Research Paper

EPRA International Journal of Economic and Business Review-Peer Reviewed Journal
Volume - 11, Issue - 7, July 2023 | e-ISSN: 2347 - 9671| p- ISSN: 2349 – 0187

SJIF Impact Factor (2023): 8.55 || ISI Value: 1.433 || Journal DOI URL: https://doi.org/10.36713/epra2012

PRODUCTION SYSTEMS IN DRYLANDS OF JATH TEHSIL OF SANGLI DISTRICT

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ABSTRACT DOI No: 10.36713/epra13735 Article DOI: https://doi.org/10.36713/epra13735

There are several possibilities for increasing the income of farmers. There are different strategies of crop productions for different states/regions and they are location-specific. The performance of agriculture sector depends on rainfall, climate change, resource scarcity, changing demand pattern of food and agriculture products and many more uncertainties. Particularly, Jath tehsil is a drought-prone tehsil and it has almost all area as dryland area. The farmers in this area choose to an effective risk-coping strategy of farming, because they are not aware of the risks faced and they are unable to manage them effectively. So, they adopt subsistence farming strategy.

KEY WORDS: ***production, drought-prone area, dryland, risk-coping, livelihood, diversification, climate***

I) INTRODUCTION

The livelihood security is associated with diversification strategy. The livelihood diversification is related with household coping strategy, non-farm activities, rural-urban migration and rural poverty[1] **(**Ellis F., 1998**).** The diversification in drylands depends on multiple factors. The past trend of dryland inhabitants was different in terms of diversification of farm products i.e. various crops, by-products, livestock and employment as land labors. Now, the production system is totally changed giving a new face of diversification in the system. These changes are in the areas production systems in drylands. The inhabitants suffer from droughts and erosion, torrential rains of short duration that flood crops and increase the incidence of pests, along with food insecurity and the effects of degradation due to overexploitation of communal resources.[2] (Ulrich A.; Ifejika Speranza C.; Roden P.; Kiteme B.; Wiesmann U.; Nüsser M., 2012). Many systems have developed in diversification; such as subsistence systems, commercial systems, off-farm income systems, and, so on. So, the production systems are a result of multiple combinations of strategies and decisions.

This paper examines the productive systems in the dryland region of Jath tehsil in Sangli district. The production system topology was developed with insights derived from the livelihood diversification literature to demonstrate the dryland diversification of study area (Jath tehsil).

II) REVEW OF LITERATURE

Benjamín Figueroa-Sandoval, Martín A. Coronado-Minjarez, Eduviges J. García-Herrera, Artemio Ramírez-López, Dora M. Sangerman-Jarquín, and Katia A. Figueroa-Rodríguez (2019) [3] have written in their article that - Drylands have been characterized as

marginalized areas with high levels of poverty using various farming strategies. There were many production systems in the region, which were grouped as: Subsistence, commercial and off-farm income systems. The studies indicate the presence of these three types of production systems in India. The study found that 70% of the farms in dryland farming systems were small and extensive and 20% were irrigation based and intensive, the rest were off-farm based and irrigation based semi-intensive. K J S Satyasai, Nirupam Mehrotra (2015)[4], in their Research paper, 'Enhancing Farmers' Income' said that - There are several farming practices for increasing the income of farmers. Some of them may have realized over the years depending on the process involved. There are different strategies in different states/regions and the clientele groups. For the development of agriculture location-specific strategies should be applied to district or agro-climatic zone level. Mazibuko N.V.E. and Antwi M.A, (2019) [5] The Small farmers do not have a strong education background. Majority of them have no formal education. They are not capable of adapting to new farming processes, innovations and agricultural infrastructure. This is worrisome factor in the way of progressive development in agriculture. Small farmers behave as self-labour in their farming activities. This is, again, a worrisome factor in the progressive development of agriculture. Isaac Gershon Kodwo Ansah, Cornelis Gardebroek & Rico Ihle (2021)[6] said in their article that - The coping strategy chosen depends on four specific shocks - climate, pest, health and price which interact. In the studies conducted it was found that climate-health, climate-pest, climate-price and pest-health shock were interrelated. They were to be the main reasons for asset depletion. I Putu Irvan and Ni Nyoman Yuliarmi (2019)[7] said in their article that - The government should conduct the responsibility of socialization and supervision of farmers regarding land management and cultivation techniques. Organic farming practices may be promoted so that soil fertility is maintained. Farmers' groups should be formed in order to maintain the proper sale value of crops; and they should be participated in the markets. The government should provide infrastructure for farmers in the dryland areas. Sabine U. O'Hara (1997)[8] said in his article that - In narrow way, the sustaining production consists of intergenerational welfare, maintaining productivity, maintaining capital stocks including natural stocks and resilience of economic systems. In broader way, the sustaining production implies production which sustains the social and biophysical context within which it takes place, and it is sustainable in the long term. Sukhdev Singh Sandhu and Jasdeep Singh Toor (20220[9] wrote in their article that - The Government should implement the appropriate policies to increase the level of income of farmers in dryland areas. There is a strong need to establish agro-based industries in rural areas, so that it can provide jobs to youths and enhance productivity. The proper implementation of MGNREGA would be undertaken to help overcome the problems of agricultural laborer households. Report of the Committee on Doubling Farmers' Income, Volume V (2017)[10], Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare stated that–The successful production of rainfed crops largely depends on how efficiently the surplus runoff is harvested, stored and recycled for supplemental irrigation. Storage of water in the soil and in natural or man-made structures are important aspects of water conservation. Therefore, there is a great potential for integrated management of surface and ground-water supplies. The integrated management can be done with adaptation of drip/micro-irrigation, rainwater harvesting, groundwater recharge, and water-saving techniques. Ramilan T.,Kumar S., Haileslassie A., Craufurd P., Scrimgeour F, Kattarkandi B. and Whitbread, A.(2022) [11] stated that - Rainfed marginal type farming system with higher levels of inter-cropping, drought-tolerant cropping, and a higher percent of legumes has been seen in dryland areas. Agronomic adaptation strategy is developed by growing drought-tolerant varieties. There is the lowest resilience capacity in rainfed marginal livelihood attributed to smaller landholding and non-availability of irrigation water. K. V. Praveen, A. Suresh, A. A. Reddy and D. R. Singh (2018)[12] stated that - There are different strategies for risk management. The farmers in drylands adopt risk coping strategies against the shock. The farmers prefer to adopt strategies like mixed farming, multiple cropping, varietal diversification and others as adaptation mechanism. These strategies are largely practiced by the farmers in dryland areas.

III) PROFILE OF STUDY AREA

Profile[13] of JATH: The study area of *Jath* tehsil in Sangli district is a drought-prone area. This tehsil has major portion of drylands and limited natural resources. Agriculture is the main activity of Jath tehsil.

Table No. 1 Salient Features of JATH Block:

Block Name	**Jath**
Geographical Area (Sq. Km.)	2247.61
Location	17°3′N, 75°13′E
Hilly Area (Sq. Km)	0
Drought Area (Sq. Km)	2247.61 (100%)
Population (2011)	328324
Male Population	168256 (51.25%)
Female Population	160068 (48.75%)
Literacy Rate	61.17 %
Climate	Monsoon Tropical/ Sunny
Density	146.6 / KM^2
Villages	125
Houses	64007.
Famous Places in Tehsil	Yalamma Temple,Ambabai Mandir, Daridev Mandir, Shanane Sri. Danamma Devi Mandir,Guddapur
Railway Route	Jath road Railway station Walekhindi
Rainfall Analysis:	
Normal Rainfall	558.7 mm
Annual Rainfall (2017)	519.3 mm
Geomorphology, Soil & Geology	
Geomorphic Unit	Plateau undissected to highly Dissected, with weathered thickness ranging from 0 to 2 m.
Soil	Medium black soil, Red Sandy soils and Shallow black soils.
Hydrology	Deccan Traps (Basalt), Age: Late Cretaceous to Eocene.
Land Use, Agriculture, Irrigation & Cropping Pattern:	
Forest Area (Sq. Km.)	113.05
Cultivable Area (Sq. Km.)	1040.36
Net Sown Area (Sq. Km.)	1881.80
Water Resources:	
Ground Water	118.51 Sq, Km
Area under Drip & Sprinkler	34.66 Sq, Km
Irrigation Status (%)	34739 ha (25.85%)
Principal Crops cultivated	Crop Types
	Jowar, Bajra, Maize, Tur, Mung, Gram Harbhara, Sugarcane, onion, Grapes, Cotton, Ground nuts, others

Sources: 1. Hydrological Report for Sangli, Y-2019-20.
2. Report 2018 on Maps and Ground Water Management Plan, Nagpur, by Catherine Luis & J. R. Varma

TRENDS IN AGRICULTURE: There are four agriculture strategies – 1. No agriculture production, 2. Monoculture production, 3. Mixed production, and 4. Polyculture production. First strategy is farming

without having own land. i.e. land- laboring. Such type of agriculture consists of poor farmers and landless labors. They have marginal source of income. Second strategy consists of such farmers having their own land that they cultivate only one crop. The marginal and small farmers come in this category. Third strategy is mixed production system which consists of cultivating two or more crops in a single field. Such type of farming is done by medium and big farmers. The fourth strategy is polyculture production which consists of more than three crops grown by farmers along with livestock. They are, generally, medium and big farmers.

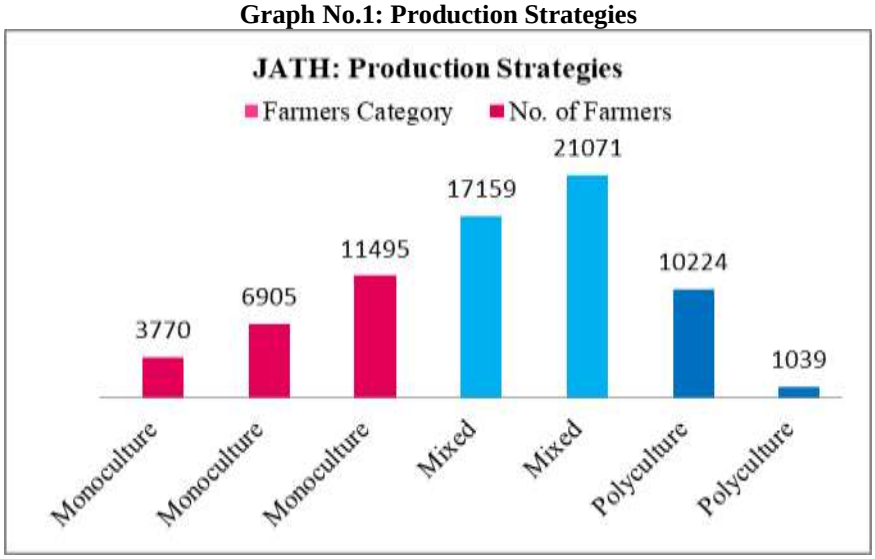
There are hardly any data that can give farmers' income estimates. The income earned by farmers net of input cost has seen low and high growth paths in different periods. The growth in farm income requires favourable farm produce prices. Low growth of farm income seems to have been associated with distress. Many farm households adopt high-income earning avenues and tend to generate income from non-farm activities.

Table No. 2 Landholdings of Farmers in Jath Tehsil:

S. No.	Farmers' Category	Jath Tehsils				
		No. of Farmers		Landholding (ha)		Production Strategy
		No.	%	Ha.	%	
1	Landless: < 0.01 ha	3770	5.26	340	0.20	Monoculture
2	Lower Marginal:0.01-0.4 h	6905	9.64	4425	2.59	Monoculture
3	Upper Marginal:0.01-0.4 h	11495	16.04	9350	5.48	Monoculture
4	Small: 1.00 - 2.00 ha	17159	23.94	22370	13.11	Mixed
5	Semi-Medium: 2.0-4.00 ha	21071	29.40	56855	33.32	Mixed
6	Medium: 4.00- 10.00 ha	10224	14.27	60265	35.32	Mixed, polyculture
7	Large: Above 10.00 ha	1039	1.45	17030	9.98	Mixed, polyculture
*	Total	71663	100.00	170635	100.00	

Source: Profile of Sangli district (Tehsil-wise)

Graph No.1: Production Strategies



IV) RESEARCH METHODOLOGY

This study aims to provide evidence of the livelihood diversification in study area and supports to explore the socio-economic lives of the farmers in Jath tehsil. The following are the specific objectives of this study:

1. To study the topology of agriculture production systems in dryland areas.
2. To study the basic characteristics of the production units i.e. land area, types of crops, livestock, irrigation status, farm income and non-farm income.

3. To determine the socio-economic factors, i. e. family size, number of members, active members, age, education, employment, etc.
4. To provide baseline for farmers to turn to adaptive production strategies in the study area.

HYPOTHESIS

1. The Per Capita Income of the farmers in the study area is lower.
2. Jath tehsil is drought-prone area having limited resources, low rainfall, adverse climatic conditions, and lower rate of productivity.

Selection of Study Area

The study was conducted with rural farmers in JATH block in Sangli district. Jath tehsil has total 125 villages. Out of these villages, 10 villages were selected for sample study.

Sampling: 10 farmers from each village were interviewed for sampling. Thus, a study of 100 farmers was completed in few days. Farmers were randomly selected.

Table No.3 LIST OF SAMPLE CASES IN JATH TEHSIL

S. No.	Name of the Village	Population	Selected Sample Cases	Landless	Lower Marginal	Upper Marginal	Small	Semi-Medium	Medium	Big / Large
	Tehsil: JATH		**100**	**16**	**16**	**16**	**15**	**15**	**12**	**10**
1.	Banali		10	2	2	2	2	2	1	1
2.	Shegaon		10	1	1	1	1	1	1	1
3.	Kanti		10	2	2	2	1	1	1	1
4.	Khalati		10	1	1	1	1	1	1	1
5.	Dorli		10	1	1	1	1	1	1	1
6.	Kumbhari		10	2	2	2	2	2	2	1
7.	Kosari		10	2	2	2	2	2	2	1
8.	Anakle		10	1	1	1	1	1	1	1
9.	Birnal		10	2	2	2	2	2	1	1
10.	Ekondi		10	2	2	2	2	2	1	1

Source: Field Survey, 2023

Data Collection: The data was collected through direct interviews with farmers. The assistance of the local government was taken at village level. Involvement of participants was first based on personal willingness to discuss the topics, leading to recommendations by participants (snowballing), and the establishment of working relationships with the researcher. Interviews were conducted informally and guided by prepared questions.

V) RESULTS AND DISCUSSION

VARIABLE FACTORS OF PRODUCTION SYSTEMS

Factors of Production units: These factors consist of land area, types of crops, irrigation, size of livestock, off-farm income, and others.

Socio-economic Factors: These factors consist of variables relating to farmer households. They are gender, age, family size, active members, education, and others.

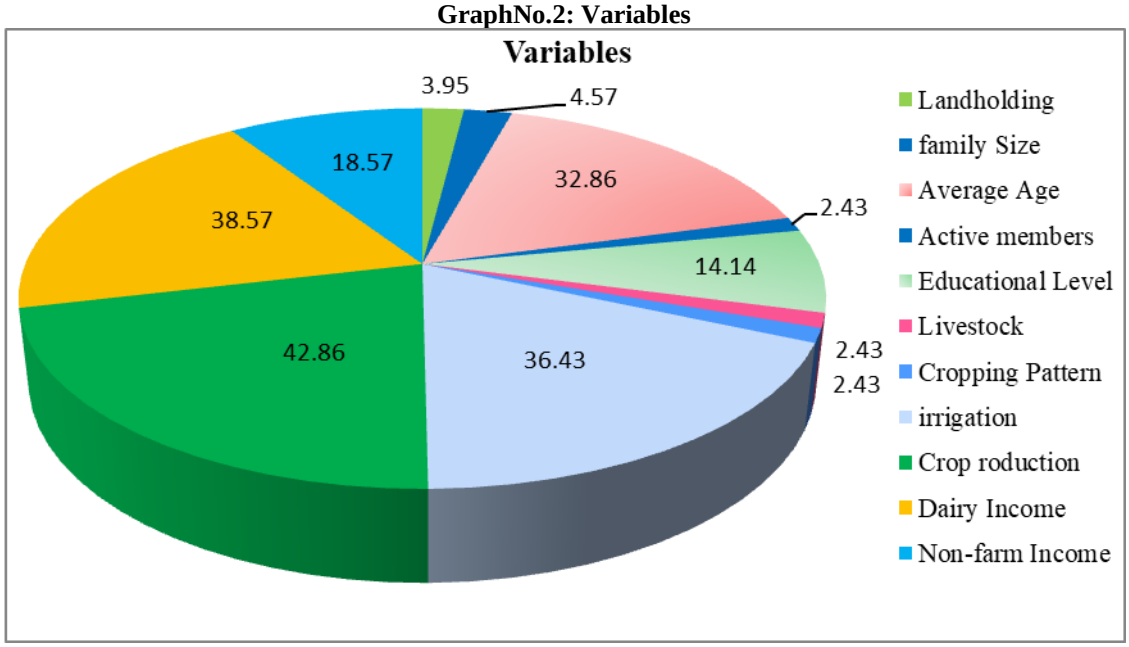
There are many methodologies that can create production system topologies. Generally, many factors are considered to understand the production systems in the dryland regions. Accordingly, the production factors and socio-economic factors are taken into consideration in production systems adopted by farmers in this area. The analysis was performed using seven categories of farmers, i.e. Landless, lower marginal farmers, upper marginal farmers, small farmers, semi-medium farmers, medium farmers and big farmers.

Table No. 4 Descriptive Statistics of Variables by Categories:

Particulars	Landless	Lower Marginal	Upper Marginal	Small Farmers	Semi-Medium	Medium Farmers	Big Farmers
No. of Farmers	16	16	16	15	15	12	10
Landholding/farmer	0.01	0.37	0.96	1.33	2.70	5.89	16.39
Family Size	5	5	4	5	5	4	4
Average Age	30	31	32	35	34	33	35
Active Members	3	2	2	2	3	3	2
Education level	10	12	14	15	15	16	17
Livestock size	2	2	2	2	2	3	4
Cropping pattern	1	1	1	2	3	4	5
Irrigation %	0	10	20	20	40	75	90
Crop Production %	30	30	50	50	50	50	40
Dairy Income %	60	60	40	30	30	25	25
Non-Farm Income %	10	10	10	20	20	25	35

Source: Field Survey, 2023. (* Total number of farmers)

GraphNo.2: Variables



DIVESRIFICATION OF THE PRODUCTION SYSTEMS

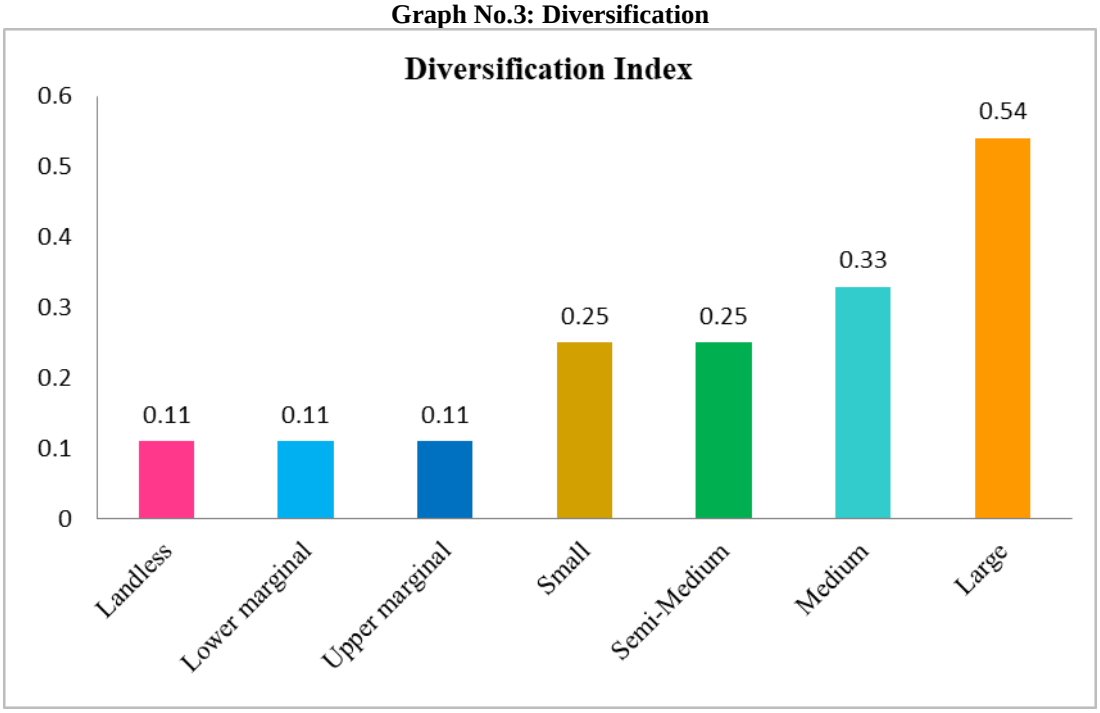
The number of production units (farmer households) ranged from 10 to 16 in sample cases. They were grouped in to seven categories – landless, lower marginal, upper marginal, small farmers, semi-medium, medium farmers and big farmers. The category of all marginal farmers is categorized as the most intensive agriculture production system having small size of land and livestock. Their percentage is 45.45% to the total farmers in Jath tehsil. Category 4 consists of small farmers. Category 5 and 6 consists of medium farmers; as well as big farmers are counted to 16.39 at 1.45%. Big farmers are characterised by large quantum of land and owing farm machineries. They presented the high level of non-farm income.

Table No.5 DIVERSIFICATION OF INCOME SOURCES

S. No.	Category of Farmers	Cultivation Income	Livestock Income	Business Income	Salary/ wages	Total Income %	Index of Diversification
1	Landless	30	60	0	10	100	0.11
2	Lower Marginal	30	60	0	10	100	0.11
3	Upper Marginal	50	40	0	10	100	0.11
4	Small	50	30	0	20	100	0.25
5	Semi-Medium	50	30	0	20	100	0.25
6	Medium	50	25	10	15	100	0.33
7	Large	40	25	15	20	100	0.54
	All categories						0.24

Source: Field Survey, 2023

Graph No.3: Diversification



Index

There are many conclusions regarding incomes of farmers. In respect of the marginal farmers, the major income of 90% comes from agriculture activities besides only 10% from other activities. So, diversification index arrives at 0.11. In respect of the small and semi-medium farmers, the major income of 80% comes from agriculture activities besides only 20% from other activities. The diversification index arrives at 0.25. In respect of the medium farmers, the major income of 75% comes from agriculture activities besides only 25% from other activities. So, diversification index arrives at 0.33. In respect of the large farmers, the major income of 65% comes from agriculture activities besides only 35% from other activities. So, diversification index arrives at 0.54. However, the income ranges amongst all categories of farmers are different as they own more or less assets, and diversify their incomes. In respect of marginal farmers, the income from allied activities is seen more and remarkable than farm activities as they do these activities for their subsistence.

VI) HYPOTHESIS TESTING:

Sr. No.	Z-test (Two tailed test) at 95 Percent Confidence Interval					
	Indicators	**Sub-Hypothesis**	**Observation**	**P-Value**	**Mean Difference**	**Decision**
	Productivity per Ha	H_0-30.55═30.25	5	0.000	0.50	H_0-Reject
		H_1-30.55≠30.25				**H_a-Accept**
	Income per Ha	H_0-91650═90750	5	0.000	-900	H_0-Reject
		H_1-91650≠90750				**H_a-Accept**

SOCIO-ECONOMIC CHARACTERISTICS OF THE FARMERS

Significant differences were observed in socio-economic variables. The variables, family size, active members, education, and others differ in nature. This affects productivity. The marginal and small farmers take education up to secondary school; while medium and big farmers give their children higher education. As a result, such educated youths get better employments and add to family-income from good salaries. The big farmers also generate high income from agriculture as they own large quantum of land.

VII) FINDINGS

Jath tehsil is 100% drought-prone area. Always there remains low rainfall. The geographical area of this tehsil is 224761 ha. i. e. 26.10% of total area 861000 ha of the district. The quality of land (dryland) is inferior to have good yield of farm products. The average rainfall is below 560 mm per year. The Farmers cultivate drought tolerant crops like jowar, bajra, maize, groundnut, etc. and plant fruits like guava, ber, pomegranate, dragon fruit, etc. These crops require low amount of water. This tehsil has low productivity and lower yields below average. The composition of total income consists of farm income as well as non-farm income. The farm incomes of marginal farmers arrive to 90% and non-farm incomes to 10%. The farm incomes of small and semi-medium farmers count to 80% and non-farm incomes to 20%. The farm incomes of medium farmers count to 75% and non-farm incomes to 25%. The farm incomes of large farmers count to 65% and non-farm incomes to 35%. The main activity of the people of this tehsil is agriculture. Nearly 72% people are engaged in agriculture. The rest are in other jobs, taking education, unemployed, and labour works. The main allied activity of farmers' community is dairy farming. They earn nearly 25% to 60% of their income from milk production. The farmers belonging to categories, marginal and small, have no farm machineries. Instead they hire it when they are in need. Medium and large farmers own high-cost farm machinery. The socio-economic status of medium and large farmers is better in villages; they are involved in political activities. The children of the medium and large farmers generally take higher education. Ultimately, they get better jobs/employments and add to non-farm incomes. There is no medium or big size industry in this tehsil, except one sugar mill and 2 textile mills. There is a least number of productive units; instead there are many servicing and trading enterprises. There are large numbers of educated youths who are unemployed. Though they are highly educated, they have to accept lower level jobs. Some of them work on temporary basis. The livelihood of the population of this tehsil is not sustainable due to climatic conditions, limited resources, financial un-stability and other effective factors.

VIII) POLICY SUGGESTIONS

The whole population of this tehsil should be alert well in advance and informative of forecasts relating to climatic conditions. For this better assistance of meteorological department can be taken. The population of this tehsil should find the alternative ways for generating additional income for their better living. The farmers' community should enhance the farm productivity by adapting to new processes and modern technologies in farming. The youths of farmer households must take higher education to have eligibility for getting better jobs/employments. They can avail scholarships, education loans and free-ships. So, they cannot be sharers in income of family. The farmers must produce drought tolerant crops and while doing so, they can get financial and technical assistance from government agencies. There is scope for horticulture. So, the fruits like pomegranate, guava, ber, banana, grape, etc. can be grown on commercial basis. The farmers or their groups can erect minor irrigation projects so as to meet the need of water. The communities of this tehsil should be health conscious. There are many schemes of the governments and insurance companies that compensate for health problems. There are PM Swasthya Yojana, and PM Jan Arogya Yojana that bear all expenses of hospitalization. The farmers should open agro-based enterprises at local place which can hire farm machineries on nominal rent to farmers. This will imply new jobs and fulfill farm needs. The youths of farmer households after taking higher education and without accepting any jobs may set their businesses at local place; thus generating self-employment instead of

seeking jobs. Farmer households should reduce the expenditure on social functions. Farmers should always remain conscious about government schemes from which they can be benefited. They should properly get help of government schemes when they wanted to invest in farming activities. Farmers should stock their produces when prices fall; and sell them in market when prices goes up. Proper care of storage is to be taken. Farmers should not make over-borrowing; instead they should have habits of taking loan in the nick of time. Farmers should develop the saving habits.

IX) CONCLUSION

There are few studies regarding the topology of production systems in drylands. The study was to understand the agriculture production system in drylands. The dryland area of Jath tehsil in Sangli district was chosen for study. The most appropriate production system, i.e. subsistence production system was presented using variables related to production, socio-economic and social capital. The first challenge was to make a study of dryland region and farmers livelihoods.

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