Agricultural Development and Socio-Economic Profile of Farmers in Arunachal Pradesh: With Special Reference to Tawang District

Lobsang

Assistant Professor, Saint Claret College, Ziro

ABSTRACT: Arunachal Pradesh is an agrarian economy and it is the main source of earnings for people. In Arunachal Pradesh, the contribution of the agriculture sector to its GSDP is 44.78 percent. The present study is to analyze the trend and growth in production and productivity of food crops in Arunachal Pradesh. It also tried to examine the socio-economic profile of farmers in rural households. The study was based on both primary and secondary data. The secondary data were collected from NEDFI Data Bank and Statistical Abstracts of Arunachal Pradesh. The primary data were collected by conducting field surveys in Tawang District. The survey was based on a multi-stage sampling technique. In the first stage, the Tawang district was selected and in the second stage, *Namazing and Kharsa* villages of the Jang block were selected purposively. The sample size was 50 households. During the study, it was found that the overall production of food crops in the state was very low. The main issues of agriculture development in the state are limited arable land and low productivity. There has been a diversification of livelihood towards non-agricultural income sources. The socio-economic profile of farmers are found poor. People's dependency on the public distribution system for food grains has substantially increased. It is a indication of inadequate production of food grains in the district. There is a need to focus on improving the productivity of major crops as the income of farmers is low.

KEYWORDS: Growth Rate, Production, Household, Socio-Economic.

INTRODUCTION

Agriculture is the main source of earnings for the people of Arunachal Pradesh. The share of agriculture and allied activities to total Gross-State Domestic Product (GSDP) at a constant price is 44.78 percent in 2016-17 (Economic Survey of Arunachal, 2017). The state gets as much as 500 centimeters of rainfall and this accounts for the large numbers of rivers and lakes in the region apart from these, extensive forests which have to include the people to adopt the 'Jhum" form of cultivation in which a select area of the forest plot is burnt and used for cultivation.

Jhum or slash and burn cultivation is an old-age practice among the tribal groups throughout the tropics. It is largely viewed as an exploitative system where the land and natural resources are not managed optimally and are taken to be a major cause of deforestation and ecological instability. The difficult topography, inhospitable terrain, incessant rains, and harsh climatic conditions in the region leads the people to adopt this old-age practice. A large segment of the tribal population of the region and the majority of tribal groups have been traditionally practicing Jhum. Apart from Jhum, sedentary and terrace cultivation are also practiced by the people ((*BARTHAKUR, 1984*). The main issues of agriculture development in the state are limited arable land and low productivity, with this background, the present study aims to examine trends and growth in agriculture production in the state.

The study is based in Tawang district which is located in the northwest part of Arunachal Pradesh on the international borders with China and Bhutan. Tawang district occupies an area of 2172 Sq.km and it is situated at the height of 3500 meters from the sea level. Out of the total area of 2172 Sq.km of the district, about 1768 Sq.km is under forest cover. Most of the people depend on agriculture for a living, owing to Tawang's cold climate, farmers breed yaks and sheep, although in lower altitudes crops are also planted. In early, the people of Tawang depends mainly on breeding yaks and sheep because of difficult topography and inhospitable terrain, which people find very difficult to cultivate crops. In low-lying areas, farmers practice subsistence farming in which wheat is the major crop produced along with maize, millet, rice, and paddy. Other important crops of the district include potatoes, oilseeds, and vegetables.

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REVIEW OF THEORETICAL LITERATURE

The history of England is clear evidence that Agricultural Revolution preceded the Industrial Revolution there. In U.S.A. and Japan, also agricultural development has helped to a greater extent in the process of their industrialisation. Similarly, various under-developed countries of the world engaged in the process of economic development have by now learnt the limitations of putting over-emphasis on industrialisation as a means to attain higher per capita real income.

Lewis (1954) in his article "Economic Development with Unlimited Supplies of Labour"   envisages the capital accumulation in the modern industrial sector so as to draw labour from the subsistence agriculture sector. Schultz (1964) in his book "Transforming Traditional Agriculture" argued that agriculture remains as traditional if the art of cultivation do not change. He stated that there is a need to introduce new and improved inputs to raise productivity and transform traditional agriculture.

Mellor (1966) "The Economics of Agricultural Development" suggest ways to transform agriculture. According to him three phases of agricultural development; Traditional agriculture, Technologically dynamic agriculture-low capital technology, Technologically dynamic agriculture-high capital technology. He also argued that there is a need to encourage institutional changes and develop skills for smooth progress of agriculture.

REVIEW OF EMPIRICAL LITERATURE

Ahmed and Bhowmick (1991) attempted to examine the extent of variability in area, yield and price; the nature of price, productivity and acreage movement over a period in relation to technology and factors responsible for determining the area under the principle crops. The study was based on five principle crops; rice, rapeseed and mustard, jute, wheat and potato in Assam. Time series data were used and simple linear model was used for the purpose. The study concluded that acreage under the principle crops in Assam is influenced by the yield of the crop, lag acreage and area under irrigation. Farmers in Assam were not at all price responsive for the crops considered here with respect to allocation of acreage. It means that farmers in this area are yet to take farming as a business.

Rahul Mahanta (2003) An Analysis of Regional Disparities in Agricultural Development Assam. Regional disparity exists in agricultural development in Assam. The study assumes that there are three sources that is, input effect, spatial effect and temporal effect that cause variation in the level of agricultural development. The study is envisaged to the Assam state with 23 districts. Agriculture production is taken as indicator of agricultural development in Assam. Principal component analysis has been used to examine inter-regional disparity in agricultural development and other tools like balance ratio, index of inter-regional imbalances, index of inter-regional imbalances has been used. Applying above methodology and analysis, the study found that the variation in the agriculture production can be minimized by adopting appropriate strategy which combines both input and spatial factors. Such a strategy will help to make a balanced regional agricultural development in the state of Assam.

Sharma (1999) analysed the impact of mechanization and land productivity in the Jorhat district of Assam for 1991-92 covering the crops; rice, mustard and potato. Field level data was used and multiple-regression was run. The study found that mechanization improved productivity.

Borbora and Mahanta(2001) tried to identify inter-district disparities in agricultural sector in 23 districts of Assam. The period of study is 1998-99. Crops are not specified. Secondary data, cross-section was used for estimating land productivity. The method of analysis is principal component method used to determine factors influencing production. To measure inter-district disparity in agricultural development in the state 13 indicators were developed. The study found that inter-district disparity existed in proportion to the area under cultivation.

Surendra singh and Bimal Sharma (2007) analysed the "changing pattern of agricultural productivity in Brahmaputra valley". The Brahmaputra valley, in spite of favorable agro-ecological condition for agricultural development, the land used trends were being observed as stagnant and steady during the 1970s and 1980s. Based on homogeneous character, the entire Brahmaputra valley is divided into five agro-ecological zones, namely, the lower Brahmaputra valley, middle-lower Brahmaputra valley, central Brahmaputra valley, upper northern and the upper southern plains of Brahmaputra. The study concluded that the smoothness of general land use trends become fluctuating under the use of modern agricultural technology. As a result, intensification in agriculture practices has been started especially during the last decade of the century.

Kaul and Ram (Sept. 2010) "Impact of Urbanization on Agriculture production of India" The present paper deals with the impact of urbanization on agriculture sector in India. The main objectives of the study are to study the migration of labour and its implications for urbanization, factors affecting flow of migrants to urban centers, to investigate the effect of urbanization on agriculture production and to suggest the policy measures for agriculture production in the wake of urbanization. The study is based on state wise data for the year 2001. The data has been collected from secondary sources from various reports published from different agencies. Regression model has been used for examining the process. The study indicated that the migration of

people from relatively richer states is somewhat smaller. Also the flow of migrants from the states would reduce, if the states are more urbanised. Study further indicated that the extent of urbanization and migration of people from the states had a positive impact on agriculture production and development. Thus, it would have a positive implication for rural poverty.

The review of literature shows that there is a dearth of study on agricultural development in the hills of North East India. Hence, the present study was undertaken to fill the gap in knowledge.

MATERIALS AND METHODS

The study was conducted in Namazing & Kharsa village of the Tawang district of Arunachal Pradesh. It is located in the Jang subdivision of Tawang district, Arunachal Pradesh. Both villages have around 620 households with a population of 2434 of which 1425 are males while 1009 are females as per the population census 2011. Namazing and Kharsa villages have a lower literacy rate compared to Arunachal Pradesh. In the 2011 census, the literacy rate of Namazing and Kharsa was 43.35 percent and 61.8 percent compared to 65.38 percent in Arunachal Pradesh (Population Census, 2011). The villages are situated 5 km away from sub-divisional headquarter Jang and 37 km away from district headquarter Tawang. Tawang district occupies an area of 2172 Sq.km and is situated at the height of 3500 meters from sea level. The district is roughly located around latitude $70^045'$ N and longitude $90^0 15'$ E at the northwest extremity of bordering China. According to the 2011 census, the Tawang district has a population of 49950 with a sex ratio of 701 females for every 1000 males. The vast area of the district is under mountains, rivers, and forests. Annual rainfall in the district varies from 1500 mm to 2000 mm. The climate of the district is largely influenced by the nature of its terrain. The summer is moderate and extremely cold in winter. However, the mountain peaks are covered with perpetual snow. In winter, the temperature falls below the freezing point. The nature and properties of soil vary with the area. The soil of the valleys is clay alluvium and rich in organic content and the soil of mountains is relatively lacking in organic materials. Agriculture is the primary economic activity of the vast majority of its people. However, in recent years there has been a diversification of income sources in the district. The major crops grown in the district are maize, millet, wheat, pulses, potato, chili, and paddy.

The study was based on both primary data and secondary data. The secondary data were collected from NEDFI Data Bank and Statistical Abstracts of Arunachal Pradesh. The primary data were collected by conducting a field survey in the study villages. The survey was based on a multi-stage sampling technique. In the first stage, the Tawang district was selected and in the second stage, *Namazing and Kharsa* villages of the Jang block were selected purposively. However, the random sampling technique was applied to select the households for the collection of required data as this technique reduces biasness and ensures a representative sample. The required data were collected through the personal interview method. Adequate time was given to the respondent during the interview. The duration of each interview was around 15 minutes. The questionnaire was so designed to collect information on socio-economic characteristics, access to basic facilities, and asset holdings of the farm household. It was also designed to collect information relating to the area, inputs of production of the sample farms, other miscellaneous expenditure, and output of all crops cultivated both in value and quantitative terms. All these variables were measured per unit area. The sample size was 50 households. The unit of observation was farming households. The collected data were well tabulated and processed and analyzed using statistical techniques.

The compound annual growth rates (CAGR) of area, production, and productivity were calculated to examine the performance of the agriculture sector in the State.

The compound annual growth rate was calculated by applying the following formula:

$Y_t = Y_0 (1 + r)^t$

Where, Y_t = Value in year t

Y_0 = value in base year

t = time period

r is the compound annual growth rate

Taking log to both sides we have;

$LogY_t = LogY_0 + t Log (1 + r)$

Or, $Log Y_t = a + bt$ [b = Log (1 + r)]

Where, b is the exponential growth rate

Therefore, r = [Anti-log b -1]

The statistical analysis was done by using statistical packages such as *MS Excel* and *SPSS.*

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RESULTS AND DISCUSSION

Changes in Land Use Pattern in Arunachal Pradesh:

The analysis of land use statistics reveals that the total operational area in the Arunachal Pradesh declined from 405878 in 1995-96 hectares to 384000 hectares in 2010-11. In terms of the State's geographical area, the operational area declined from 4.85 percent in 1995-96 which fell to 4.59 percent in 2010-11 (Table 1). The gross cropped area in the State has increased from 2.96 percent in 1995-96 to 3.32 percent of the geographical area in 2010-11.

Table 1. Changes in Land Use Pattern in Arunachal Pradesh (percent of geographical area)

Sl. No.	Category	1995-96	2000-01	2005-06	2010-11
1	Operational Area	4.85	4.70	4.32	4.59
2	Net area sown	2.43	2.39	2.07	2.54
3	Current fallow	0.34	0.27	0.44	0.48
4	Fallow land other than current fallow	0.72	0.76	0.62	0.84
5	Uncultivated land excluding fallow land	0.97	0.55	0.40	1.43
6	Cultivable waste land	0.51	0.33	0.34	0.76
7	Land not available for cultivation	0.40	0.39	0.44	0.76
8	Gross cropped area	2.96	2.57	2.57	3.32
9	Cropping intensity (in %)	121.82	107.42	124	130.5
10	Net irrigated area (as % of Gross cropped area)	15.46	20.68	21.93	NA
11	Average size of holdings	3.83	3.69	3.33	3.51

Source: Economic Survey of Arunachal Pradesh, 2017.

Among the North Eastern States in 2010-11, the net sown area as a percent of the geographical area was the lowest in Arunachal Pradesh (2.53 percent) followed by Nagaland (7.42 percent). This can be attributed to their difficult and inhospitable mountainous terrains as well as large forest covers.

Growth of Area, Production, and Productivity of Food Crops

The analysis of growth in the area, production, and productivity of food grains in the State during the period 2003-04 to 2019-20 revealed that food grains production in the State increased from 242.4 thousand tonnes to 495.6 thousand tonnes (Table 2). The compound annual rate of growth (CARG) of food grains in the State during this period was computed to be 9.35 percent. This was mainly on account of an increase in productivity which increased from 12.26 quintals per hectare in 2002-03 to 21.68 quintals per hectare in 2019-20 (Table 4). The compound annual rate of growth in the yield of food grains during this period was 7.38 percent.

Table 2. Trend and Growth in Production of Food Crops in Arunachal Pradesh

(Production in MT)

Year	Paddy	Maize	Millet	Wheat	Pulses	Total Food grains
2003-04	152500	56441	19411	6250	7793	242395
2005-06	146191	57898	22376	6140	8285	240890
2007-08	237219	57430	19425	5294	8618	327986
2009-10	215842	60144	18391	4770	9656	308803
2011-12	255000	68500	22000	6500	10500	362500
2013-14	276171	68978	23825	4470	11143	384587
2015-16	330537	72358	25689	5489	12163	446236
2017-18	350000	77216	27300	7742	13464	475722
2019-20	367125	49205	27460	7742	14151	495683
CAGR	**11.60**	**-1.70**	**4.43**	**2.71**	**7.74**	**9.35**

Source: Statistical Abstract of Arunachal Pradesh (Year Wise)

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However, the area under food grains increased marginally during this period. The area grew at CARG of only 1.83 percent (Table 3). The increase in food grains production during 2002-03 to 2019-20 was mainly contributed by the increase in the production of paddy, pulses, and millet.

During the same period, production of wheat registered a CARG of 2.7 percent, and production of maize registered negative growth**.** During this period the yield rates of maize, millet, and wheat grew marginally at CARG of 1.4 percent, 1.36 percent, and 3.30 percent respectively.

Table 3. Trend and Growth in Area under Food Crops in Arunachal Pradesh

(Area in Hectare)

Year	Paddy	Maize	Millet	Wheat	Pulses	Total Food grains
2003-04	124584	40548	21110	4114	7305	197661
2005-06	122267	41853	22802	3976	7720	198618
2007-08	124029	42736	22308	3558	8512	201143
2009-10	121468	43630	21373	3170	8818	198459
2011-12	123496	46500	22000	3700	9500	205200
2013-14	131989	47018	22744	2960	9672	214383
2015-16	131863	49563	24360	3056	10560	219402
2017-18	132000	50797	26765	3930	13200	226692
2019-20	133500	51100	26790	3930	13350	228670
CAGR	0.86	2.93	3.02	-0.57	7.82	1.83

Source: Statistical Abstract of Arunachal Pradesh (Year Wise)

Table 4. Yield rate of food grains in Arunachal Pradesh

(Yield in quintals per hectare)

Year	Paddy	Maize	Millet	Wheat	Pulses	Total Food grains
2003-04	12.24	13.92	9.2	15.19	10.67	12.26
2005-06	11.96	13.83	9.81	15.44	10.73	12.13
2007-08	19.13	13.44	8.71	14.88	10.12	16.31
2009-10	17.8	13.8	8.6	15	11	15.6
2011-12	20.6	14.7	10	17.6	11.1	17.7
2013-14	20.9	14.7	10.5	15.1	11.5	17.9
2015-16	22.5	15.2	10.5	17.3	11.2	19.3
2017-18	25.52	15.2	10.2	19.7	10.2	20.99
2019-20	27.5	15.61	10.25	19.7	10.6	21.68
CAGR	10.64	1.44	1.36	3.30	-0.08	7.38

Source*:* Statistical Abstract of Arunachal Pradesh (Year Wise)

Despite growth in the yield rate of food grains over the years, it is still low. For instance, in 2019-20, the yield rate of food grains in the State was 7.38 quintals per hectare which were lower than the national average of 21.20 quintals per hectare (NEDFI Data Bank). Hence, efforts must be made to raise the productivity of food grains in the State to ensure food security.

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Growth in Production and Productivity of Food Crops in Tawang District:

An analysis of the area under food crops in the Tawang district during the period 2003-04 to 2019-20 reveals that the total area under total food grains has declined from 5516 hectares to 4541 hectares (Table 5). This indicates that there has been a shift in the area towards the production of commercial crops which is an indication of agricultural transformation.

Table 5. Area under Food Crops in Tawang District of Arunachal Pradesh

(Area in Hectare)

Year	Rice	Wheat	Maize	Millet	Pulses	Total
2003-04	907	2290	880	885	554	5516
2005-06	777	1702	722	835	124	4160
2007-08	770	1662	710	835	179	4156
2009-10	760	1155	695	1000	152	3762
2011-12	777	1156	722	1015	172	3842
2013-14	835	986	700	1015	156	3692
2015-16	850	1013	856	1125	253	4097
2017-18	883	11,04	910	1261	333	4491
2019-20	917	1104	923	1262	335	4541
Average Annual Growth Rate	**0.33**	**-7.67**	**1.14**	**4.82**	**6.23**	**-1.77**

Source*:* Statistical Abstract of Arunachal Pradesh (Year Wise)

The annual average growth rate of food grains in the district during this period was found to be 2.91 (Table 6), which means that there is very low growth in the production of food grains in the Tawang district. The low growth in the production of food grains in the Tawang district is mainly due to a decline in the area under food crops. The average annual growth of area under the production of food grains registered negative growth of -1.77 during 2003-04 to 2019-20 (Table 5). It was mainly on account of a sharp fall in the area under wheat which registered negative growth of -7.67 percent on an average during the period.

Table 6. Production of Food Crops in Tawang District of Arunachal Pradesh

(Production in MT)

Year	Rice	Wheat	Maize	Millet	Pulses	Total Food Grains
2003-04	1210	3330	1654	948	610	7752
2005-06	1057	2601	1408	1002	133	6201
2007-08	1623	2535	1420	1002	213	6793
2009-10	1178	1739	1494	1200	192	5803
2011-12	1300	1952	1600	1331	227	6410
2013-14	1319	1409	1512	1218	197	5655
2015-16	1659	1506	1728	1308	295	6496
2017-18	2191	1,931	2090	1439	471	8122
2019-20	2625	1931	2180	1446	478	8660
Average Annual Growth Rate	**12.77**	**-3.54**	**3.86**	**5.13**	**11.61**	**2.91**

Source: Statistical Abstract of Arunachal Pradesh (Year Wise)

The analysis of trends and growth in production of food crops in the district during the period 2003-04 to 2019-20 showed that food grains production in the district increased marginally from 7752 tonnes to 8660 tonnes (Table 6). The annual average growth rate of food grains in the district during this period was computed as 2.9. It means that the production of food grains in the Tawang district has increased marginally which is not a healthy trend. The production of wheat in the Tawang district has declined from 3330 tonnes to 1931 tonnes which is negative growth of -3.54. The production of pulses has also declined from 610 tonnes to 478 tonnes. The decline in the production of wheat and pulses was due to a sharp fall in the area under production.

However, the production of other crops increased during 2003-04 to 2019-20. The production of rice increased from 1210 tonnes to 2625 tonnes, the production of millet rose from 948 tonnes to 1446 tonnes and the production of maize rose from 1654

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tonnes to 2180 tonnes during the period (Table 6). The increase in production of rice, millet, and maize was mainly due to an increase in yield rate which is an indication of improvement in efficiency. But the increase in production of these was due to both area expansion and an increase in yield rate.

An analysis of trends and growth in the yield rate of food crops in the district during the period 2003-04 to 2019-20 showed that the yield rate of total food grains in the Tawang district has increased from 14.05 quintals to 19.7 quintals (Table 7).

Table 7. Yield Rate of Food Crops in Tawang District of Arunachal Pradesh

						(Yield in quintal/hectare)
Year	Rice	Wheat	Maize	Millet	Pulses	Total Food Grains
2003-04	13.34	14.54	18.8	10.71	11.01	14.05
2005-06	13.6	15.28	19.5	12	10.73	14.91
2007-08	21.08	15.25	20	12	11.9	16.35
2009-10	15.5	15.06	21.5	12	12.63	15.43
2011-12	16.73	16.89	22.16	13.11	13.2	16.68
2013-14	15.8	14.29	21.6	12	12.63	15.32
2015-16	20.32	15.6	22.5	12.3	13.6	16.86
2017-18	24.81	17.49	22.97	11.41	14.14	18.9
2019-20	28.63	17.49	23.62	11.45	14.27	19.07
Average Annual Growth Rate	**12.36**	**2.71**	**2.92**	**1.05**	**3.40**	**4.14**

Source: Statistical Abstract of Arunachal Pradesh (Year Wise)

The average annual growth of yield of food crops during the period under review was computed to be only 4.1 which is very low growth. This indicates that the level of resource use efficiency and technology of production in the district is poor.

Among the various food crops, the yield rate of rice has increased from 13.34 quintals in 2003-04 to 28.63 quintals in 2019-20 with an annual average growth of 12.36 percent. During the same period, the yield rate of maize, pulse, and millet grew at an annual average growth of 2.9 percent, 3.4 percent, and 1.05 percent respectively.

The percentage share of Tawang district in total production of food crops in Arunachal Pradesh in 2019-2020 showed that the district accounted for only 1.47 percent of the total food grains production in the State. This implies that its contribution to food grains production in the state is very low. This is because the hilly topography and rough terrain of the district do not favor the production of food crops except some coarse cereals.

Socio-economic Profile of Surveyed Households and Access to Basic Facilities:

Socio-economic characteristics play a profound role in determining one's accessibility to the common resources, livelihood patterns, household food & nutritional security, etc. They are also indicators of household well-being. Hence, an attempt was made to understand the socio-economic profile and households' access to basic facilities in the rural area of the district.

The analysis of the primary data showed that most of the respondents (68 percent) belong to the age group between 40-50 and 50-60. The minimum age of respondents is 37 and the maximum is 71, and the mean value is 50.28. The age distribution of the respondents showed that most of them belonged to the higher age group.

The level of educational attainment of the surveyed household found that 72 percent of respondents are illiterate. (Table 8).The number of respondents having education up to primary and middle level is 12 percent. The maximum year of schooling is only 12 years, the mean value is 2.16 and the standard deviation is high i.e. 3.86 This reveals that the education level of the people in the area is very low.

Table 8. Classification of Respondents based on Education (Year of Schooling)

Years of Schooling	Frequency	Percent
Illiterate	36	72
Upto 5 years	6	12
Upto 10 Years	6	12
Above 10 years	2	4
Total	50	100

Source: Fild Survey, 2021

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The occupation distribution of the farm household showed that most of the respondents are engaged in the service sector (28 percent). The increase in the service sector is mainly because of the expansion of public administration in the district. The percentage of respondents engage in agriculture is only 16 percent. This is mainly due to limited arable land and low productivity. Of the respondents engage in contract work are 16 percent. The respondents engage in another sector (including

casual labor) are 24 percent (Table 9). This shows that people in the area have adopted diversified livelihoods to overcome the limitations posed by limited arable land.

Table 9. Classification of Respondents based on Occupation

Occupation	Frequency	Percent
Agriculture/Herd	8	16
Labour	8	16
service	14	28
contract	8	16
Others	12	24
Total	50	100

Source: Fild Survey, 2021

The annual household income of the surveyed respondent showed that 36 percent of the respondent comes under the income group of less than one lakh (Table 10) and 40 percent of the respondents have an annual income of more than 3 lakh. Around 20 percent of the respondents have an annual household income between 1-3 lakh . So there is high-income inequality within the same village. This is mainly due to differences in education levels.

Table 10. Classification of Respondents based on Annual Household Income

Income group	Frequency	Percent
Less than 1 lakh	18	36
1-2 lakh	2	4
2-3 lakh	10	20
3 lakh and above	20	40
Total	50	100

Source: Fild Survey, 2021

The percentage share of agriculture in the total income of the farm household revealed that 64 percent of respondents have less than 30 percent share of agriculture in total income (Table 11). And 32 percent of respondents have around 90 percent of the share of agriculture in total income.

Table 11. Classification of Respondents based on Share of Agriculture in Total Income

Percentage Share of Agriculture in total Income	Frequency	Percent
Less than 30 Per cent	32	64
30- 50 Per cent	2	4
Above 90 Per cent	16	32
Total	50	100

Source: Fild Survey, 2021

There has been diversification toward non-agricultural income sources among the households in the surveyed villages.

The family size of the households showed that 20 percent of the households have a small family size. And 72 percent of the respondents have a medium family size. It means most of the respondents have a medium family size. And only 8 percent of respondents in the study village have a large family size.

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The share of agriculture in total annual household income is only 6.17 percent (Figure 1). The reason behind the less share of agriculture in total income is low productivity, as the village is located in a hilly and mountainous region. So the terrain is difficult, and incessant rains and harsh climate conditions in the region lead to low productivity. The share of livestock in the total annual household income of the surveyed households was 15.79 percent. As people of this region depend on breeding yaks and other milk and draught animals, and products of these animals have a good source of income for the people.
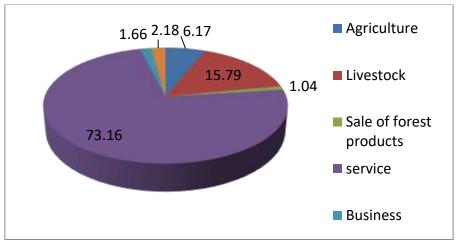

Figure 1. *Share of Different Sources in Total Annual Household Income of the Surveyed Households*
Source: Fild Survey, 2021

Access to basic facilities like drinking water, sanitation, electricity, housing, drainage, and others are crucial to well-being as they contribute to physical and mental comfort and quality of life. It was found that all the households have their own houses and there is no rented house in the village. There is no thatched house in the village and all the houses are found in pucca.

The source of drinking water in the surveyed households showed that 64 percent of the respondents have drinking water from the tap in the dwelling while 36 percent of the respondents have drinking water from a public tap (Table 12). Access to drinking water is found to be good.

Table 12. Classification of respondents based on the source of drinking facilities

Drinking water	Frequency	Percent
tape in dwelling	32	64
public tape	18	36
Total	50	100

Source*:* Fild Survey, 2021

The survey found that all the respondents have toilet facilities and most of the respondents use covered dry latrines (76 percent). It was found that only 24 percent of the households have septic tank toilets (Table 13). This indicates poor access to sanitary toilet facilities in the rural area of the district.

Table 13. Classification of surveyed respondents based on Toilet type

Toilet Type	Frequency	Percent
Septic Tank Toilet	12	24
Covered Dry Toilet	38	76
Total	50	100

Source*:* Fild Survey, 2021

An attempt was also made to study the sources of fuel of the surveyed households. The survey found that there are two main sources of fuel used in every household. These are LPG and firewood. It was found that 24 percent of the household used LPG as a main source of fuel and 76 percent of the households used wood as a main source of fuel for cooking and heating purpose (Table 14).

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Table 14. Classification of surveyed respondents based on the source of fuel

Source of fuel	Frequency	Percent
LPG	12	24
Wood	38	76
Total	50	100

Source*:* Fild Survey, 2021

During the winter season due to extreme cold people use firewood for heating purposes. But in summer LPG is the main source of fuel for cooking. The use of firewood during winter creates a huge demand for it. This has led to extensive felling of trees for firewood leading to large deforestation. Hence, there is a need to improve the supply of electricity and encourage people to adopt electric heaters. This is important to protect the environment and maintain ecological balance in the district.

It was found that all the respondent households have ration cards from PDS. It was found that 64 percent of the respondents were holding APL ration cards and 36 percent of them were holding BPL ration cards (Table 15). This indicates that there is a high incidence of poverty in the area. The dependence on PDS rice indicates inadequate production of food grains in the village.

Table 15. Classification of surveyed respondents based on the type of ration card

RC Type	Frequency	Percent
APL	32	64
BPL	18	36
Total	50	100

Source*:* Fild Survey, 2021

Policy Implications

Based on the above findings and discussion, the following policy implications can be suggested:

➢ There is a need to focus on improving the productivity of major crops. This may require the introduction of new inputs and better technology. The government may provide improved inputs to farmers at a subsidized rate as the income of farmers is low.

➢ Over the year people's dependency on the public distribution system for food grains has substantially increased. This is a clear indication of too much dependency on government aid.

➢ There is a need for support and encouragement for local products so that the income level of the farmers could rise.

➢ There is a need to encourage diversification toward plantation crops as the topography of the state is not very suitable for the production of food crops.

➢ Skill and training are essential to building up the capacity of the people to undertake plantation crops.

➢ The access to basic facilities particularly sanitary toilets was poor. So efforts must be made to encourage the people in the rural area to adopt proper sanitary toilets by providing incentives.

➢ There is a need to improve the electricity supply so that the dependency on firewood could be reduced.

CONCLUSION

Based on the above findings and discussion, it can be concluded that agriculture is the main source of earnings for the people of Arunachal Pradesh as well as the Tawang district. Over the years the production and productivity have increased but the increase in productivity was low. The main issues of agriculture development in the state are limited arable land and low productivity. The total operational area in the state has been declining mainly because of the increase in population. During the study, it was found that the overall production of food crops in the Tawang district was very low. This was mainly due to a fall in area under food crops. At the same time growth in productivity of major crops was very low. There has been a diversification of livelihood towards non-agricultural income sources among the households in the surveyed villages. This was mainly due to low productivity and limited arable land as the study village is located in the hilly and mountainous region.

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