

Sustainable Livelihoods at the Courtyard of Tribal Farmers through Poly Cropping (A Case Study)

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Abstract: A sustainable low cost and low external input based polycropping model evolved by tribal farmers under rainfed situation providing solutions to many problems both in agricultural & economic front. The study on poly cropping model adopted by tribal farmers needs a land holding size varies from 0.4 acre to 5 acres. The 5 acres model meet the diversified food requirements of a family of 10 members. The model accommodates diversified crops ranging from Cereals, Millets, Pulses, Oil seeds, Flower crops. A total of 20 crops will be grown under mixed cropping system.

After analysing the Expenditure particulars of 5 acres Model, it is observed that 48.42% of the total expenditure is made on Sowing & harvesting, followed by 24.22% of expenditure on seed procurement, followed 14.52% of expenditure on Land preparation & intercultivation followed by 8.08% on grading & processing followed by 4.03% on Marketing.

The farmers are getting Pulses, Oilseeds, Millets, Cereals, Beans, Crops with medicinal values, Flower crops. 15.15% of total income is derived from Maize, 36% of income getting from Turmeric (18.18%) & Pippallu (18.18%) because most of the produce is marketed in the near by sandies. 13.452% income derived from Pulse crops like Konda kandi (12.12%), Ruppam Minumu (0.484%), Timmiri Kandula (0.848%), 25.33% of income is derived from Beans crops produced in the model i.e. Tella Chikkullu (9.08%), Rajmash (7.272%), Alasana (6.06%), Sriram Chikkullu (2.909%). Millet & Oil seed crops are mostly used for domestic consumption with little marketable surplus, The farmers are getting 5.39% & 1.5% respectively from millets & Oil seed crops.

The data implies that the tribal farmers are getting major food requirements from this poly cropping model and getting additional income from marketable surplus derived from commercial crops like Turmeric, Pippallu, Beans, Pulses and some millet crops.

Apart from the family consumption the model provides a net income of Rs.1,33,000 with a per capita income of Rs.13,300 - each for a family of 10 members and the model provides 640 mandays of gainful employment.

The Mixed vegetable model on 0.4 acres area provides 25 diversified vegetables not only for the family consumption but also steady income for a family of 6 members. The two models provide gainful employment for entire family members right from sowing, intercultivation, harvesting, processing and marketing etc.

After analysing the data collected based on the mixed vegetable model adopted by the Mali community, The farmers are growing 25 types of different vegetables throughout the season. The expenditure particulars of the Model is observed that 21.12% of the total expenditure is made on Marketing, followed by 16.9% of expenditure on plant protection, followed 12.67% each of expenditure is made on Seed beds preparation, transplanting of seedlings & harvesting followed by 8.45% each on field preparation and intercultivation operations followed by 7.04% of expenditure is made for purchase of seeds & seedlings.

After meeting their family requirements the farmers are marketing the vegetables, out of the total income 16.73% each from Tomato & Carrot followed by 10.46% from coriander followed by 8.368% each from Cabbage, Chillies and Potato followed by 6.276% from Brinjal followed by 4.184% each from Cauliflower and Amaranthus followed by 3.138% from Chukkakura and the remaining income is derived from remaining 15 types of vegetables. Around 85% of the total income is derived from 9 vegetable crops (Carrot, Tomato, Coriander, Cabbage, Chillies, Potato, Brinjal, Cauliflower & Amaranthus) out of 25 crops. The remaining crops mostly meeting family vegetable requirements.

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After meeting the family (joint family of 6 members) food requirements, the system provides a net income of Rs. 1,70,000/ annually. The model provides a per capita income of Rs.28,000/- for a family of 6 members and the model provides 840 mandays of gainful employment.

The two model studied were evolved by the tribal farmers to answer many of livelihood problems arised over years and model provides sustainable solution to the problems of the tribal farmers.

Keywords: Polycropping, Polyculture, High Altitude and Tribal zone, Chintapalle, Cropping system, Farming system, Intercropping, Multi storied cropping, Organic farming, Kharif, Rabi, Summer.

INTRODUCTION

Polyculture is agriculture using multiple crops in the same space, providing crop diversity in imitation of the diversity of natural ecosystems, and avoiding large stands of single crops or monoculture. It includes multi-cropping, intercropping, companion planting, beneficial weeds, and alley cropping. It is the raising at the same time and place of more than one species of plant or animal. Polyculture is one of the principles of perm culture.

ADVANTAGES

Polyculture, though it often requires more labor, has two main advantages over monoculture.

Polyculture reduces susceptibility to disease. For example, that planting several varieties of rice in the same field increased yields by 89%, largely because of a dramatic (94%) decrease in the incidence of disease, which made pesticides redundant.

Polyculture increases local biodiversity. This is one example of reconciliation ecology, or accommodating biodiversity within human landscapes. This may also form part of a biological pest control program.

OBJECTIVES

1. To study the economic feasibility of the sustainable models evolved by the tribal farmers.
2. To study the employment potential of the sustainable poly cropping models ad by the adopted by the tribal farmers.

MATERIAL & METHODS

To evaluate the sustainable livelihood models evolved by the tribal farmers. The data collected fro

m the data from the tribal farmers by individual interview method. The data got analyzed using statistical methods like percentage & ranking methods. The analyzed data was interpreted by using py charts.

BACKGROUND

With the inception of National Agricultural Research Project, to develop need based, location specific, problem solving and result oriented technologies, Regional Agricultural Research Station for High Altitude and Tribal area Zone with its lead center located at Chintapalle, Visakhapatnam district as the seventh agro-climatic zone of Andhra Pradesh was established in the year **1985**. It was rendering service to tribal farming community of Eastern Ghats which include 41 mandals belonging to Srikakulam, Vizianagaram, East Godavari, merged mandals from Khammam and Visakhapatnam districts of Andhra Pradesh.

GEOGRAPHICAL FEATURES

The geographical location of the zone is 17°.13' North latitude, 84°.33' East longitude and 1200 mts., above the mean sea level. The zone has Variable landscape ranging from wide plains to rolling, hill ranges covered with dense vegetation and valleys.

The HAT mandals receives 1150 - 1300 mm rainfall annually both from south-west and north-east monsoon. The temperatures range from Min. 4 °C-17 °C to Max. 20 °C-38 °C with a relative humidity varying from 40 - 85%. Soils are deep, medium to heavy ranging from sandy loam to clay loam and are acidic to slightly acidic with a P^H ranging from 5.1 to 6.5 with low available organic carbon content ranging from 0.27 to 0.72 per cent. Further, the soils are low in available nitrogen and

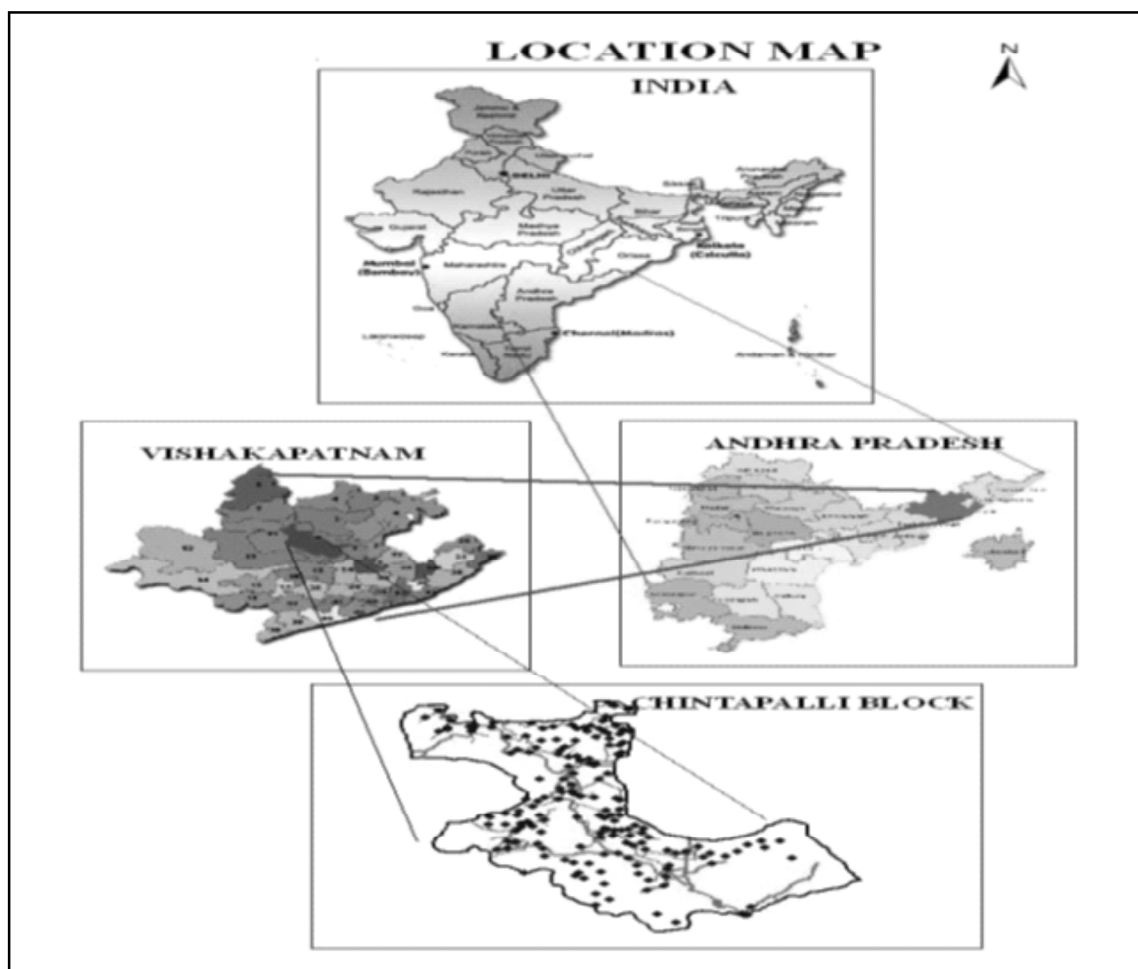


Figure 1

phosphorus, medium to high in available potassium. Among the micronutrients, zinc is the limiting nutrient.

Soils : Red sandy loams (51.58 per cent); red loams with clay base(43.20 percent) and alluvial soils (4.30 per cent)

Land use Pattern : Total geographical area - 17.996 lakh.ha.

Forests - 58.86% , Area sown -19.24%,

Irrigated area - 27.20%

Crops grown:

Kharif : Paddy, Maize, Little Millet, Finger Millet, Turmeric, Ginger, Tuber crops, Pepper and Coffee and Vegetables.

Rabi: Paddy, Niger, Rajmash Beans,Rice bean, Bengalgram, Cole crops and vegetables

ORGANIC AGRICULTURE

- It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony
- It relies on number of farming practices that take full advantage of ecological cycles

ORGANIC FARMING SYSTEMS

- Soil fertility is enhanced by:
Crop Rotation, Intercropping, Poly-culture and Cover crops and mulches
- Pest control is achieved by:
Using appropriate cropping techniques, Biological control & Natural pesticides (mainly extracted from plants)
- Weed control is managed by:
Crop rotation,Time of sowing/ seeding,

Mechanical cultivation, Mulching & Transplanting

➤ **CROPPING AND FARMING SYSTEMS:**

Cropping systems: Rice-wheat, Maize-Chickpea and Rgi-chickpea systems were found suitable and remunerative systems.

Inter cropping: Redgram + Ragi intercropping at 1:4 ratio was more profitable than other systems tried.

Backyard rearing: Back yard rearing of **Vanaraja** birds was found suitable and profitable to the tribal women.

Multi storied cropping systems:

- Silver Oak + Pepper + Cardamom
- Silver Oak + Pepper + Coffee
- Silver Oak + Pepper + Medicinal Plants

Farming systems: Niger + Apiculture

- Poultry cum fish culture and Fish cum paddy
- Silver Oak + Pepper + Cardamom + Apiculture
- Agriculture + Sheep rearing.

Polycropping model adopted by Tribal farmers at HAT Zone, Visakhapatnam. dt: A sustainable low cost and low external input based polycropping model evolved by tribal farmers under rainfed situation providing solutions to many problems both in agriculturally & economically.

The tribal farmers adopt a sustainable model of agriculture which involves family labour, because they adopt joint family system and take up agricultural operations on mutually cooperative basis.

The poly cropping model adopted by tribal farmers needs a land holding size varies from 1/2 acre to 5 acres. The 5 acres model meet the diversified food requirements of a family of 10 members. The model accommodates diversified crops ranging from Cereals, Millets, Pulses, Oil seeds, Flower crops. A total of 20 crops will be grown under mixed cropping system.

The model provides gainful employment for entire family members right from sowing, intercultivation, harvesting, processing and marketing etc.

The farmers are resource poor, remotely placed away from hazles of modern day agriculture. The inputs will be generated insitu and cost affective. The model meets the food and financial requirements of the tribal farming community throughout the year.

Model-1

Name of the farmer: Lochala Dhanunjayudu

Village: Pedabarada

Mandal: Chintapalle

District: Visakhapatnam

Situation : Rainfed situation

Soils: Red sandy loams

Polycropping system adopted: Mixed cropping model No. of crops grown: 20 nos Area: 2 ha

Poly cropping mode 1(5 Acres):

Crops covered under the model:

S.no	Crop group	Crop	Duration
1	Cereals	Maize	April/May to sept/october
2	Millets	Ragi	April/May to sept/october
3		Sama	April/May to sept/october
4		Korra	April/May to sept/october
5		Tella Jonna (Gada jonna)	April/May to sept/october
6	Pulses	Konda kandi	April/May to sept/october
7		Ruppa minumulu	April/May to sept/october
8		Thimira Kandulu	April/May to sept/october
9		Bochu kandulu	Sep/Oct to Dec/January
10	Beans	Thella Chikkullu	Sep/Oct to Dec/January
11		Rajmah chikkullu	Sep/Oct to Dec/January
12		Sri rama chikkullu	April/May to sept/october
13		Alasandalu	April/May to sept/october
14		Tella chikkullu	Sep/Oct to Dec/January
15	Oil seeds	Niger	Sep/Oct to Dec/January
16		Groundnut	Sep/Oct to Dec/January
17		Castor	Sep/Oct to Dec/January
18	Commercial crops	Turmeric	12 months to 24 months
19	Medicinal crops	Pippallu	April/May to sept/october
20	Flower crops	Bhanti	June to October

The mixed cropping system includes companion crops, Border crops, Repellent crops, medicinal crops, Ornamental crops, Commercial crops. The crops will meet the comprehensive dietary needs of tribal farmers very effectively.

The cropping system is suitable for rainfed situation (with standing the vagaries of monsoon). The system is suitable for all existing soils of the zone. The crops grown in the model are suitable for suitable normal rainfall situation, Delayed on set of monsoons and Prolonged dry spell situation. The crops adopted in the model are suitable for early kharif, normal kharif, Late Kharif, Rabi & Summer seasons.

The pest attack in the model was marginal due to adoption of mixed/Poly cropping system with diversity of crops. On the other hand the varieties of various crops adopted in the system are indigenous/ Tradition resistant to many pests & diseases.

Plant protection measures adopted in the model:

Since there is diversified cropping system pest attack was minimum. The farmers adopt spraying of botanical pesticides like decoctions prepared from *Jatropa*, *Pongamia* & *Neem* periodically. Application of ash on leaves is also adopted.

RESULTS & DISCUSSIONS

Economics of the Poly cropping model(2 ha)

A. Cost of cultivation of the model

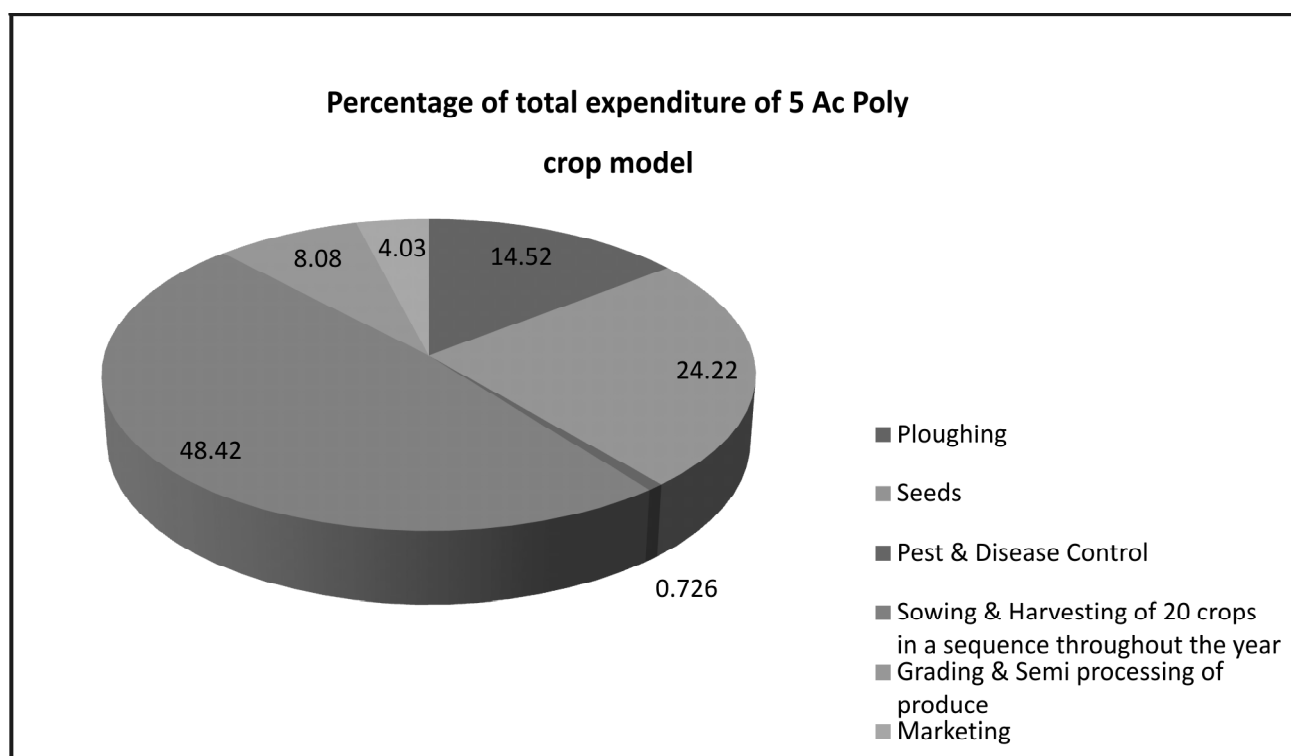
S.no	Practice	Cost(Rs)			% of total expenditure	Rank based on Expenditure
		Family labor	External	Total		
1	Ploughing (three ploughings @Rs.6000/-)	Rs.10,000/-	Rs.8,000/-	Rs.18,000/-	14.52	III
2	Seeds(10 bags @90 kg= 900kgs all mixed seeds)	Rs. 12,000/-	Rs. 18,000/-	Rs. 30,000/-	24.22	II
3	Pest & Disease Control (2 Sprays Botanical Herbal Sprays)2 sprays*@ Rs.450/-	Rs.900/-		Rs.900/-	0.726	VI
4	Sowing & Harvesting of 20 crops in a sequence throughout the year	Rs.40,000/-	Rs.20,000/-	Rs.60000/-	48.42	I
5	Grading & Semi processing of produce	Rs.10,000/-		Rs.10,000/-	8.08	IV
6	Marketing	Rs.5,000/-		Rs.5,000/-	4.03	V
	Total	Rs.77,900/-	Rs.46,000/-	Rs.1,23,900/-	100.00	

Net cost: (Total cost- Family labor) = Rs. 1,23,900- Rs. 77,900= Rs46,000/-

After analysing the Expenditure particulars of the Model is observed that 48.42% of the total expenditure is made on Sowing & harvesting, followed by 24.22% of expenditure on seed procurement, followed 14.52% of expenditure on Land preparation & intercultivation followed by 8.08% on grading & processing followed by 4.03% on Marketing.

Actually the farmers are preserving their own seed and if some seed required they procure from fellow farmer on mutually exchange basis ie. They provide double quantity of seed to the fellow farmer after end of the season.

During preparatory cultivation the farmers of village take up operations on mutually cooperative basis, apart from their family labor.



B. Returns: The income obtained from marketable surplus apart from family consumption.

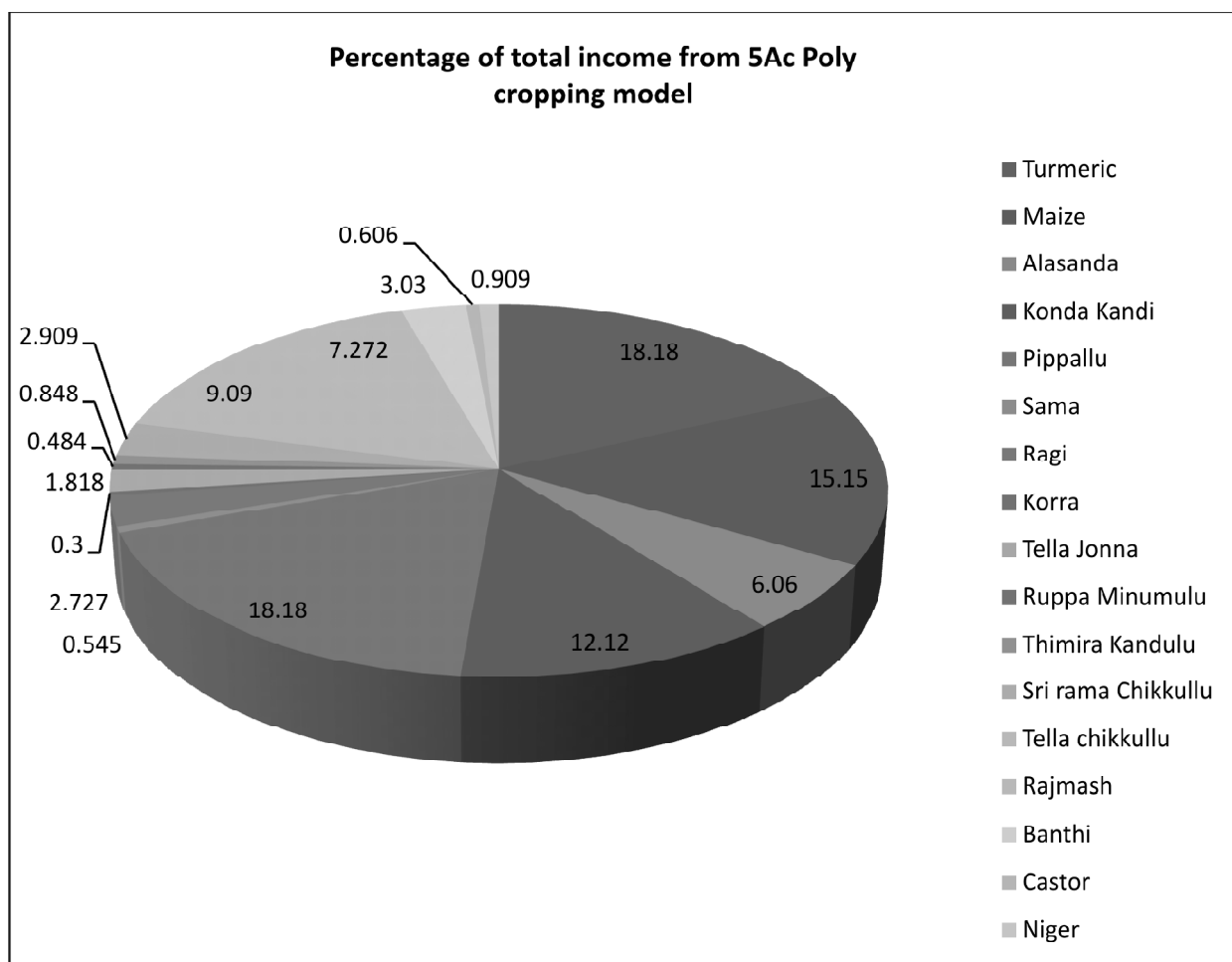
S.no	Crop	Yield	Returns(Rs)	% of total income	Rank based on income
1	Turmeric(1/2acre)	375kg@Rs.80/-	Rs.30,000/-	16.75	I
2	Maize(2 acre)	35 quintals	Rs.25,000/-	13.96	II
3	Groundnut(1/2 acre)	350 kg@Rs.40	14,000	7.82	V
3	Alasanda	40kunchas@250	Rs.10,000/-	5.58	VII
4	Konda Kandi	40 kunchas@200	Rs.20,000/-	11.17	III
5	Pippallu	100 kunchas@300	Rs.30,000/-	16.75	I
6	Sama	30 kunchas@30	Rs.900/-	0.502	XV
7	Ragi	90 kunchas@50	Rs.4,500/-	2.513	X
8	Korra	10 kunchas@50	Rs.500/-	0.279	XVII
9	Tella Jonna	60 kunchas@50	Rs.3,000/-	1.675	XI
10	Ruppa Minumulu	10 kunchas@80	Rs.800/-	0.446	XVI
11	Thimira Kandulu	20 kunchas@70	Rs.1,400/-	0.782	XIII
12	Sri rama Chikkullu	60 kunchas@250	Rs.4,800/-	2.681	IX
13	Tella chikkullu	60 kunchas@250	Rs.15,000/-	8.379	IV
14	Rajmash	60 kunchas@200	Rs.12,000/-	6.70	VI
15	Banathi		Rs.5,000/-	2.79	VIII
16	Castor	25 kunchas@40	Rs.1,000/-	0.558	XIV
17	Niger	15 kunchas@100	Rs.1,500/-	0.837	XII
	Gross income		Rs.1,79,000	100	
	Total cost of external labor		Rs.46,000/-		
	Net income		Rs.1,33,000/-		
	1 Kuncha = 4 kgs				

The farmers are getting Pulses, Oilseeds, Millets, Cereals, Beans, Crops with medicinal values, Flower crops. 15.15% total income is derived from Maize, 36% of income getting from Turmeric (18.18%) & Pippallu (18.18%) because most of the produce is marketed in the near by sandies. 13.452% income derived from Pulse crops like Konda kandi (12.12%), Ruppa Minumu (0.484%), Timmiri Kandula (0.848%), 25.33% of income is derived from Beans crops produced in the model ie. Tella Chikkullu (9.08%, Rajmash (7.272%), Alasanda (6.06%), Sriram Chikkullu (2.909%). Millet & Oil seed crops are mostly used for domestic consumption with little marketable surplus, The

farmers are 5.39% & 1.5% respectively from millets & Oil seed crops.

The data implies that the tribal farmers are getting major food requirements from the poly cropping model and getting additional income from marketable surplus derived from commercial crops like Turmeric, Pippallu, Beans, Pulses and some millet crops.

- ❖ Per capita income (for a family of 10 members): Rs.13,300/-
- ❖ No. of mandays of work generated@200/day: 640 man days



After meeting the family (Joint family of 10 members) food requirements, the system provides a net income of Rs. 1,33,000/ annually. Monthly Rs. 13,300/- to meet other expenses of the family. For a tribal family placed remotely the amount optimum for other expenses.

Model - II: Sustainable Livelihood generation through Mixed Vegetable cultivation among Mali tribes of Visakhapatnam

Name of the farmer: Killo Thrimurthulu

Village: Choudupalle

Mandal: Chintapalle

District: Visakhapatnam

Situation: Perinial streams

Soils: Sandy loams

Polycropping system adopted:

Mixed Vegetable cultivation

No. of vegetable crops grown: 25 nos

Area: 40cents(0.16ha)

Vegetable crops grown under the model

S.no	Crop group	Crop	Duration
1	Vegetables	Ginger	Kharif(June - Aug)
2		Beans	
3		Maize	
4	Colecrops	Cabbage	Rabi(Sept - February)
5		Cauliflower	
6	Roots	Carrot	
7		Beatroot	
8	Vegetables	Brinjal	
9		Chillies	
10		Bhendi	
11	Creapers	Cucurbit	
12	Gourds	Bottle goud	
13		Pumpkin	
14	Bulbs	Onion	
15		Cloves	
16	Leafy Vegetables	Coriander	
17		Amaranthus	
18		Palak	
19		Gongura	
20		Chukka kura	Summer(March- May)
21	Vegetables	Tomato	
22	Tubers	Sweet potato	
23		Potato	
24	Gourds	Ridge gourd	
25		Bittergourd	

Combination of crops grown

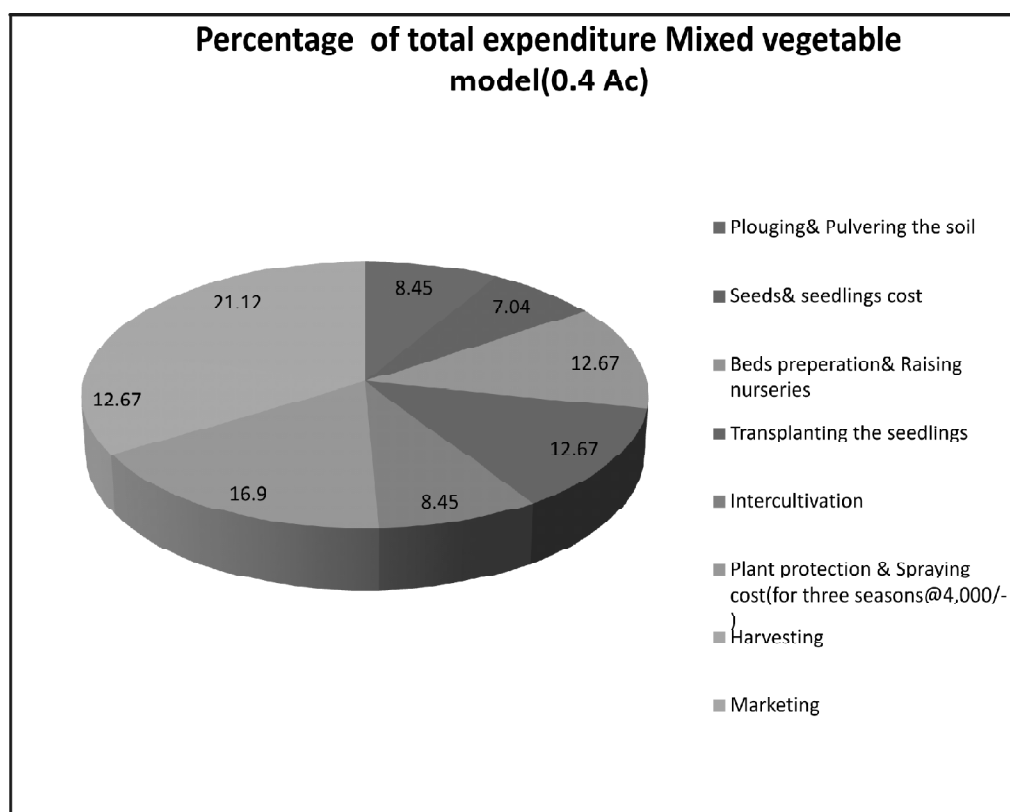
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|----|---|----|--|
| 1. | Cabbage intercropped with Maize, Beat root, Amaranthus, Coriander in 10 cents | 4. | Ginger - Beans, Maize |
| 2. | Cauliflower intercropped with beet root, Chillies and Brinjal. | 5. | Sweet potato - Potato |
| 3. | Carrot - Coriander | 6. | Tomato- Coriander, Amaranthus. |
| | | 7. | Creaping of Bitter gourd & Ridge gourd on Chillicrop at flag end of chilly season. |

RESULTS & DISCUSSION

Economics of the Poly cropping model(0.4 acre)

A .Cost of cultivation of the model

S.no	Practice	Cost (Rs)			% of total expenditure	Rank based on Expenditure
		Family labor	External	Total		
1	Plouging& Pulvering the soil (three ploughings @Rs./2000)	Rs.6,000/-		Rs.6,000/-	8.45	IV
2	Seeds& seedlings cost		Rs.5,000	Rs.5,000/-	7.04	V
3	Beds preperation& Raising nurseries(during three seasons@3,000/-)	Rs. 9,000/-		Rs. 9,000/-	12.67	III
4	Transplanting the seedlings (for three seasons@3,000/-)	Rs.9,000/-		Rs.9,000/-	12.67	III
5	Intercultivation (for three seasons @2,000/-)	Rs.6,000/-		Rs.6,000/-	8.45	IV
6	Plant protection & Spraying cost (for three seasons@4,000/-)	Rs.6,000/-	Rs.6,000/-	Rs.12,000/-	16.90	II
7	Harvesting (for three seasons@3,000/-)	Rs.9,000/-		Rs.9,000/-	12.67	III
8	Marketing (2 men *30 times/ annum	Rs.15,000/-		Rs.15,000/-	21.12	I
	Total	Rs.60,000/-	Rs.11,000/-	Rs.71,000/-	100	



After analysing the Expenditure particulars of the Model is observed that 21.12% of the total expenditure is made on Marketing, followed by 16.9% of expenditure on plant protection, followed 12.67% each of expenditure is made on Seed beds preparation, transplanting of seedlings & harvesting followed by 8.45% each on on field preperation and

intercultivation operations followed by 7.04% of expenditure is made for purchase of seeds & seedlings.

B. Returns: The income obtained from marketable surplus of vegetables apart from family consumption.

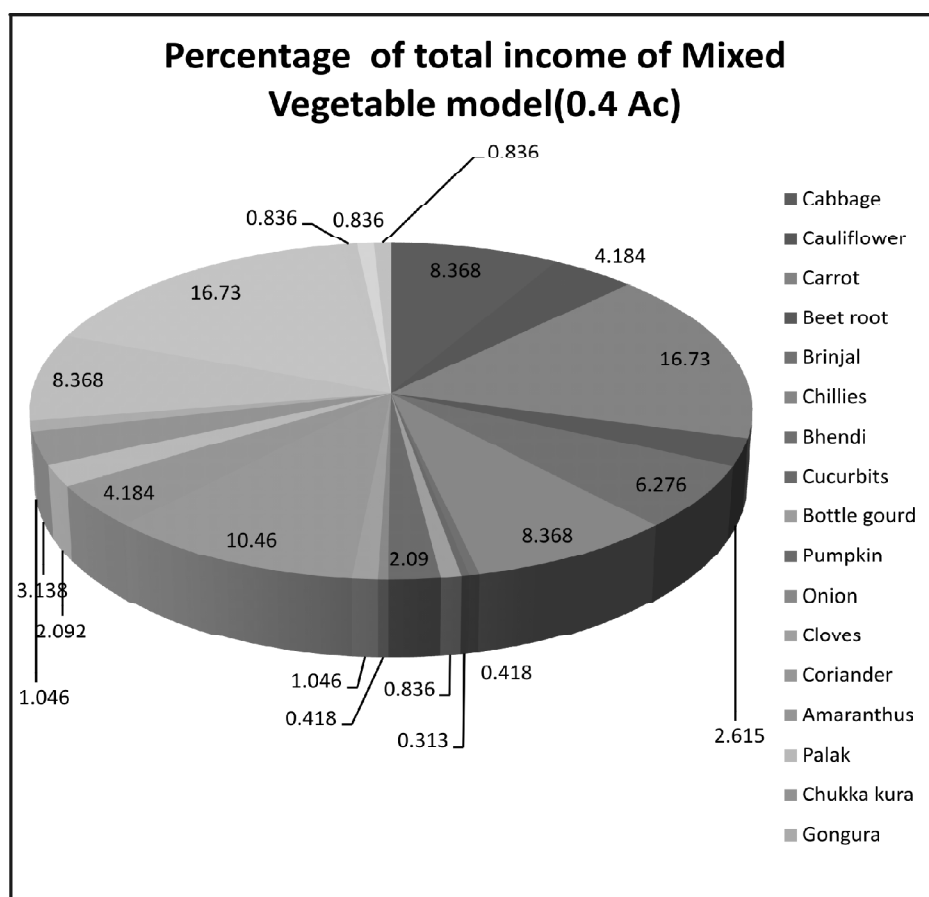
S.no	Crop	Yield (Kgs)	Rate (Rs)	Returns (Rs)	% of total income	Rank based on income
1	Cabbage	2000	10	20000	8.368	III
2	Cauliflower	1000	10	10000	4.184	V
3	Carrot	2000	20	40000	16.73	I
4	Beet root	125	50	6250	2.615	VII
5	Brinjal	1500	10	15000	6.276	IV
6	Chillies	1000	20	20000	8.368	III
7	Bhendi	50	20	1000	0.418	XI
8	Cucurbits	150	5	750	0.313	XII
9	Bottle gourd	100	20	2000	0.836	X
10	Pumpkin	500	10	5000	2.092	VIII
11	Onion	50	20	1000	0.418	XI
12	Cloves	50	50	2500	1.046	IX
13	Coriander	500	50	25000	10.46	II
14	Amaranthus	1000	10	10000	4.184	V
15	Palak	500	10	5000	2.092	VIII
16	Chukka kura	500	15	7500	3.138	VI
17	Gongura	500	5	2500	1.046	IX
18	Potao	2000	10	20000	8.368	III
19	Tomato	2000	20	40000	16.73	I
20	Ridge gourd	100	20	2000	0.836	X
21	Bitter gourd	100	20	2000	0.836	X
22	Beans	100	20	2000	0.836	X
	Gross income			2,39,000	100	
	Total cost			71,000		
	Net income			1,68,000		

❖ Per capita income (for a family of 6 members): Rs.28,000/-

❖ No. Of mandays of work generated@Rs.200/day: 840 man days

After analysing the data collected based on the mixed vegetable model adopted by the Mali community, The farmers are growing 25 types of different vegetables throughout the year. After meeting their family requirements the farmers are marketing the vegetables as mentioned above. Out of the total income 16.73% each from Tomato & Carrot followed by 10.46% from coriander followed

by 8.368% each from Cabbage, Chillies and Potato followed by 6.276% from Brinjal followed by 4.184% each from Cauliflower and Amaranthus followed by 3.138% from Chukka kura followed by 2.615% from Beet root followed by 2.09% each from Pumpkin & Palak followed by 1.046% from Cloves and Gongura followed by 0,836% of income each from Bottle gourd, Ridge gourd & Beans followed



by 0.418% from Bhendi & Onion followed by 0.313% from Cucurbits.

Around 85% of the total income is derived from 9 vegetable crops (Carrot, Tomato, Coriander, Cabbage, Chillies, Potato, Brinjal, Cauliflower & Amaranthus) out of 22 crops. The remaining crops mostly meeting family vegetable requirements.

A net income of Rs.1,70,000/- getting from mixed vegetable model grown in an area of 0.16ha supports a family with 6 members throughout year. The farmers are growing major food grains like paddy, Millets, Pulses and oil seeds in an additional area of 0.2 ha to meet all the dietary needs of the family. The other expenses of the family is met from net income derived from mixed vegetable model. This is providing a sustainable livelihood for the tribal farmers.

CONCLUSION

The Poly crop model I with mixed crop cultivation in 2 ha of area Apart meeting the family

consumption the model provides a net income of Rs.1,20,000 and a per capita income of Rs. 13,300/- each for a family of 10 members and the model provides 640 mandays of gainful employment.

The Poly crop model II with mixed vegetable cultivation in 0.16 ha of area, after meeting the family (Joint family of 6 members) food requirements, the system provides a net income of Rs. 1,70,000/- annually. Apart from the family consumption the model provides a per capita income of Rs.28,000/- for a family of 6 members and the model provides 840 mandays of gainful employment.

The tribal families happily placed in the midst of nature have evolved a cropping system (Poly cropping system), Which not only provides a subsistence income, Gainful employment without disturbing the natural eco system. The system never demands high value external inputs and expertise.

The two model studied were evolved by the tribal farmers to answer many of livelihood problems arised over years and model provides sustainable solution to the problems of the tribal farmers.

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