	4590	47	4310	11540	7230
S. Cane	6	11790	29720	17930	16	12440	35040	22600
Maize	8	3145	9370	6225	18	3395	10940	7545
RFB	9	895	3015	2120	26	1210	4450	3240
Poultry 1000 birds	-	250760	261606	10846	-	253450	265663	12213

Note : COC : Avg. Cost of Cultivation, GR : Gross Returns, NR : Net Returns
RFB : Rice fallow black gram

revealed that, the improved management practices of the medium farmers, identification of potential buyers both for the crop produce and poultry eggs, timely and adequate loan acquisition and its efficient utilization especially in poultry enterprise etc., were mainly responsible for higher net returns to the medium farmers.

The details pertaining to the profitability of the total farming system and comparison within the system were studied and the details are presented in Table-4. It is clear from the Table, in small and medium farms, a total of 17 and 20 farmers respectively are taking up this allied enterprise in four different farming systems viz., Paddy + RFB + Poultry, Paddy + S. Cane + RFB + Poultry, Paddy + Maize + RFB + Poultry and Maize + Poultry. It is important to note that, both in small and medium farms, **Paddy + S. cane + RFB + Poultry system** showed more net returns/farmer when compared to other systems. It is followed by Paddy + RFB + Poultry, Maize + Poultry and Paddy + Maize + RFB + Poultry in small farms and Paddy + Maize + RFB + Poultry, Maize + Poultry and Paddy + RFB + Poultry in medium farms. Hence, the farmers (5 small and 6 medium) are getting benefited by practicing **Paddy + S. cane + RFB + Poultry system** over other systems. But, the per cent contribution of the poultry enterprise to the annual net

Table-4: Profitability of Farming System with Poultry and Comparison within the System

Farming System	Small Farmers (n= 17)					Medium Farmers (n= 20)				
	Area+No. of Birds	No. of Farmers	TCOC	GR	NR	Area+No. of Birds	No. of Farmers	TCOC	GR	NR
1. Farming System : Paddy + RFB + Poultry										
Paddy	9 Acres		37980.00	79290.00	41310.00	23 Acres		99130.00	265420.00	166290.00
RFB	5 Acres		4475.00	15075.00	10600.00	14 Acres		16940.00	62300.00	45360.00
Poultry	2200 Birds		551672.00	575534.67	23862.67 (31.49)	4700 Birds		1191215.00	1248617.65	57402.65 (21.34)
Total of System 1	9 Acres + 2200 Birds	5	594127.00	669899.67	75772.67	23 Acres + 4700 Birds	7	1307285.00	1576337.65	269052.65
Avg. of System 1 / Farmer /year			118825.40	133979.93	15154.53	Avg.of System 1 / Farmer		186755.00	225191.09	38436.09
2. Farming System : Paddy + S. Cane + RFB + Poultry										
Paddy	3 Acres		12660.00	26430.00	13770.00	11 Acres		47410.00	126940.00	79530.00
S. Cane	6 Acres		70740.00	178320.00	107580.00	16 Acres		199040.00	560640.00	361600.00
RFB	2.5 Acres		2238.00	7538.00	5300.00	7 Acres		8470.00	31150.00	22680.00
Poultry	850 Birds		213146.00	222365.67	9219.67 (6.79)	1600 Birds		405520.00	425061.33	19541.33 (4.04)
Total of System 2	9 Acres + 850 Birds	5	298784.00	434653.67	135869.67	27 Acres + 1600 Birds	6	660440.00	1143791.33	483351.33
Avg. of System 2 / Farmer / year			59756.80	86930.73	27173.93	Avg.of System 2 / Farmer		110073.33	190631.89	80558.56
3. Farming System : Paddy + Maize + RFB + Poultry										
Paddy	4 Acres		16880.00	35240.00	18360.00	13 Acres		56030.00	150020.00	93990.00
Maize	3 Acres		9435.00	28110.00	18675.00	6 Acres		20370.00	65640.00	45270.00
RFB	1.5 Acres		1343.00	4523.00	3180.00	5 Acres		6050.00	22250.00	16200.00
Poultry	755 Birds		189323.80	197513.04	8189.24 (16.92)	1300 Birds		329485.00	345362.33	15877.33 (9.27)
Total of System 3	7 Acres + 755 Birds	4	216981.80	265386.04	48404.24	19 Acres + 1300 Birds	4	411935.00	583272.33	171337.33
Avg. of System 3 / Farmer / year			54245.45	66346.51	12101.06	Avg.of System 3 / Farmer		102983.75	145818.08	42834.33
4. Farming System : Maize + Poultry										
Maize	5 Acres		15725.00	46850.00	31125.00	12 Acres		40740.00	131280.00	90540.00
Poultry	1225 Birds		307181.00	320468.17	13287.17 (29.92)	2700 Birds		684315.00	717290.99	32975.99 (26.69)
Total of System 4	5 Acres + 1225 Birds	3	322906.00	367318.17	44412.17	12 Acres + 2700 Birds	3	725055.00	848570.99	123515.99
Avg. of System 4/ Farmer / year			107635.33	122439.39	14804.06	Avg.of System 4 / Farmer		241685.00	282856.99	41171.99
TOTAL OF THE SYSTEM	30 ACRES + 5030 BIRDS	17	1432798.80	1737257.55	304458.75	81 ACRES + 10300 BIRDS	20	3104715.00	4151972.30	1047257.30
AVG. OF TOTAL SYSTEM/FARMER			84282.28	102191.62	17909.34	AVG.OF TOTAL SYSTEM/FARMER		155235.75	207598.62	52362.87

Note : TCOC : Total Cost of Cultivation, GR : Net Returns, Figures in parenthesis indicate % contribution of poultry enterprise to annual net income in each FS.

income of the farmer was higher in Paddy + RFB + Poultry in small farms (followed by Maize + Poultry, Paddy + Maize + RFB + Poultry and , Paddy + S. Cane + RFB + Poultry) and Maize + Poultry in medium farms (followed by Paddy + RFB + Poultry, Paddy + Maize + RFB + Poultry and Paddy + S. Cane + RFB + Poultry). The informal discussions held with the sample farmers revealed that by raising a single crop (paddy) with a fallow black gram or exclusively maize crop, facilitated the farmers to concentrate more on the allied enterprise. This is very interesting in the sense that, even though the net returns contributed by the **Paddy + S. cane + RFB + Poultry system** was highest over other systems both in small and medium farms, the per cent contribution of the poultry enterprise to annual net returns was lowest in this system in both category of farms. This might be due to less attention on this allied enterprise when compared to the cropping systems by the farmers. The analysis further indicate that, in small farms, in all the identified farming systems, the per cent contribution of the poultry enterprise to annual net returns of the farmers was more when compared to medium farms. This was again because of small sized land holdings, effective supervision of this allied enterprise on par with selected crop enterprises. The farmers are taking up two major crops (paddy and maize, paddy and sugar cane) because of their good knowledge in the crop cultivation aspects and to get over the risk of market price fluctuations especially for paddy crop enterprise in the last 5 years. Majority of the sample farmers (n=37) are practicing this allied enterprise because of the following reasons:

- Existence of timely and specific market outlets
- Easy availability of loans from the Banks for this enterprise as this is relatively more suitable in this zone.
- Greater scope for the export to other states.
- Facilitate the farmer to look after his crop enterprises also efficiently.
- Efficient utilization of poultry dung as manure to the cultivated crops
- Maize grains serve as a source of feed to poultry birds.
- Weather abnormalities and extreme temperatures are not common in this zone.

However, the sample farmers expressed some important constraints in practicing poultry enterprises viz., severe competition in egg marketing due to entry of more number of firms into the market, lack of timely services from the Veterinary department, increased cost of feed to the birds, higher initial establishment costs, frequent disease problems (especially viral diseases) leading to mortality of the birds etc.

Taking the entire system as a whole, a total of 17 small farmers cultivating 30 acres of land with selected crops + rearing 5030 poultry birds and a total of 20 medium farmers cultivating 81 acres with the selected crops and 10300 poultry birds are getting benefited by generating net returns of Rs.3.04 lakhs and Rs.10.47 lakhs respectively. The average annual net income derived by each farmer in the selected categories of farmers was also worked out and it was higher for medium farmers (Rs.0.52 lakhs) when compared to small farmers (Rs.0.18 lakhs), because of large sized land holdings and maintenance of more number of poultry birds.

ii. Agriculture with Sheep rearing

Agriculture with sheep rearing is also a profitable farming system particularly in rainfed areas. As the selected villages are mostly rainfed, this allied enterprise is having lot of significance among the sample farmers. The survey was conducted on the sample farmers to assess the costs and returns, profitability of the system and comparison within the system and the details are shown in Tables-5 and 6.

Table-5 reveals that, the average cost of cultivation, gross returns and net returns of both crop enterprises and selected allied enterprise were higher for medium farmers when compared to small farmers. This implies that, the medium farmers are gaining much in raising sheep enterprise when compared to small farmers. The informal discussions held with the sample farmers revealed that, the improved management practices and efficient marketing of mutton at higher prices were mainly responsible for more net returns to the medium farmers.

Table-5: Costs & Returns of farming system with Sheep (Rs/Acre)

Crop/ Enter-prise	Small (n=12)				Medium (n=11)			
	Area (Acres)	COC	GR	NR	Area (Acres)	COC	GR	NR
Paddy	9	3970	8620	4650	17	4140	10250	6110
S. Cane	7	10350	31650	21300	12	11290	34450	23160
Maize	2	3140	9310	6170	5	3015	9470	6455
RFB	5	790	3025	2235	11	940	3840	2900
Sheep (Rs/yr)	20 ram lamb	40400	66900	26500	20 ram lamb	41620	70640	29020

Note : COC : Avg. Cost of Cultivation, GR : Gross Returns, NR : Net Returns
RFB : Rice fallow black gram

The details pertaining to the profitability of the total farming system and comparison within the system are studied and presented in Table-6. It is clear from the Table that, in small and medium farms, a total of 12 and 11 farmers respectively are taking up this allied enterprise in three different farming systems viz., Paddy + RFB + Sheep, Paddy + S. Cane + RFB + Sheep and Paddy + Maize + RFB + Sheep. It is important to note that, in small farms, **Paddy + RFB + Sheep** system and in medium farms, **Paddy + S. Cane + RFB + Sheep** system gave more net returns/farmer when compared to other systems. It was followed by Paddy + S. Cane + RFB + Sheep and Paddy + Maize + RFB + Sheep in small farms and Paddy + RFB + Sheep and Paddy + Maize + RFB + Sheep in medium farms. The per cent contribution of sheep enterprise to the annual net income of the farmer was highest in Paddy + RFB + Sheep system both in small (82.56%) and medium (66.55%) farms followed by Paddy + Maize + RFB + Sheep and Paddy + S. Cane + RFB + Sheep in both farms. This is interesting in the sense that, even though sheep enterprise contributed more share to the annual net income of the farmer both in small and medium farms in Paddy + RFB + Sheep system, Paddy + S. Cane + RFB + Sheep system contributes more annual net income to the farmers of medium farms. This clearly implies, by practicing the sheep enterprise, there is significant impact on the annual net income of the sample farmers, that too with farmers taking up one major crop. This is because,

Table-6: Profitability of Farming System with Sheep and Comparison within the System

Farming System	Small Farmers (n=12)					Medium Farmers (n=11)				
	Area+No. of Sheep	No. of Farmers	TCOC	GR	NR	Area+No. of Sheep	No. of Farmers	TCOC	GR	NR
1. Farming System : Paddy + RFB + Sheep										
Paddy	5 Acres		19850.00	43100.00	23250.00	11 Acres		45540.00	112750.00	67210.00
RFB	2.5 Acres		1975.00	7563.00	5588.00	7 Acres		6580.00	26880.00	20300.00
Sheep	103 no.		208060.00	344535.00	136475.00 (82.56)	120 no.		249720.00	423840.00	174120.00 (66.55)
Total of System 1	5 Acres + 103 sheep	3	229885.00	395198.00	165313.00	11 Acres + 120 Sheep	4	301840.00	563470.00	261630.00
Avg. of System 1 /Farmer / year			76628.33	131732.67	55104.34	Avg. of System 1/Farmer		75460.00	140867.50	65407.50
2. Farming System : Paddy + S. Cane + RFB + Sheep										
Paddy	3 Acres		11910.00	25860.00	13950.00	3 Acres		12420.00	30750.00	18330.00
S. Cane	7 Acres		72450.00	221550.00	149100.00	12 Acres		135480.00	413400.00	277920.00
RFB	2 Acres		1580.00	6050.00	4470.00	3 Acres		2820.00	11520.00	8700.00
Sheep	90 no.		181800.00	301050.00	119250.00 (41.58)	105 no.		218505.00	370860.00	152355.00 (33.32)
Total of System 2	10 Acres + 90 sheep	6	267740.00	554510.00	286770.00	15 Acres + 105 sheep	4	369225.00	826530.00	457305.00
Avg. of System 2 /Farmer / year			44623.33	92418.33	47795.00	Avg. of System 2 /Farmer		92306.25	206632.50	114326.25
3. Farming System : Paddy + Maize + RFB + Sheep										
Paddy	1 Acre		3970.00	8620.00	4650.00	3 Acres		12420.00	30750.00	18330.00
Maize	2 Acres		6280.00	18620.00	12340.00	5 Acres		15075.00	47350.00	32275.00
RFB	0.5 Acres		395.00	1513.00	1118.00	1 Acres		940.00	3840.00	2900.00
Sheep	35 no.		70700.00	117075.00	46375.00 (71.92	45 no.		93645.00	158940.00	65295.00 (54.96)
Total of System 3	3 Acres + 35 sheep	3	81345.00	145828.00	64483.00	8 Acres + 45 sheep	3	122080.00	240880.00	118800.00
Avg. of System 3 /Farmer / year			27115.00	48609.33	21494.33	Avg. of System 3 /Farmer		40693.33	80293.33	39600.00
TOTAL OF THE SYSTEM	18 ACRES + 228 SHEEP	12	578970.00	1095536.00	516566.00	34 ACRES + 270 SHEEP	11	793145.00	1630880.00	837735.00
AVG. OF TOTAL SYSTEM/FARMER			48247.50	91294.67	43047.17	AVG. OF TOTAL SYSTEM/FARMER		72104.09	148261.82	76157.73

Note : TCOC : Total Cost of Cultivation, GR : Gross Returns, NR : Net Returns, Figures in parenthesis indicate % contribution of sheep enterprise to annual net income in each FS.

the farmers can pay more attention towards this allied enterprise which is not the case when they cultivate more number of crop enterprises in their production programmes. In Paddy + S. Cane + RFB + Sheep and Paddy + Maize + RFB + Sheep systems, the farmers are taking up more crop enterprises because to get over the risk of market price fluctuations especially for paddy crop enterprise in the last 5 years. The analysis further indicate that, in small farms, in all the identified farming systems, the per cent contribution of the sheep enterprise to annual net returns of the farmers was more when compared to medium farms. This is again because of small sized land holdings, effective supervision of this allied enterprise on par with selected crop enterprises.

The informal discussions held with the sample farmers revealed that, there was significant impact by practicing this allied enterprise on their annual net income. This is because there was more income from mutton and many farmers hire the sheep for manuring their fields for reducing costs on inorganic fertilizers. This is especially gaining importance in the present scenario of Indian agriculture as cost effectiveness leads to maximization of profits in the agri-business. Moreover, the availment of loan for this allied enterprise was very easier from the financial institution because of the promising nature of this enterprise in arid climate. However, the farmers expressed some important constraints in sheep rearing viz., lack of proper veterinary facilities, lack of scientific guidance in sheep rearing, lack of proper marketing facilities for sheep wool, high cost of mutton when compared to chicken (hence less demand for mutton) etc.

Taking the entire system as a whole, a total of 12 small farmers cultivating 18 acres of land with selected crops + rearing 228 sheep and a total of 11 medium farmers cultivating 34 acres with the selected crops and 270 sheep were getting benefited by generating net returns of Rs.5.17 lakhs and Rs.8.38 lakhs respectively. The average annual net income derived by each farmer in the selected categories of farms was also worked out and it was higher for medium farms (Rs.0.76 lakhs) when compared to small farms (Rs.0.43 lakhs), because of large sized land holdings and maintenance of more number of sheep.

iii. Agriculture with Sericulture

In this zone, the climatic conditions are quite suitable for sericulture, as sericulture farmers can rear silkworms through out the year. Because of this, some of the medium farmers diverted a portion of their land to grow mulberry for rearing silk worms. The survey was conducted on the sample farmers to assess the costs and returns, profitability of the system and comparison within the system and the details are shown in Tables-7 and 8.

Table-7: Costs & Returns of farming system with Sericulture

(Rs./Acre)

Crop/ Enter-prise	Small (n=11)				Medium (n=9)			
	Area (Acres)	COC	GR	NR	Area (Acres)	COC	GR	NR
Paddy	5	4015	8340	4325	7	4470	9975	5505
S. Cane	2	10745	27620	16875	9	12140	33625	21485
Maize	2	4620	9275	4655	3	4725	10720	5995
RFB	3	795	3140	2345	4	990	3795	2805
Mulberry Sericul-ture*	1 acre + 500 layers	52080	77280	25200	1 acre + 500 layers	54170	81300	27130

Note : COC : Avg. Cost of Cultivation, GR : Gross Returns, NR : Net Returns
RFB : Rice fallow black gram, * : 500 eggs for three rearings.

Table-7 reveals that, the average cost of cultivation, gross returns and net returns of both crop enterprises and selected allied enterprise are higher for medium farmers when compared to small farmers. This implies that, the medium farmers are gaining much in raising sericulture enterprise when compared to small farmers.

The details pertaining to the profitability of the total farming system and comparison within the system are studied and presented in Table-8. It is clear from the table, in small and medium farms, a total of 11 and 9 farmers respectively are taking up this allied enterprise in two different farming systems viz., Paddy + Maize + RFB + (Mulberry & Sericulture) and

Table-8: Profitability of Farming System with Sericulture and Comparison within the System.

Farming System	Small Farmers (n= 11)					Medium Farmers (n=9)				
	Area+No. of layers	No. of Farmers	TCOC	GR	NR	Area+No. of layers	No. of Farmers	TCOC	GR	NR
1. Farming System : Paddy + Maize + RFB + (Mulberry & Sericulture)										
Paddy	5 Acres		20075.00	41700.00	21625.00	7 Acres		31290.00	69825.00	38535.00
Maize	2 Acres		9240.00	18550.00	9310.00	3 Acres		14175.00	32160.00	17985.00
RFB	3 Acres		2385.00	9420.00	7035.00	4 Acres		3960.00	15180.00	11220.00
M + S*	1.5 Acres + 400 layers		38950.00**	67200.00	28250.00 (42.66)	5 Acres + 1300 layers		125070.00	211500.00	86430.00 (56.06)
Total of System 1	8.5 Acres + 400 layers	8	70650.00	136870.00	66220.00	15 Acres + 1300 layers	4	174495.00	328665.00	154170.00
Avg. of System 1 /Farmer / year			8831.25	17108.75	8277.50	Avg.of System 1 /Farmer		43623.75	82166.25	38542.50
2. Farming System : S. Cane + (Mulberry & Sericulture)										
S. Cane	2 Acres		21490.00	55240.00	33750.00	9 Acres		109260.00	302625.00	193365.00
M + S*	0.5 Acres + 120 layers		12740.00	23270.00	10530.00 (23.78)	4 Acres + 900 layers		100120.00	170600.00	70480.00 (26.71)
Total of System 2	2.5 Acres + 120 layers	3	34230.00	78510.00	44280.00	13 Acres + 900 layers	5	209380.00	473225.00	263845.00
Avg. of System 2 /Farmer / year			11410.00	26170.00	14760.00	Avg.of System 2 /Farmer		41876.00	94645.00	52769.00
TOTAL OF THE SYSTEM	11 ACRES + 520 LAYERS	11	104880.00	215380.00	110500.00	28 ACRES + 2200 LAYERS	9	383875.00	801890.00	418015.00
AVG. OF TOTAL SYSTEM/FARMER			9534.55	19580.00	10045.45	AVG. OF TOTAL SYSTEM/FARMER		42652.78	89098.89	46446.11

Note * : M+S - Mulberry + Sericulture, ** On an average for feeding 600 layers, one hectare of mulberry leaves are required.
TCOC : Total Cost of Cultivation, GR : Gross Returns, NR : Net Returns, Figures in parenthesis indicate % contribution of sericulture enterprise to annual net income in each FS.

S. Cane + (Mulberry & Sericulture). It is important to note that, both in small and medium farms, **S. Cane + (Mulberry & Sericulture)** system gave more net returns/farmer when compared to other system viz., Paddy + Maize + RFB + (Mulberry & Sericulture). But, it is interesting to note that, the per cent contribution of sericulture enterprise to the annual net income of the farmer was higher in Paddy + Maize + RFB + (Mulberry & Sericulture) system when compared to other system both in small and medium farms. This might be the reason why more number of sample farmers (n=12) are practicing this system. This further indicates the suitability of the mulberry crop in the cropping programme of the sample farmers. This analysis also indicate that, in medium farms, in both the identified farming systems, the per cent contribution of this allied enterprise to the annual net income of the farmers was more when compared to small farms. This again indicates the proper scientific management of sericulture enterprise by the medium farmers in the study area.

The informal discussions held with the sample farmers revealed that, this allied enterprise, even though, contributing significantly to the net income to the farmer, it is less popular among the farming community of the study area, because of the following reasons:

- Lack of proper guidance from the Sericulture staff due to less and untrained staff.
- Severe competition from neighbouring states, as they are selling good quality silk at lower prices.
- High cost of rearing of silk worms.
- Lack of knowledge regarding pest and disease control mechanisms
- Poor marketing facilities in the study area.
- Less number of reeling units in the study area.
- Poor contacts of the farmers with the exporters of silk to other states.
- Lack of proper market information network.

Taking the entire system as a whole, a total of 11 small farmers cultivating 11 acres of land with selected crops + rearing 520 layers of silk worms and a total of 9 medium farmers cultivating 28 acres with the selected crops and

2200 layers are getting benefited by generating net returns of Rs. 1.11 lakhs and Rs. 4.18 lakhs respectively. The average annual net income derived by each farmer in the selected categories of farms was also worked out and it is higher for medium farms (Rs. 0.46 lakhs) when compared to small farms (Rs. 0.10 lakhs), because of large sized land holdings and scientific management of sericulture.

Contribution of selected allied enterprises to the Farmer's Annual Net Income

The contribution of selected allied enterprises to the annual net income of the sample farmers was studied and the results are presented in Table-9. It is clear from the table that, sheep enterprise (both in small and medium farms) contributed more to the annual net income of the sample farmers followed by sericulture and poultry (both in small and medium farms). The contribution of the sheep enterprise to the annual net income of the sample farmers is more in small farms (58.48 %) when compared to medium farms (46.77 %) and to be more precise, in small farms, the per cent contribution of sheep enterprise to the annual net income of the sample farmers is more even when compared with crop enterprises. Eventhough, the medium farmers are practicing sheep and poultry with improved management practices and with adequate loan amount, the per cent contribution of these enterprises on the annual net income is more on the small farms because it facilitates close supervision on both production and marketing aspects of these enterprises on par with the crop enterprises. In medium farms, besides supervising crop production and marketing aspects, a little attention will be paid towards these allied enterprises. This clearly implies that, by practicing these allied enterprises with more attention, there will be a significant positive impact on the annual net incomes of the sample farmers. Eventhough, sericulture and poultry enterprises showed significant positive impact on the annual net incomes of the sample farmers of both small and medium farms, but their contribution is far less when compared to the crop enterprises grown in both the farming systems. This clearly implies, when compared to sheep, the other two allied enterprises are less influencing on the annual net income of the farmers.

The possible reasons for this are explained earlier under Tables-6 and 8. Eventhough the opportunity costs of the poultry enterprise (ie., returns from the next best alternative enterprises viz., sericulture and sheep) are higher, majority of the farmers are practicing it because of the reasons as explained under Table-4.

Table-9 : Contribution of selected allied enterprises to the Farmer's Annual Net Income

Crop/ Allied Enterprise	Small		Medium	
	Net Returns	% share	Net Returns	% share
Crop	249900	82.08	921460	87.99
Poultry	54558.75	17.92	125797.30	12.01
Total	**304458.75**	**100.00**	**1047257.30**	**100.00**
Crop	214466	41.52	445965	53.23
Sheep	302100	58.48	391770	46.77
Total	**516566**	**100.00**	**837735**	**100.00**
Crop	71720	64.9	261105	62.5
Sericulture	38780	35.1	156910	37.5
Total	**110500**	**100.00**	**418015**	**100.00**

Relative Profitability of the selected Farming Systems

The relative profitability of the selected farming systems both in small and medium farms was studied and the details are presented through Table-10. It is clear from the Table-10 and a close perusal of Table-9 reveals that, the farming system, Agriculture + Sheep was most profitable among the selected farming systems with an annual net returns of Rs.0.43 lakhs / farmer and Rs. 0.76 lakhs / farmer in small and medium farms respectively. This farming system was followed by Agriculture + Poultry and Agriculture + Sericulture both in small and medium farms respectively. However, it is very interesting to note that, in terms of per cent contribution of the selected allied enterprises to the annual net income of the farmer (Table-9), sericulture ranks 2nd after sheep and it was followed by poultry enterprise. This was because of increased market competition due to the entry of more number of poultry firms in the

last 6-7 years in this zone, thereby, adversely affecting the profitability of this allied enterprise. This once again indicates the potentiality of the North Coastal Zone in Andhra Pradesh in taking up sheep as an allied enterprise followed by sericulture and poultry enterprises so as to ensure the sustainability of the small and medium farmers in the agri-business in the context of changing agricultural scenario under World Trade Agreement.

Table-10: Relative Profitability of the selected Farming Systems

Farming System	Small				Medium			
	No. of Farmers	Crop (Acres)	Allied Enterprise	Net Returns (Rs. Lakhs)	No. of Farmers	Crop (Acres)	Allied Enterprise	Net Returns (Rs. Lakhs)
Agril. + Poultry	17	30	5030 Birds	3.04 (0.18)*	20	81	10300 Birds	10.47 (0.52)
Agril. + Sheep	12	18	228 Sheep	5.17 (0.43)	11	34	270 Sheep	8.38 (0.76)
Agril. + Seri-culture	11	11	520 Layers	1.11 (0.10)	9	28	2200 Layers	4.18 (0.46)
TOTAL	**40**	**59**			**40**	**143**		

Note : * : Figures in parenthesis indicate Rs. Lakhs / farmer

Number of man days generated by agriculture and allied enterprise

The number of man days generated by the allied enterprises often indicate the additional period of employment of the farming community in the farm business sector. This also contributed significantly towards the sustainability of the small and medium farmers in the continuation of farm business. Since agriculture is mostly rainfed in NCZ and the farmers possess small sized and fragmented land holdings, practicing of allied enterprises of agriculture often increase and stabilizes their annual net income and generate adequate employment opportunities. Keeping these aspects in view, the number of man days generated by the agri and allied enterprises were studied and the details are presented in Table-11. It is clear from the Table that, the selected

allied enterprises are generating man days for more than half a year. In case of poultry, with at least 500 birds, the farmer could work for 225 days/year. The informal discussions held with the farmers revealed that the work would be more especially during summer season so as to protect the birds from the high temperatures. Moreover, the prevalence of Ranikhet disease make the farmers more cautious towards attending the works. Similarly sheep enterprise generate 245 man days to the farmer from a 20 ram lamb unit. Sericulture enterprise generated 220 man days to the farmer (mulberry and cocoon rearing). A close perusal of the Table-11 further reveals that, the selected enterprises were generating more number of man days to the farmers when compared to the cropping systems alone if followed by them.

Table-11:Number of mandays generated by Agri & allied enterprises/year

S.No.	Crop/Enterprise	Unit	Mandays
1	Paddy	Per acre	70
2	Sugar cane	Per acre	165
3	Maize	Per acre	45
4	RFB*	Per acre	25
5	Poultry	500 birds/year	225
6	Sheep rearing	Per year	245
7	Sericulture (mulberry+cocoon)	Per year	220

Note : * Rice Fallow Black gram

Summary and Conclusions

The major conclusions emerged from the study are as follows:

1. Paddy was the major crop cultivated both by the small and medium farmers. This was followed by fallow blackgram as it is a traditional practice in this zone. The farmers are also cultivating maize and sugar cane in considerable areas as both had good potential in this zone. Both small and medium farmers are practicing sericulture enterprise and hence they diverted a portion of their cultivated land towards the cultivation of mulberry crop with assured irrigation facilities.

2. The net returns derived from all the selected crops was higher in medium farms when compared to small farms. This was mainly due to higher gross returns from these crops due to adoption of improved management practices by medium farmers. However, no efforts were made by the farmers towards cost reduction practices, which is gaining more and more importance in the light of World Trade Agreement. Hence, the paradigm shift from productivity to profitability should be brought about among the farmers for boosting their net returns.

3. Benefit cost ratios were worked out to study the profitability of selected crops for every rupee invested by the sample farmers. The study revealed that, both in small and medium farms, these ratios were higher for paddy and black gram crops respectively. Hence, paddy followed by black gram is the most profitable cropping pattern if adopted on scientific scale.

4. Agriculture with poultry, agriculture with sheep rearing and agriculture with sericulture were the important farming systems identified in the study area. The relative profitability of the selected farming systems both in small and medium farms was studied and it revealed that, the farming system, Agriculture + Sheep was most profitable among the selected farming systems with an annual net returns of Rs.0.43 lakhs / farmer and Rs.0.76 lakhs / farmer in small and medium farms respectively. This farming system was followed by Agriculture + Poultry and Agriculture + Sericulture both in small and medium farms respectively.

5. The contribution of selected allied enterprises to the annual net income of the sample farmers was studied and it revealed that, sheep enterprise (both in small and medium farms) contributed more to the annual net income of the sample farmers followed by sericulture and poultry (both in small and medium farms). The contribution of the sheep enterprise to the annual net income of the sample farmers was more in small farms (58.48 %) when compared to medium farms (46.77 %) and to be more precise, in small farms, the per cent contribution of sheep enterprise to the annual net income of the sample farmers was more even when compared with crop enterprises. Even though, sericulture and poultry

enterprises showed positive impact on the annual net incomes of the sample farmers of both small and medium farms, but their contribution was less when compared to sheep enterprise. This implies, when compared to sheep, the other two allied enterprises were less influencing on the annual net income of the farmers.

6. In terms of number of man days generated by the selected farming systems, the allied enterprises generated man days for more than a year. The highest number is generated by sheep enterprise followed by poultry and sericulture enterprises. The study further revealed that the selected allied enterprises were generating more employment when compared to the cropping systems practiced alone.

7. The relative profitability of the selected farming systems both in small and medium farms was studied and it revealed that, the farming system, Agriculture + Sheep was most profitable among the selected farming systems with an annual net returns of Rs.0.43 lakhs/farmer and Rs.0.76 lakhs/farmer in small and medium farms respectively. This farming system was followed by Agriculture + Poultry and Agriculture + Sericulture both in small and medium farms respectively. However, in terms of per cent contribution of the selected allied enterprises to the annual net income of the farmer, sericulture ranked 2nd after sheep and it was followed by poultry enterprise. This was because of increased market competition due to the entry of more number of poultry firms during the last 6-7 years in this zone, thereby, adversely affecting the profitability of this allied enterprise.

On the whole the study revealed that, paddy followed by black gram is the most profitable cropping pattern if adopted on scientific scale. Regarding farming systems, in terms of the per cent contribution of allied enterprises on the annual net income of the farmer, agriculture with sheep ranks first followed by agriculture with sericulture and agriculture with poultry enterprises. However, it is very interesting to note that, in terms of annual returns/farmer, agriculture + poultry ranks second after agriculture + sheep and it is followed by agriculture + sericulture. The study further revealed that the increased

net returns due to adoption of allied enterprises is significant in all the farming systems. Further, the employment potential of the allied enterprises is relatively high over the cropping systems. Hence, it is suggested that the farmers should take up allied enterprises of agriculture as a farming systems approach for better utilization of farm by-products, stabilizing their annual net income, effective utilization of family labour for longer periods in a year and to reduce the risk in agri-business, thereby paves the way for sustainable agricultural production. This is especially true in case of small and medium farmers of NCZ, as their low scale returns from sub-divided and fragmented land holdings can be increased and sustained through practicing farming systems approach.