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## **Potential of Horticultural Farming and Livelihood Sustainability: A Case Study of Plum Farming at Enhulumi Village of Phek District, Nagaland**

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### **Abstract**

*In recent years, horticulture has become a major industry in the economy. Among the variety of fruits produced in the country, Plum is one of the important commercial crops. It constitute a valuable component in the diet, both in terms of nutritive and dietary values. Data shows that India is the eight largest plum producing country in the world. The present study is a case study of plum at Enhulumi village under Phek district in Nagaland. Impact of family size and modern education on the level of production is tested and it is found that number of family size and modern education does not have significant impact on plum production. The agro-climatic condition is found to have favoured this small village for plum. Plum cultivation and production is increasing year by year. However, factors like price instability combined with poor infrastructural facilities hinder the plum production. Therefore, support from private and public agencies to facilitate price stability, technical and financial aid would boost up the economy of this rural village.*

## **Introduction**

**A**griculture has been the backbone of the Indian economy. It is directly linked to human development having a direct bearing on poverty reduction and sustainable development. The proportion of workforce engaged in agriculture is highest, while the income generated from this sector is the least comparing to secondary and tertiary sectors in India. However, with the advancement of modern science and technology, the workforce engaged in primary sector particularly in agriculture has been declining over the years. Also, the cultivation of cash crops has given emphasis in the agricultural system. Thus, horticulture has become one of the most important backbones of the economy in the country.

The recent statistics for India has shown that the production of horticulture is higher than that of the food grain. In 2017-18, the production of horticulture was 306.8 MT comparing to food grain production of 279.5 MT (GoI, 2018). Further, the scope for the growth of horticulture production is quite immense in India. However, lack of awareness among the farmers on the productivity and the bottleneck infrastructural facilities remains a major hurdle for the growth of fruit production in the country (Sachitanand, 2018).

India produces variety of deciduous fruits including pome and stone fruits. The major fruit grown areas are North-Western States like Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, and North Eastern states like Arunachal Pradesh, Nagaland, Meghalaya, Sikkim and Manipur (Ghosh, n.d.). Among the stone fruits, plum is one of the fast growing commercial fruit items in India. Data shows that India is the eight highest producer of plum in the world in 2017 with 2,62,197 tonnes (FAO, 2020).

Plums have an extensive history linked to the ancient plum varieties of Damascus. Reddy (2013) in an article “All

About Plum in India” stated that Chinese are believed to be as early as 470 BC approximately. There are varieties of plum grown across the globe. Europe is a home for European plum (*Prunus domestica*), America bred the American plum (*Prunus Americana*), South Asia (first) cultivated the cherry plum (*Prunus cerasifera*) and Western Asia has the Damson plum (*Prunus salicina*). Sati, et.al (2015) conducted a study of potential of horticulture in livelihood sustainability and development particularly on plum in Sichuan Province, China. They showed that Plum has generated a huge source of income to the farmers. The quality and productivity are high but it is largely dependent on the weather condition. Also, bottleneck infrastructure is the hindrance of livelihood sustainability on plum. Hence, the study has concluded that given the weather condition stable, the farmers will be able to sustain livelihood from plum cultivation if the required infrastructural facility is given.

In a study conducted in 1906 by Sandsten showed that for Madison, USA, the current blooming period was influenced more by the condition of preceding summer and fall rather than by the current spring weather. Also, the production of plum is immensely dependent on the weather condition of a specific region as it requires adequate water, wind, temperature and sunlight. However, excessive of all these factors resulted in negativity in plum production. In 1919, Dorsey studied the relation of plum to weather in USA and concluded that certain weather conditions, good and bad, go together, but temperature and rain are the most important elements from the standpoint of setting fruit.

Plum is one of the most important stone fruits in the world. It constitutes a valuable component of diet, both in terms of nutritive and dietary values. Plum is becoming an increasing popular object of nutritional studies on humans and animals. Yet, it is not consumed as a staple food. Hence, the market of

plum is susceptible to the social and political stability of the nation. In relation to such a study, Lorubare (2016) has shown that the horticulture is the fastest growing industry in Tanzania but the unfavourable political situation with neighbouring country (Kenya) had adversely affected on small holder farmers to a great extend.

In Nagaland, about 96.5 percent of the total population was dependent on agriculture in 1950s (NSHDR, 2004). However, it has declined to 61.6 percent in 2011 (Census of India, 2011). In order to emphasis the importance of cash crops in agriculture, the Government of Nagaland has created a separate department of Horticulture in the year 1992 (GoN, 2017). Since then, horticulture has become the major focus of cultivation in Nagaland. Many of the local farmers are switching their effort from traditional jhum and terrace cultivation to horticulture farming. The amount of rainfall and favorable climatic condition for horticulture has positively impacted on the growth of fruit cultivation in the State (Chirhah & Buruah, 2019). The diverse agro-climatic conditions with varied soil types and abundant rainfall prevailing in the state enable the cultivation of horticultural crops (NSHDR, 2016). In Nagaland, data shows that the major fruits cultivation are orange, banana, pineapple and passion fruits (GoN, 2018). Amongst the various fruit items, plum is one of important commercial crop but, it is not as significant as other crops in the State. It is found that plum is not common in all the districts. As far as the data is concerned, plum has been accounted as part of a commercial crop only in recent years. In 2009, the plum production in Phek district was found to be 1.5 tonnes (NPDHR, 2009).

Plum, in Enhulumi village, was a part of age old traditional cultivation of the farmers although the history of its arrival remains unknown. Earlier, plum was cultivated only for personal consumption purpose and therefore, it was cultivated only on

small scale. Lately, its economic viability has been realized by the villagers. However, systematic study on importance of modern education, workforce participation and its livelihood sustainability has not been done for plum cultivators at Enhulumi village. Hence, this paper intends to study to fill the lacunae of the existing literature.

**i. Objectives of the study**

- a. To assess whether there is a positive impact of modern education and family size on plum production
- b. To determine whether the plum farming has the potential in livelihood sustainability

**ii. Methods of collecting and analyzing of data**

- a. In order to satisfy the objective of the study, both *qualitative and quantitative methods* are used in collection of data.
- b. The data are collected through *primary* as well as *secondary data*. Secondary data are collected through published materials and unpublished articles. Primary data are collected through questionnaire, interview and observations.

A total of 50 households are taken as sample size collected in 2018. Household survey was done with the head of the families. The production was estimated in terms of income received from the sale. The absolute figure of the production was transformed into natural logarithm for regression analysis.

- c. *Indicators* such as level of production, educational level of the farmers, family size are taken for quantitative study while farmers' experiences, problems, suggestions, etc. are undertaken for the qualitative assessment.
- d. *Statistical tools* namely; mean, correlation and simple regression analysis are used in the study.



### iii. Area of Study

The present study is a case study of Enhulumi village. The NH 29 crosses the village. It is 87 Kms away from the State capital and 56 Kms away from its district headquarters. It falls under the administrative circle of Chizami Sub-Divisional Officer (Civil) in Phek district Nagaland. The topography of the village is slope and is situated adjacent to the *Ewulu Biodiversity Conservation and Great Hill Barbet Sanctuary*. The temperature of Enhulumi village ranges between 4° Celsius in winter to 28° Celsius in summer. The altitude stood at 1331 feet above mean sea level with the coordinates of 25°35'15"N and 94°21'59"E. According to Census of India 2011, the total household of the village was 230 with a total population of 1014. The literacy rate stood at 75.90 percent while the working population stood at 66.8 percent.

### Brief account of agriculture at Enhulumi

The main occupation of the village is agriculture. Enhulumi village practice Jhum as well as Terrace cultivation. *Jhum cultivation* is basically done for growing crops such as millets, maize and other vegetables. Alder tree is common in Jhum field which is good for natural regeneration of soil. The *terrace cultivation* is done for rice cultivation. In fact, it is the terrace cultivation in which the villagers mainly depend upon for their livelihood as their staple food (rice) is cultivated. The *wet terrace* cultivation is considered to be superior over *dry terrace* since wet terrace is easier in cultivation as the water is pooled throughout the year. Moreover, aquatic animals are also reared in it like fish, larvae, snail, etc. which also serves as delicacy in traditional food. However, in recent years, there is a shift in its pattern of cultivation whereby the dry terrace is used to cultivate double cropping. But, it has become obvious that due to climate change, the source of water for cultivation has drastically reduced for both wet and dry terrace. Therefore, several wet terrace become

dry, while many dry terrace field do not get sufficient water for cultivation. Besides jhum and terrace cultivation, home garden and firewood reserved forest are common to Enhulumi village.

### **Plum Cultivating at Enhulumi village**

Plum cultivation was practice by farmers even in olden days, yet, they did not realized that it can fetch them income. However, in recent times, the farmers have realized the importance of cultivating cash crops. Hence, cultivation of fruits has been picking up at a swift pace. Among the fruits, plum is one of the most common cash crops besides kiwi, cardamom, peach, etc. The most common type of plum found in the village is *Prunus Salicina*, famously known as Japanese plum.

i) **Plum farm**: Cultivation of plum for commercial purpose was initiated during 2008-09. Since then, the villagers have decided to take up proper farming spot for plum cultivation in order to produce in larger quantities. Hence, the location of *Keciphobou* has been identified. *Keciphobou* is situated above NH-29 on the south-west of the village. However, the farming of plum is not limited to this (*Keciphobou*) area. Large numbers of plum trees are also cultivated alongside the terrace fields and in the backyards.

The plum cultivation is increasing year by year in Enhulumi village. On becoming aware of plum as a good source of income, the villagers began to expand the uncultivated areas into plum farming. Even some of the dry terrace fields are converted into plum farming. Plum farming and its expansion is done by the self-interest of the farmers themselves. It is found that about 94 percent of the household living in the village has at least one tree. It is estimated that the total area under plum farming is about 100 hectare (VDB, 2019).

ii) **Methods of farming**: The farmers are not technically trained nor learned from the modern educational system. They follow

their own traditional pattern of growing fruits. The farmers follow basically two special methods; *firstly*, grafting is commonly done in plum cultivation. The technique of grafting is done with the traditional knowledge. Grafting of plum is preferably done with the sapling of peach plant. According to farmers, peach sapling is the best for plum grafting in terms of taste and growth. It is found that the normal plum plant takes 8-10 years to bear fruit. But in case of grafting, it bears fruit in 3-5 years varying from place to place. Also, Farmers practice peach seedling in the farm itself instead of transplanting from nursery as it deposits better fruits.

*Secondly*, the branches of the plum tree are tied by a rope with a stone to the ground. This is to weigh down the branches of the tree so that its entire branches receive proper sunlight. Besides, this provides sufficient space to bear fruit. Branches which receives better sunlight bear more fruit and it also taste better. The technique also helps farmers to harvest easier and prevents the fruit to be destroyed by the wind. In addition to tying down the branches with a rope, weeds that grow in the farm are cut and placed over the branches to weigh them down.

iii) ***Production and productivity***: The production of plum has been increasing over the years as the plantation is also increasing every year with improvement of management in the cultivation. As per the estimate of the Village Development Board, the average annual production over the last three years i.e. 2017–2019 is about 32.33 tonnes (Table-1). The production in absolute term has continuously increased in recent years. However, it is found that the annual growth was declined to 2.86 percent during 2018-2019 from 17.65 during 2017-18. The main reason for the fall in 2019 was excessive rainfall and hailstorm during its flowering.

The productivity of a particular tree depends largely on the type of soil, climate and sunshine besides farming methods. Plum

tree grows favourable in silt and loam soil. The productivity of plum is astonishing at Enhulumi village. In a study conducted by Chirhah & Buruah (2019), it is found that one single tree bears fruit up to 160 Kgs. The same study suggests that the best years of bearing fruit is during 8-10 years of its life span. However, it is also found that beyond these years, the setting of fruit remain substantial for many years although at declining rate. The plum tree is observed to survive for about 20 years in average.

Table-1: Annual production of plum for the last three years i.e. 2017, 2018, 2019

Year	Production (in Tonnes)	Annual Average Growth (%)
2019	35	2.86
2018	34	17.65
2017	28	-
Total	97	-
Average for 3 years	32.33	-

Source: Field Survey, 2019

**iv. Marketing of Plum:** The produce is marketed mostly in Dimapur and some in Kohima. Enhulumi plum is found to have an advantage over the neighbouring areas in the market as the trees bear fruit earlier and has better taste, shape and colour (Morung Express, 2015). However, the price declines almost every day soon after the harvest begins. Plum is harvested during Mid-May till early June. The first batch of harvest fetches up to Rs. 25 per kilogram and then it starts to fall to as low as Rs. 8 per kilogram (table-2). Due to the absence of proper marketing agency, the trade is done by the farmers themselves.

Table-2: Plum price levels in the village

*Harvest period (Weeks)	Price per kilo (in Rs.)
First week (May 15-22)	20-25
Second week (May 22-30)	14-19
Third week (June 1 & beyond)	08-13

Source: Field survey, 2019

\*Harvest period is assessed on average.

## **Plum and its relativity**

The villagers, being in rural areas, mostly depend on agriculture which is generally a low income activity. Hence, plum plays a significant role on the economy of the village. The plum production and its relationship with other factors like family size, educational level and livelihood sustainability is discussed below.

### ***i. Family size and its production***

According to 2011 census, the average household size of Enhulumi village is 4.41 members. Similarly, the study reveals that 64 percent of farming household has family size between 4–7 members, while 18 percent each of farming household has less than 3 and more than 7 members (Annexure-1). The farming is done manually, while machines and modern tools are not used. As such, the number of workers employed in the farm is an important input factor in plum production. Hence, it is pertinent to assess whether the number of workers<sup>1</sup> have any positive impact on the level of production.

The relationship between number of family size and the level of production have been examined. Family size is taken as an independent variable, while the level of production as dependent variable. It is estimated that there is positive correlation between family size and the level of production but the degree of correlation is low as its value ( $r$ ) is 0.239 (table-3). Further, simple regression analysis is tested to see whether there is significant impact of family size on the level of production. It is estimated that the impact of one percent increase in family size increases the level of production by 23.9 percent. However, t-test (1.701) shows that it is not statistically significant. Hence, we can conclude that family size doesn't have any significant positive impact on the level of plum production.

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<sup>1</sup> In the study, the number of workers is synonyms to family size.

Table-3: Impact of family size and educational level on the level of production

Independent Variable	Constant (a)	Regression Coefficient (b)	Correlation Coefficient (r)	r <sup>2</sup>	Std. Error	df <sup>2</sup>
Family Size	9.07	23.9 (1.701)	0.239	0.057	0.038	48
Educational level	8.55	-9.7 (0.678)	0.097	0.009	0.091	48

Dependent variable: Level of production

Note: The figure in the brackets is t-value, r<sup>2</sup> is the level of determinant and df<sup>2</sup> is degree of freedom at two levels

Source: Household survey, 2018

### ii. Education and level of production

Education is an important phenomenon in any level of economic activity. Similarly, education is an important factor in agricultural sector particularly in cash crops farming. Hence, it is felt imperative to examine whether the modern education has any positive impact on the level of production. Amongst the sample farmers, fifty-six percent studied up to high school, twenty percent primary school, sixteen percent illiterate, six percent graduate and two percent higher secondary levels (Annexure-1).

In the analysis, the level of education (class) is taken as independent variable, while the level of production is taken as a dependent variable. It is found that the correlation is negligible as the coefficient of correlation (r) value is as low as 0.097 (table-3). Further, regression analysis is used to estimate whether the level of education has significant impact on the level of production. It is resulted that the level of education has no significant impact on its production rather it is showing negative impact as the coefficient of regression (b) value is resulted to be -9.7 percent. Also, t-test (0.678) result shows that the impact of modern education on plum production is not statistically significant. Hence, it can be concluded from the study that the

modern education as a factor has no role on the plum farming in Enhulumi village.

### ***iii. Potential of plum in livelihood sustainability and development***

The cultivation of paddy in terrace is still occupied as the most important occupation and the main source of livelihood. The plantation of paddy in terrace is done in the month of June. During this time, farmers require finance for hiring labourers for cultivation; therefore, many families struggle due to their meager income. Also, June is the eighth month of post-harvest of paddy and thus many small cultivators fall short of food requirements. Hence, June is the crucial month for this rural village on these two accounts. Now, plum being harvested in the mid-May and early June, the income received from the sale of the fruit is a great relieve for the farmers as it could enables the farmers to procure necessary food stuffs and hire labours as well. It is estimated that on the average, a family receives Rs. 9000 from the sale of plum during one season (2019). However, there is a big uncertainty in the cultivation of plum as it solely depends on climate. Heavy wind and continuous downpour especially during the flowering season adversely affects setting of the fruit. The farmers have experienced such misfortune in the past where hailstorm has destroyed the flower which resulted in poor harvest.

### ***iv. Challenges of the plum growers***

Plum farming in Enhulumi village is not free from problem and challenges. It is obvious that weather is an uncertain phenomenon. It is found that there is no regulated marketing agency for the farmers. Also, large number of small farming and fragmentation is another problem in farm management. Organizing small farmers for marketing is another stress as it is not worth transporting less than two tonnes to the market due to heavy transportation charges. Failure to transport their produce

in time also leads to wastage as there is lack of warehouse and processing unit in the village.

The price stability is found to be missing. In the later part of the harvest, farmers fail to earn even their daily wage as the price in the market falls too low due to which they prefer the fruit to be left unharvested. Furthermore, the price of the fruits remains unknown to the farmer until it is sold in the market as the fruits are taken on credit by the farmer traders in the village and they are paid only after the fruits are sold in the market. Clearing of jungle and planting of saplings in the initial stage of farming requires financial investment as they need to hire labour and procure saplings, hence shortage of finance is another barrier to expand their farming. In addition, there is lack of technical support and poor infrastructural facilities along with the absence of post-harvest management system. Hence, these numerous challenges and problems need to be addressed so that the economy of the rural farmers will be uplifted.

## **Conclusion**

Plum is found to be a boost to the rural economy. The methods of cultivation being based on the traditional knowledge, the farmers are able to manage farming except from bad weather. The increasing production level and the expansion of new sites every year are worth noting for the upliftment of the rural economy. There is variation in the level of plum production among the farmers, yet, it is seen that the farming is expanding every year. About ninety-four percent of the household living in the village engaged in plum farming is another boom for plum cultivation vis-à-vis rural economy. It is also found that so far, the number of workers and the modern education have no significant impact on the level of production. This means the cultivation is primarily based on traditional knowledge and favourable agro-climatic condition. Hence, there is a scope for



expanding plum farming in this rural village. Also, it is worth mentioning that plum farming is an environmental friendly as there is no slash and burn for its cultivation.

However, it is found that the foremost requirement for livelihood sustainability is to facilitate farmers get price stability and harvest management of the fruit. To solve the wastages of the produce, the immediate need of the farm is to be equipped with regulated marketing agency which can transport the fruits till the end of the harvest. Also, facilitating price stability, setting up of processing unit, storage facility and construction of approach roads shall advance farming. The village being favoured by agro-climatic condition for plum and endowed with traditional knowledge of its cultivation; facilitating market management, technical support and financial aid shall definitely boost up plum farming. In conclusion, livelihood sustainability on plum farm single-handedly is fickle but it is beyond doubt that in addition to agriculture, plum has immense potential to boost up the economy of the rural people.

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**Annexure-1:** Distribution of respondents

Sl. No.	Particulars	Frequency	Percentage	
1	Family size	<3	9	18
		4-7	32	64
		>7	9	18
2	Annual income	5,000-10,000	32	64
		10,000-20,000	11	22
		20,000-30,000	2	4
		30,000-50,000	4	8
		50,000 and above	1	2
3	Education	Illiterate	8	16
		Primary	10	20
		High school	28	56
		Pre University	1	2
		Graduate	3	6

Source: Chirhah & Buruah, 2019.