ECONOMICS OF PRODUCTION AND MARKETING OF PINEAPPLE (*Ananas comosus*) IN KISHANGANJ DISTRICT OF BIHAR, INDIA

काशी हिन्दू विश्वविद्यालय BANARAS HINDU UNIVERSITY

THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF

Master of Science (Agriculture)
in
Agricultural Economics

Supervisor
Prof. H.P. Singh

Submitted by
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I.D. No. 19412AGE012 **2021** **Enrolment No. 417393**

Dedicated to
My Parents
and
My Brother

Dr. H.P. Singh
Professor

Department of Agricultural Economics
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Ref. No.: ..... ***Date: .....***

CERTIFICATE

To
The Registrar (Academic)
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Varanasi – 221 005

Through: The Head, Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, 221005

Dear Sir,

I have great pleasure in forwarding the thesis entitled **"Economics of Production and Marketing of Pineapple (*Ananas comosus*) in Kishanganj district of Bihar, India"**, submitted by ***Ms. Sharina Nasreen*** **(I.D. No. 19412AGE012)**, in partial fulfilment of the requirements for the degree of **Master of Science (Agriculture)** in **Agricultural Economics**, Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi and placing on record that she has completed the requisite residential requirements as contained in the statute of the University.

I certify that the entire scheme of investigation presented herein was planned and carried out solely by the candidate under my guidance and supervision. The data presented in the thesis, to the best of my knowledge and belief, are genuine and original.

Thanking you.

Yours faithfully,

FORWARDED

(Prof. H.P. Singh)
Supervisor

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DEPARTMENT OF AGRICULTURAL ECONOMICS
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***Date**:*

Place**: Varanasi* ***(Sharina Nasreen)

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LIST OF SYMBOLS AND ABBREVIATIONS

%	:	Percentage
/	:	Per
ADF	:	Augmented Dickey Fuller
AIC	:	Akaike Information Criterion
AM	:	Arithmetic Mean
ANOVA	:	Analysis of Variance
APMCs	:	Agricultural Produce Marketing Committees
AR	:	Auto Regressive
ARCH	:	Autoregressive Conditional Heteroskedasticity
ARMA	:	Auto Regressive Moving Average
ARIMA	:	Auto Regressive Integrated Moving Average
BC	:	Before Christ
BHU	:	Banaras Hindu University
C-D-V Index	:	Cuddy Della Valle Index
CV	:	Coefficient of Variation
EGARC	:	Exponential Generalized Autoregressive Conditional Heteroskedasticity
e.g.	:	For example
et al.	:	And others
etc.	:	And so on
FAO	:	Food and Agriculture Organization
Fig.	:	Figure

GARC	:	Generalized Autoregressive Conditional Heteroskedasticity
i.e.	:	That is
Max	:	Maximum
Min	:	Minimum
MMT	:	Million Metric Tonnes
No.	:	Number
R^2	:	Coefficients of Multiple Determination
SD	:	Standard Deviation
SIC	:	Schwarz Information Criterion
qtls	:	Quintals
viz	:	Namely

Chapter I

INTRODUCTION

Agriculture is demographically the broadest economic sector and plays an important role in the overall socio-economic structure of India. Horticulture is a major contributor of agriculture. In recent years, Indian horticultural production has increased substantially. Horticulture includes cultivation of fruits, vegetables and flowers. Fruits and vegetables represent almost 90% of the total horticultural production of the country. Fruit is a wonderful gift of nature to humanity. Fruit production plays an important role in employment, income generation, export and satisfying family nutrition security. The production and consumption of high quality fruits allows us to maintain a healthy and balanced daily diet. The commercial importance of fruits has increased globally because, in addition to their social and nutritional importance, they also make a significant contribution to the national economy.

Among tropical fruits, pineapple (*Ananas comosus*) is the second most important fruit in the world. The cultivation of pineapple originated in Brazil and gradually spread to other tropical regions of the world. In 1548 the Portuguese introduced its cultivation in India (Bender 2005). Currently, 85 countries around the world produce about 23.61 million tons of pineapple. In addition to being food, pineapple has always been a symbol and artistic theme for its natural sweetness throughout history. It is also used as a symbol of decoration, welcome and wealth. The rarity, reputation, and visual appeal of pineapples make it a quintessential exotic fruit. Pineapples are grown in areas where the climate is relatively uniform throughout the year and the yield is the best. Current production is still limited to the tropical regions of the world. The current total world production is 23 MMT, which is produced in about 80 countries around the world. Costa Rica is the world's largest producer of pineapples, accounting approximately 3.3MMT of the world's pineapple production followed by Philippines, Brazil and Indonesia. In 2013-14, India ranked seventh among the world's pineapple producing countries (Government of India, 2014).

The origin of pineapple is in Brazil, and it has gradually spread to other parts of the world. The demand for pineapples is increasing year by year. The highest proportion is still consumed in the form of fresh fruit (about 50%). There are some value-added pineapple products, such as pineapple sauce, juice, candy, jelly, candied fruit and vinegar. The global trade in fresh pineapples has doubled in the past ten years. Costa Rica, the Philippines, Brazil, Thailand, Indonesia, India, Nigeria, China, Mexico and Colombia are the top ten pineapple producers in the world. The main pineapple exporters are Costa Rica, the Netherlands, the Philippines, Belgium and the United States. The main importing countries are the United States, the Netherlands, China, Germany and Spain. The most popular pineapple varieties in the international market are MD2, Smooth Cayenne and Queen. Pineapples are grown annually using a main area of 84,000 hectares. Nepal, Maldives, the United Arab Emirates and Saudi Arabia are India's largest pineapple export destinations. The MD2 variety was developed by Costa Rica.

Pineapple (*Ananas comosus* L.) is one of the important commercial fruit crops in India. India's pineapple cultivation ranks sixth in the world, but its share of the global market is only 8%. India's production is 1,341,000 tons. The plantation area and pineapple production in India have increased significantly. The plantation area increased from 87,000 hectares in 2006-07 to 89,000 hectares in 2010-11, and the same yield increased from 1,362 million tons in 2006-07 to 1,415 million tons in 2010-11. The main pineapple producing states of India are Assam, West Bengal, Karnataka, Meghalaya, Kerala and Bihar. The largest pineapple producing area is in Assam and West Bengal has a high yield per hectare. In India, we grow two main pineapple varieties called "Kew" and "Mauricio". In the north-eastern states, they focus on the Kew variety, while in the south of the country, people focus on growing the Mauritian pineapple variety. The Queen variety is the best and can be used to prepare juices, concentrates, zucchini and pineapple pulp. Pineapple (*Ananas comosus*) is an important and inexpensive fruit crop, rich in vitamins A, B and C, and also contains a large number of essential nutrients for human health. In addition, a large number of high value-added products can be produced. If sauces, mixed jams, etc., provide profitable prices for farming communities in a sustainable way, it will also create employment opportunities for the unemployed rural population. Due to the importance of this crop,

the Government of India approved one-tenth of the Pineapple Exporting Agricultural Zone for the full development of pineapple producing areas. Generally speaking, pineapple prefers the humid tropical climate and sandy loam texture to produce the best quality fruits, but it can also be grown successfully in areas with an annual rainfall of 100 to 150 cm.

Only a few studies have compared climate change with pineapple cultivation. Williams et al. (2017) conducted a comparative analysis of the climate and changes in pineapple cultivation in Ghana. He found that variables such as temperature and rainfall have different effects on pineapple cultivation. The impact of the rains will have different effects during the sowing and growing stages. In their research, rain and pineapple yield did not produce higher correlation characteristics. There are risk factors for changes in rainfall patterns associated with the Ghanaian pineapple crop, and the growth of the crop depends on the availability of water in the environment.

As per APEDA, India's total area under pineapple production 88700 hectares and production is 1.4154 million tons. The largest pineapple acreage is in Assam (14,000 hectares), with average productivity. Total production in West Bengal is higher and productivity is also high. The productivity of Karnataka, Kerala and Meghalaya is much lower.

The commercial cultivation of pineapple began in India about 40 years ago. The hot and humid climate is suitable for growing pineapple. It can also be grown in rainy areas. In India, the main pineapple producing state is West Bengal (320,000 tons), followed by Assam (290.21 tons), Kerala (255,900 tons) and Karnataka (158.12 million tons). Karnataka has the highest productivity (62.49 tonnes / ha), followed by West Bengal (29.54 tonnes / ha), Bihar (27.64 tonnes / ha) and Kerala (27.36 tonnes / ha). (Summary of horticulture statistics in 2015).

Bihar is located on the river plain of the Ganges River Basin. The groundwater resources are abundant and the alluvial soil is fertile. This makes Bihar's agriculture rich and diverse. Rice, wheat and corn are the main cereal crops. Pigeon pea, black-gram, green-gram, chickpea, peas, lentils and khesari are some legumes grown in Bihar. Bihar is the largest vegetable producer, dominated by potatoes, onions, brinjal and cauliflower. In the cultivation of fruits, it is the largest producer of lychees and the third

largest producer of pineapple, as well as being the main producer of mangoes, bananas and guavas. Sugar cane and jute are the other two main cash crops in Bihar. Pineapple cultivation in Bihar started in the Kishanganj district only a few years ago. However, almost 5,000 acres of pineapple are being planted in the Thakurganj and Pothia blocks in the area.

Although growing pineapple requires an investment of Rs 130,000 to Rs 150,000 per acre, the farmer's harvest per acre is between Rs 360,000 and Rs 420,000. However, it has yet to spread to other places in the area. In addition, the edaphological and climatic conditions, with a temperature that ranges between 15 and 35 degrees Celsius, are very suitable for growing pineapple inside the farms in this area. The temperature difference between day and night is four degrees, which is a miracle for pineapple cultivation. Considering the aforementioned, following objectives were decided to conduct a thorough research and explain various factors related to pineapple cultivation.

The specific objectives of the study were:

1. To estimate the costs and returns of pineapple production in study area.
2. To examine the resource use efficiency of pineapple production
3. To study the disposal pattern of pineapple
4. To study the marketing pattern of pineapple in the delineated area
5. To document the constraints in production and marketing of pineapple in study area.

Limitations of the study

1. This research is based on raw data. Because data is collected using survey methods, the inherent loopholes associated with this type of research must have penetrated the research. When possible, we sincerely strive to obtain accurate and reliable information through cross-examination. However, since the estimates provided are averages, the degree of difference (if any) is negligible.
2. However, it can be recognized that the research results do not need to be promoted outside the study area, nor do they need to be applied to other

situations with similar agro-climatic and socioeconomic conditions.

3. This study is related to pineapple, which is a perennial crop with a long gestation period and a long economic life. Farmers have no records and it is difficult to collect data based on withdrawals.

Chapter II

REVIEW OF LITERATURE

A review of previous research aids in identifying the study's conceptual and methodological difficulties. There have been very few research on pineapple and thus the study on economic analysis of pineapple has become crucial. This would allow the researchers to gather data and apply logical reasoning and meaningful interpretation to the cultivation of pineapple. This chapter provides a brief overview of previous research works linked to the current subject. The evaluations are organized under the headings below, with the aims of the current study in mind.

2.1 Costs and returns of pineapple production

2.2 Resource utilisation efficiency in pineapple production

2.3 Disposal pattern of pineapple

2.4 Marketing analysis of pineapple

2.5 Constraints in pineapple production and marketing

2.1 COSTS AND RETURNS OF PINEAPPLE PRODUCTION

Chakraborty and Bera (2008) revealed that with the increase in the operating holdings of various groups, the total returns are increasing. The total yield obtained by farmers belonging to all farm size groups is estimated at Rs. 149 750.62 per acre. The yield per acre under different cost concepts (i.e. cost A, cost B and cost C) is Rs. 54228.26, Rs. 34278.40 and Rs. The 30646.39 and cost of return indices are approximately 1.57, 1.29, and 1.26, respectively. In summary, due to the increase in the amount of cost in each stage, it was found that the amount of return per acre under different concepts of cost and return-to-cost ratios decreased in the later stages.

Jomy (2015) computed the profits measures of pineapple cultivation in Kerala for first, second and third year. In the first year gross profits was worked out at 25716 per ha for small farms, 355515 per ha for medium farms and 328496 per ha on aggregate level. The diverse profits measures in the first year pineapple cultivation display that medium farms acquire extra returns than small farms. In the second one year, gross

profits for the small farms become computed at 216038 per ha, 280291 per ha for medium farms and 260038 per ha for all farms. In the third year gross profits become worked out at 160045 per ha for small scale, 228353 per ha for medium scale and 204696 per ha for all farms. The net profits is about 15 per cent of the gross profits of small farms and 32 per cent of the gross profits of medium farms.

He concluded that each farm commercial enterprise profits and net profits are more in medium farms than in small farms in all of the 3 years of cultivation.

Singh (2015) reported that an analysis of the costs and benefits of pineapple cultivation in Manipur state shows that the costs and benefits in summer are higher than those in winter. In these two seasons, costs and profitability increased with the increase in farm size (Rymbai et al., 2013). The cost-benefit ratio in winter is higher than in summer. The C2 cost of the small category is 99775.73, the medium category is 120316.77, and the large category is 150843.72. The A1 cost accounted for 64.59%, 65.48% and 68.08% of the total cost of small, medium and large planting respectively.

Sharma (2016) found that in the average situation of a farm, the total cost of pineapple production per hectare is estimated at Rs. 37116.54. From the perspective of total cost, the share of fixed costs is 4.80% and the remaining part is shared by variable costs (95.20%). In terms of average variable costs, the average labor participation is the highest (55.09%), followed by the cost of seed (15.07%), the cost of transportation (14.26%), the interest on working capital (6.98%) and finally the marketing cost (8.60%)) calculate. The rental value of the land is further calculated as the average total of the 45.31% fixed cost items. The value of the hired labor is Rs. Among the various items of the production cost of pineapple A1, it was found that 13036.67 per hectare was the highest.

Waziri-Ugwu (2017) indicated that 46.26% of the total variable cost was recorded for the acquisition of suckers. Land preparation which is a pre-planting operation recorded 11.12%; fertilizer and transportation recorded 16.31 % and 3.34% respectively. Planting operations, weeding operations and harvest operations accounted for 11.12%, 7.41% and 4.44% respectively.

Balogun *et al*., (2018) showed that labour represents the highest proportion of total pineapple production costs (23.2%), while transportation and suction cup costs represent 21.4% and 20.0%, respectively. However, the rent from the land used by the pineapple farm and the cost of agricultural tools accounted for approximately 5.6% and 18.7% of the total cost, respectively. The variable cost benefit of pineapple production is 3.32, which means that for every dollar invested in production, you can make a profit of about 3.3. The gross profit margin and operating index are 0.21 and 0.25, respectively, which means that pineapple planting is a profitable business.

Sanni and Yosuf (2020) revealed in their study, the purchase cost of pineapple fruits in the off-peak season accounts for 93.3 percent of variable cost and 98.5 percent of total cost for wholesalers and retailers, respectively. In contrast to the results obtained in Edo state, it is important to emphasise that the cost of transportation was minor in wholesale marketing (0.5 percent) when compared to retail marketing (1.1%). In addition, no storage cost was incurred in both wholesale and retail marketing in the FCT.

Sivakkolundu (2021) showed marginal farmers were ranked first in terms of pineapple yield, which was calculated to be 8015 kg per acre. Small farmers are in second place in terms of pineapple yield, with 7632 kilogrammes per acre calculated. The large farmers come in third place in terms of pineapple yield, with a figure of 6985 kg per acre. Medium growers come in fourth place in terms of pineapple yield, with an average of 6890 kg per acre.

2.2 RESOURCE USTILISATION EFFICIENCY OF PINEAPPLE PRODUCTION

Juan (2013) showed that all the estimated coefficients of the stochastic frontier function have a positive effect on the output, and they are all statistically significant. The reported diseconomies of scale are estimated to be 0.71, which means that doubling pineapple production per acre will require twice as much labour, seeds, and fortifications. However, the average technical efficiency achieved by this sample of farmers is 76%.

Riatania (2014) concluded that the average annual pineapple production produced by farmers is 5.6 tons, with a standard deviation of 10,582.1, indicating the difference in production between farmers. The average land area for farmers to grow pineapple is 0.68 hectares, and the average seed use is 24,372.9 bunches per hectare. The average labour force employed is 219.4 working days, indicating that farmers are still labour intensive and that most planting activities are only carried out by farmers. The average use by the farmer of other production inputs such as ethephon, manure and chemical fertilizers is 1.6 litres; 9,603.9 kg and 347.3 kg per year, respectively.

Thingbaijam (2015) reported that in all cases, the relatively high value (> 0.97) of the adjusted multiple determination coefficient (R^2) confirms the validity/reasonability of the 4 explanatory variables, namely sucker (X^1), manure and fertilizer (X^2), plant Quarantine chemicals (X^3) and manpower (X^4) affect pineapple productivity. In addition, the production elasticity of all categories is found to be> 1.00, indicating the possibility of increasing returns to scale.

Adegbite and Adeoye (2015) showed that when MVP>MFC, the suction cup was not fully utilized, and when MVP<MFC, fertilizer, labour and soil were overused. MFC. However, for the production input of MVP <; MFC, it is necessary to reduce the level of resource use until the marginal value product and marginal factor cost of each resource reach equilibrium, in order to achieve the optimal allocation of resources (i.e. MVP=MFC).

Waziri-Ugwu (2017) remarked that the resource utilization efficiency P1 (farm size = 1.2) of the farmers in the study area is underutilized because the efficiency index is greater than 1. The costs of planting material, the costs of the hand of work, fertilizer costs and equipment costs are overused as their index is less than 1. For farmers to reach the optimum level, the amount of resource overuse must be reduced until the value product marginal is equal to the cost of the marginal factor of the resource, thus maximizing profits.

2.3 DISPOSAL PATTERN OF PINEAPPLE

Mathew S *et al.,* (2018) observed that, the total quantity of pineapple produced in the first year was 264.40 q. In the second year, there was production of suckers from

the mother plant. The total quantity of pineapple and suckers produced were 286.93 q and 40513 numbers. Out of the total number of suckers produced, 47.08 per cent were used in farm as ratoon and 2.12 per cent of them were discarded due to poor quality. The quantity of pineapple sold was 282.81q (98.56%) and 20579 (50.79%) number of suckers were sold. In the third year total quantity of pineapple and number of suckers produced were 191.1 q and 38685 respectively. The final quantity of pineapple sold was186.34 q (97.55%) and 36905 suckers (95.39%). The analysis above shows that the marketable surplus of the products is higher over the three years, which is an important reason for the profitability of the pineapple growers in the study area.

2.4 MARKETING OF PINEAPPLE

Anonymous (1984) performed a study on essential fruit vegetation of Meghalaya which incorporates pineapple, grapes, apricot, peach and pomegranate. Production and marketing of pineapple in Meghalaya, mentioned in the report specially included sale of placing crop to contractor, special care in the course of harvesting, sorting and packaging of suitable quality pineapple fruit of highlands of Meghalaya.

Singh et.al. (1990) carried out have a look at on marketing of pineapple in north Tripura. They recognized special marketing channels in marketing of pineapple namely,

1. Producer → village cooperative → TSIC (processing) wholesaler → retailers→ consumers.
2. Producer → trader → retailer → consumers.
3. Producer → nearby beoparis → wholesaler (82-miles market) → retailer → consumers.
4. Producer → trader → commission agent → wholesaler → retailer → consumers.

Majority of the farmers advertised through channel III.

Sarkar (1996) attempted to study the marketing of pineapples in selected areas of Moulavi Bazar district. He found that pineapple production is governed by capital, proper agricultural management techniques, scientific knowledge and fertilizer supply.

Rani et.al. (2005) investigated the existing pineapple marketing features in Andhra Pradesh's Vishakapatnam area. The following two marketing channels were found in the study region for the marketing of pineapple fruits.

Producer → wholesaler → retailer → consumer (channel 1)

Producer → retailer → customer (Channel 2)

The research also discovered that channel 2 was a relatively new channel and efficient when compared to channel 1

Ingale (2007) conducted a research on the "production and disposal of jackfruit in the southern area of Kangkan" and observed that jackfruit reached consumers through three different channels.

1. Producer → Consumer
2. Producer → pre-harvest contractor → consumer
3. Retail → producer → consumer.

Of the three channels, the largest number of producers sold through pre-harvest contractors. He also noted that jackfruit producers are in a better position to get the price per kilogram on Channel II.

Keerthi (2008) transportation cost was round 63.74 % of total marketing cost incurred by wholesaler i.e Rs.4470.7. commission agents were also responsible for raising the overall marketing cost and received a share of 14.03%. Other costs like loading and unloading charges, equipment charges, labour charges etc. contributed very less towards the overall marketing cost. The presence of an extra market intermediary reduced the producer's share in consumer's rupee. Farmers preferred to sale to wholesalers owing to greater market fluctuations.

Olayinka (2013), in a study of the profitability and limitations of the production of pineapples in Osun state, Nigeria, found that the return on investment of farmers was only 8 Kobo. Although the study was conducted in a different state, he indicated that farmers' share of consumer spending was small. He also showed that the profit of intermediaries reported earlier in this study is much higher than that of pineapple producers. The lack of improved planting material, the low production capacity of

technology and the perishability of the fruit were the reasons for the low profit of the pineapple producers

Yusi (2016) marketing analysis shows that farmers who use the shortest distribution channel to sell pineapples have a greater contribution than the other two types of farmers. Therefore, when using marketing efficiency analysis, the shorter the distribution channel, the higher the efficiency. The highest profit and cost profit of this channel comes from local wholesalers. Shorter marketing channels will provide farmers with greater benefits as producers.

2.5 CONSTRAINTS IN PINEAPPLE PRODUCTION

Malcom (1999) pointed out that the perishable nature of pineapple is the main limitation for the production and commercialization of pineapple. The analysis of fruit loss during commercialization shows that the percentage of loss after harvest is as high as 70%. In addition, considering that the number of emerging industries that use pineapple as a raw material, the marketing of pineapple is not an exaggeration. However, the main feature of pineapple is that it is perishable, and the output and quantity of are seasonal.

Padmini (2002) identified the problems faced by pineapple growers in Kerala in their research. The study revealed the main problems faced by pineapple producers, such as the high costs of chemical and biological fertilizers, lack of financial assistance, high labour costs, and insufficient fertile land.

Hiremath (2005) pointed out that lack of processing facilities, lack of cold storage facilities, and price fluctuations are the main problems expressed by farmers. Other problems are lack of cooperative marketing, lack of packaging availability, materials at reasonable prices, transportation difficulties, and lack of adequate supply. A shortage of affordable credit limits the agricultural growth of pineapple production.

Rahman *et al.,* (2005) examined the restriction of pineapple production in Edo State, Nigeria. Farmers consider a series of restrictions, such as insufficient credit facilities, weather and disease, poor road network, high transportation costs, lack of land, poor inputs and extension services as obstacles to pineapple production in the study.

Seetha and Shivaraj (2006) studied "The production and marketing of fruits and vegetables in Karnataka" pointed out that an effective transportation system needs to be developed to quickly obtain and distribute products.

Chakraborty and Bera (2008**)** in their study reported that pineapple cultivation appears to be capital intensive but also labour intensive. The total cost of growing pineapple is estimated at Rs. Yield of 119,104.23 per acre and cost C is calculated as Rs. 30,646.39 / acre, when all sample farmers from different farm size groups are put together, the cost-of-return ratio is 1.26, but the planting cost, total return, net return, and cost ratios of return of different farm sizes are very different groups.

Olainka (2013) studied the economics of growing pineapple in Osun State, Nigeria. The main limitations of pineapple production in the study area are the shortage of high-quality planting materials, the perishable fruit, the low price of pineapple, the inability to obtain credit, and the plant diseases such as heart rot.

Roy *et al.,* (2013) identified technological gaps in pineapple cultivation among farmers in selected areas of West Bengal, and found that a lack of understanding of new pineapple growing techniques hampered pineapple production in the state.

Sharma (2016) stated that constraints reported are the lack of processing units / facilities (88.33%), problems related to marketing (85.00%), lack of training programs and lack of funds and capital facilities (78, 33%), lack of government support (73.33%), transportation facilities and their cost (70.00%), lack of classification and classification facilities and intermediaries to participate in the commercialization of products (66.67%), lack of own resources (55.00%), lack of technical knowledge and knowledge for harvesting (48.33%), cost of seedlings (30.00%), pineapple diseases and insect pests (25.00%) and insufficient seedlings (16.67%) . The severity of these problems is greater in the smallest group on the farm.

Waziri-Ugwu (2017) indicated that the variables in the regression results show that the cost of planting materials and fertilizer costs are negatively significant, and the farm size, labour costs, and fertilizer costs are all positively significant. The F-Ratio is 41.017, which indicates the overall importance of regression. Farmers complained about lack of credit facilities, poor road network and lack of extension services, high transportation costs and high cost of obtaining land.

Faiyaz *et al*., (2018**)** Shows that there are differences in productivity between states. It can be seen from the different studies carried out by different scholars that there is a lack of adequate agricultural management techniques, a lack of financial support to purchase chemical and biological fertilizers, and a lack of understanding of farmers' updating pineapple planting techniques, especially in Nagaland, Manipur and Meghalaya. In addition, pineapple growers in West Bengal, Bihar, and Orissa also lack financial assistance.

Jaji *et al.,* (2018) showed that the six factors (access to credit, pineapple variety, distance, input cost, product price and promotion service) together explain 71.181% of the total variability of factors affecting the supply of pineapple, as well as factor loading, eigenvalues, percentage of variance, and Cronbach α. The factor loadings of the elements of the six-factor solution range from 0.676 to 0.909.

Thomas and Dinesh (2020) revealed the floods in Kerala in 2018 affected most of the state's agricultural products. In case of pineapple, only 5% of the plants were submerged in water, but most of them were affected by different diseases and even cause deformations in the crop. The floods seriously affected the quality of pineapple, causing prices to fall sharply.

Sanni and Yosuf (2020) showed that the marketing of pineapple is restricted by the perishable fruit, high transportation cost, lack of processing and storage facilities, and difficulty in obtaining working capital. Pineapple traders and other stakeholders should step up their efforts, including all three levels of government and private entrepreneurs in the pineapple value chain, to establish small-scale processing facilities to reduce loss rates and improve market efficiency.

Sivakkolundu (2021) expressed restrictions include high planting material costs, delayed payments, market price fluctuations, high loan costs, insufficient labour, weighing problems, lack of sorting facilities, pineapple heart rot, lack of timely credit, insufficient electricity for irrigation, and impossibility of market information Insufficient use, cold storage facilities, inability to supply fertilizers on time, inability to provide planting materials in, lack of supervision of the market, and lack of technical knowledge.

Chapter III

RESEARCH METHODOLOGY

For any research to achieve the stated objectives, a sound investigation method and adequate analytical tools are essential to draw meaningful inferences and generalize the results of the analysis of the collected information. Therefore, this chapter involves the interpretation of databases, sampling procedures, analysis frameworks, models, important concepts related to research, and descriptions of research areas. This chapter is subdivided into the following subsections:

3.1 Sampling procedure

3.2 Study area

3.3 Collection of data

3.4 Analytical tool

3.5 Concepts and definition

3.1 SAMPLING PROCEDURE

Multistage random sampling technique was adopted to select the respondents. Data required for the present study were obtained both from primary and secondary sources. Primary data was collected from pineapple farmers by direct interview method with well structured, pre tested schedule prepared exclusively for this study. The secondary data were collected from published books, journals, magazines, websites and different government offices.

Period of the Study

The data were collected from the selected farmers during the agricultural year 2020-21, starting from June, 2020 to May, 2021 for all seasons.

Source and nature of data

Personal interview method has been employed for collection of data with the help of a pretested comprehensive interview schedule. The usefulness of the study is explained to the farmers prior to enquiry to elicit their cooperation. Primary data related

to socio-economic conditions of the sample farmers like age, education, size of the family, number of dependents, cropping pattern, size of operational holdings, existing farming system etc. Information on cost of cultivation, inputs used, yield of crops, price of output, expenses and income from different enterprises were also gathered.

Besides this, secondary data on land utilization pattern, area under principal crops, agro-climatic conditions, rainfall, population, workforce, size of holdings, irrigation sources, livestock population etc. were also collected for the study from the records of the State Development Departments, Directorate of Economics and Statistics and Directorate of Census.

3.2 THE STUDY AREA

- Profile of study area: a research programme requires the knowledge of the area in which an investigation is to be carried out. General characteristics of the study area facilitates the discussion with regards to similarities and variations of different components.
- Selection of district: to achieve good representative region for the issue being studied, a study area where the population is economically backward and disadvantaged is important. This prompted for selection of an area with economically backward population and predominance of pineapple farmers. Kishanganj, one of the most backward districts of Bihar, stands at the bottom of the 90 minority concentration districts. It has predominance of pineapple farmers which prompted the choice of this district as study area.

Table 3.1: Concentrated pockets of pineapple in Bihar

State	**Districts**
Bihar	Purnia, Kishanganj, Saharsa, Madhepura

Selection of block

Kishanganj district comprises of seven blocks namely Kochadhaman, Thakurganj, Pothia, Bahadurganj, Kishanganj, Dighalbak, Techagachh. Among all the

aforementioned blocks, Thakurganj and Pothia were selected purposively due to prevalence of pineapple cultivation and its commercial scale production for the study.

Selection of village

Out of 774 villages in district Kishanganj, 25 villages of the block Thakurganj and Pothia were randomly selected for the study and random sampling from each village was done. Categories of farmers were made according to the pre decided classification that is

- Marginal farmers (<1 hectare),
- Small farmers (1 to 2 hectare),
- Semi-medium farmers (2 to 4 hectare),
- Medium farmers (4-10 hectare)
- Large farmers (>10 hectare).

3.3 COLLECTION OF DATA

Data was collected using both primary and secondary sources:

- Primary sources included telephonic interview of farmers and limited personal interview owing to CoVID norms with pre-designed schedule. Data included information about land owned and land leased in, source of irrigation and irrigation cost, use of manure and fertilizers etc.
- Secondary sources data consisted of data from KVK Kishanganj, Kishanganj block office and Dr. Kalam Agricultural College, Kishanganj (Department of Agronomy). Data was also collected from Bihar Agricultural University (Department of Agricultural Economics, BAU, Sabour) and ADA office.
- Construction of interview schedule -A comprehensive schedule was prepared for the collection of information from the respondents keeping in view the objective of study. Before starting the data collection work thorough examination was done from the respondents in the study area.

3.4 ANALYTICAL TOOLS

In accordance with the objectives data were analysed using both Descriptive statistics and functional analysis

- Descriptive statistics: Simple statistical techniques such as average and percentage was applied to analyse the data.
- Functional analysis

Cost and Returns in field crop enterprise

Total costs were divided into two broad classes, viz. variable costs and fixed costs. Variable costs include cost incurred on seed, manures and fertilizers, plant protection chemicals, expenses on irrigation, labour charges, interest on working capital and miscellaneous charges, whereas fixed cost include land revenue, depreciation on farm implements and interest on fixed capital investment. The method adopted for computing the different cost items are described below.

Variable Cost

- **Seed/planting material:** Farm produced seed has been valued at the prevailing market prices at the time of sowing in the region and purchased seeds has been considered at actual rates paid by the sample farmers.
- **Farm yard manure and vermin-compost:** Farm yard manure was valued at the price prevailing in village. Thus, quantity of farm yard manure, vermin-compost, purchased by farmer was valued at actual price paid by sample farmer.
- **Labour:** The hired male and female labourers were paid at the prevailing wage rates per day (eight hours) in the study area.
- **Fertilizer and plant protection chemicals:** The cost of fertilizers and plant protection chemicals were considered on par with the amounts actually paid by the sample farmers.
- **Miscellaneous costs:** Miscellaneous costs include repair charges, cost of vermicompost, etc. were compared as per rates actually paid by the sample farmers.

- **Interest on working capital:** Interest on working capital was calculated at the rate of 4 per cent per annum.

Fixed Costs

- **Land revenue:** Land revenue was calculated at the rates levied by the Government.
- **Land rent:** Rental value of land was calculated as per the prevailing rate in the study area.
- **Interest on fixed capital:** This was calculated at the rate of 12.00 percent per annum on the book value of the asset/ livestock, as the case may be for the study area.
- **Depreciation charges:** The depreciation rates, life span and junk value for various agricultural implements and machinery, fishing equipment etc. were decided in consultation with the farmer. Consequently, the depreciation was calculated using the straight line method and charged to specific crops for which the article was used. In case of articles used for more no of crops, the cost was apportioned on the basis of area.

$$\left[\text{Depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Expected life span}}\right]$$

Returns

The price received by farmers on sale of pineapple and/or pre harvest contract money was used to calculate gross returns.

Analytical Techniques

This provides the simplest and most intelligible tool to analyze the existing level of farming. This technique is employed to analyze the demographic features, land use pattern, cropping pattern, input use pattern, livestock production, cost of production, gross returns and net returns from different farm products. The data are analyzed using averages, percentages and ratios techniques. The cropping intensity is worked out to examine the extent of multiple cropping.

Net present worth

This criterion assesses the present worth of accrued benefits over costs. The criterion ranks the investments for selection among the alternatives, as well as indicates the order of preference to be given. In calculating the net present worth, the difference between the present value of cost streams and present value of benefit streams were considered at a discount rate of 15 per cent which is the rate advocated by the World Bank for agricultural projects in the developing countries.

Cost concept

Cost A_1 = All actual expenses incurred in the production of pineapple crop.

1. Value of hired human labour
2. Value of owned and hired bullock labour
3. Value of owned and hired machine labour
4. Value of sucker, irrigation charges,
5. Value of insecticides, pesticide and herbicides,
6. Value of manure and fertiliser,
7. Depreciation on implement and farm building,
8. Land revenue
9. Interests on working capital
10. Other taxes

Cost A_2 = Cost A_1 + Rent paid for leased in land

Cost B_1 = Cost A_2 + interest on fixed capital excluding Land

Cost B_2 = Cost B_1 + Rental Value of owned land

Cost C_1 = Cost B_1 + Imputed value of family labour

Cost C_2 = Cost B_2 + Imputed value of family labour

Cost C_3 = Cost C_2 + 10% of Cost C_2 as managerial cost

Resource use efficiency

Cobb Douglas production function

This is used to examine factors affecting value productivity of pineapple

$$\log Y = \log A + \sum_{i=1}^{n} bi \log x_i \ + u$$

log Y =log A + b_i logx_1 +b_2 log x_2+ ……+b_6 log x_6 + u

Y =Yield

x_1 =Seed

x_2 =human labour

x_3 =plant protection

x_4=machinery use

x_5=water use

x_6=urea

Multiple linear regression can be utilised for evaluating resource use efficiency as

Y =b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b5x5 + b_6x_6

Where Y = Yield

x_1 = seed

x_2 =plant protection

x_3=machinery use

x_4=water use

x_5=urea use

x_6 = Labour

Statistical significance of estimates

To test statistical significance, t- value of the estimates was worked out at (n-k) degrees of freedom .The t- value of regression coefficient (bi) were worked out as:

$$t_{(n-k)} = \frac{b_i}{S.E(bi)}$$

SE= Standard error

Coefficient of multiple determination (R^2)

It was worked out to estimate the proportion of variation in total output or gross return per hectare explained by different explanatory variables taken together in analysis. Statistical significance of R^2 which examine goodness of fit of function was tested by working out F-ratio as follows:

$$F = \frac{R^2/k}{(1-R^2)(n-k)}$$

R^2 =value of coefficient of multiple determination

n=no. of observation

k =No. of parameters included in study

Marketing cost– It means actual expenses incurred during the marketing process.

$$C = C_f + \sum_{i=1}^{n} Cmi$$

Where,

C = total cost

C_f = cost paid by producer

C_{mi} = cost incured by i^{th} middleman

Marketing margin

$A_{mi} = P_{ri} – (P_{pi} + C_{mi})$

A_{mi} = absolute margin of 8 middleman

P_{ri} = total receipts/ sale price

P_{pi} = purchase value of goods / cost price

C_{mi} = cost incurred by i^{th} middleman

The various marketing margins are estimated by using the following formula:-

(1) Absolute margin= Sale price – Purchase price

(2) Net margin = Absolute margin – Marketing cost

(3) Percentage margin = (Absolute margin / Sale price)*100

(4) Mark-up = (Absolute margin / Purchase price)*100

Producer's share in consumer's rupee- it is the price received by the farmer expressed as a percentage of the retail price (i.e. price paid by the consumer). If P_r is the retail price, the producer's share in consumer's rupees (P_s) may be expressed as follows:

$$P_s = (P_F / P_r)*100$$

Economic Efficiency

$$\text{Marketing Efficiency} = \frac{\text{Consumer's Price}}{\text{Marketing Cost} + \text{Marketing Marging}}$$

Shepherd's method is employed to calculate economic efficiency

The higher the ratio the higher is the efficiency of marketing system which is calculated using

$$ME = V/I$$

Where V = value of produce sold

I = total marketing cost

And ME = marketing efficiency

Garrett's ranking technique

In this method, respondents were asked to rank the specific problems faced by them according to their own perception. The assigned rank was converted into percentage position which is subsequently transferred into Garrett score using Garrett's table. For each constraint, scores of individual respondents were added together and then divided by total number of respondents. Thus, mean score for each constraint has been ranked by arranging them in descending order (Rahaman and Haldar, 2014, De and Rahaman, 2014; Rahaman *et al*., 2015; Rahaman *et al*., 2013; Rahaman *et al*., 2019).

$$\text{Percentage position} = \frac{100(R_{ij} - 0.50)}{N_j}$$

Where,

R_{ij} = Rank given for the i^{th} item by the j^{th} individual and

N_j = Number of items ranked by the j^{th} individual.

The mean scores for all the factors were arranged in order of their ranks and inference were drawn.

Variability in area and production of Pineapple

Variability is computed using Cuddy Della Valli index .Since coefficient of variation over estimates the level of instability in time series data, this Index was used as it corrects CoV.

$$CV = \frac{Standard\ deviation}{Mean} \times 100$$

3.5 CONCEPTS AND DEFINITIONS

1. **Commercial Crop :** Crop produced for commercial purpose that is for sale in the market and/or for consuming in home is known as commercial crop.
2. **Cost of cultivation**
    - Paid out cost- hired labours, input cost depreciation, land revenue
    - Imputed cost- value of family labour managerial input of family, rent of owned land.
3. **Cost of Production :** All the expenses that incur in production of a crop in a field is called cost of production. It includes operational cost, material cost and other costs.
    - Operational cost- it includes the costs of field preparation (ploughing, harrowing, planking, ridge making), planting, manuring, fertilizer application, irrigation, hoeing/weeding, plant protection, harvesting, picking, grading, loading/unloading and transportation.

- Material cost- Costs of materials like suckers, manure, fertilisers, weedicides, irrigation charges, insecticides/fungicides are included in material cost.
- Other cost- this part includes the costs like interest on working capital, depreciation on general far machinery and implements, land revenue and rental value of land.

4. **Economic efficiency :** It is a broad term which assumes minimum cost for the production of goods or services maximum output and maximum surplus from operation in market. It is a situation in which nothing can be improved without something else being hurt.
5. **Resource use efficiency :** It is defined as the output of any crop per unit of the resource applied under a specified set of soil and climatic conditions. It includes the concepts of technical efficiency, allocative efficiency and environmental efficiency.
6. **Marketing channel :** Routes through which products get to end user the consumers. It consists of people organisation and activities necessary to transfer the ownership of goods from point of production to point of consumption.
7. **Marketing cost :** Cost that is directly related to selling of a product service or brand. It is the actual expense in bringing products from producer to consumer.
8. **Marketing margin :** It is characterized as some of the function of difference between return and farm price of a given farm product. It is intended to measure the cost of providing marketing services.
    - Concurrent margin- it is the difference between prices prevailing at successive at successive stages of marketing at a given point of time.
    - Lagged margin- it is the difference between the price received by a seller at a particular stage of marketing and the price paid by him at the preceding stage of marketing during an earlier period.

9. **Price Spread :** It is difference between the price paid by the consumer and net price received by the producer for an equivalent quantity of farm produce after deducting marketing cost incurred by him.
10. **Markup price :** It is the value added by a particular intermediary to the cost price of a product
11. **Producer's share in consumer's rupee :** It is the price received by the farmer expressed as a percentage of the retail price (i.e. price paid by the consumer).
12. **Pre-harvest Contractor :** Pre-harvest contractor enter into a contract with the producer for a given period under negotiated terms and conditions. He evaluates the total value and market condition well in advance and contract is based on it.
13. **Wholesaler :** Wholesaler are those middlemen who buy and sell food grains in large quantities. They may buy either directly from farmers or from other wholesalers. They sell products either in same market or in other markets. They sell to retailers, processors and other wholesalers.
14. **Retailer :** Retailers buy goods from wholesalers or directly from farmers and sell them to the consumer in small quantities. They are producer's personal representative to the consumers. Retailers are closest to consumer in the marketing channel.

Chapter IV

DESCRIPTION OF THE STUDY AREA

The description of study area provides comprehensive knowledge of the field, so it helps to better understand the research problem and improve the results of the concluding comments. This chapter provides information on the agricultural economy of Bihar, such as general situation, geographic location, agro-climatic conditions, land use patterns, and irrigation conditions, so that we can understand the state's production and consumption patterns.

4.1 PROFILE OF BIHAR

Bihar state is located in the eastern part of the country and falls in the coordinates of 24°-20'-10" to 27°-31'-15" North latitude and 83°-30' to 88°-00' East longitude. It is an entirely land–locked state, although the outlet to the sea through the port of Kolkata is not far away. Bihar lies mid-way between the humid West Bengal in the east and the sub humid Uttar Pradesh in the west which provides it with a transitional position in respect of climate, economy and culture. It is bounded by Nepal in the north and by Jharkhand in the south. The Bihar plain is divided into two halves by the river Ganga which flows through the middle from west to east.

The climate of Bihar varies from tropical to subtropical. Generally, there are three distinct seasons within a year viz. summer from March to May, rainy season from June to September with post monsoon rainfall in October and winter from December to February. The average temperature of this state varies from 27^0 Celsius to 30^0 Celsius in summer and 8^0 Celsius to 16^0 Celsius in winter. Monsoon season is June-September. The yearly average rainfall of Bihar is 1200 mm. The topography of Bihar can be easily described as the Gangetic Valley occupying the fertile alluvial plain. The plain extends from the foothills of the Himalayas in the north to a few miles south of the river Ganges as it flows through the State from the west to the east. Rich farmland and lush orchards extend throughout the state. Based on soil characterization, rainfall, temperature and terrain, four main agro-climatic zones in Bihar have been identified (table 4.1). These are North West Alluvial Plain (Zone I), North East Alluvial Plain (Zone II), South East

Alluvial Plain (Zone III A) and South West Alluvial Plain (Zone-III B). Agro climatic zone I and II is located north of the river Ganges whereas the Zone III is located south of the river Ganges. Zone I is situated in the north western part of the state whereas zone II is located in the north eastern part. Zone I and II is flood prone whereas zone III is drought prone.

Bihar is one of those few states which experienced severe pressure of population on land since the partition of the country. It is the third highest populated state of India after Uttar Pradesh. The state, comprises of 38 districts (199 towns and 45,103 villages) and with a population of over 10 crores (8.60 percent of national total) of people. The population density of Bihar is 1106 persons/ sq.km that also far higher than the national level of 382 persons/sq.km (table 4.3)

Table 4.1: Distribution of districts of Bihar under each Agro-Climatic Zone

Agro-Climatic Zone		**Districts**
I	North West Alluvial Plain	West Champaran, East Champaran, Siwan, Saran, Sitamarhi, Sheohar, Muzaffarpur, Vaishali, Madhubani, Darbhanga, Samastipur, Gopalganj, Begusarai
II	North East Alluvial Plain	Purnea, Katihar, Saharsa, Supaul, Madhepura, Khagaria, Araria, Kishanganj
IIIA	South East Alluvial Plain	Sheikhpura, Munger, Jamui, Lakhisarai, Bhagalpur**,** Banka.
IIIB	South West Alluvial Plain	Rohtas, Bhojpur, Buxar, Bhabhua, Arwal, Patna, Nalanda, Nawada, Jehanabad, Aurangabad, Gaya.

The zone wise important physiographic characteristic of different agro-climatic zones of Bihar is presented in table 4.2

Table 4.2: Important Physiographic features of different agro-climatic zones of Bihar

Agro-Climatic Zone		Type of Soil	pH	Rainfall (mm)	Temperature (^{0}C)	
					Max.	Min.
I	North West Alluvial Plain	Sandy loam, loam	6.5–8.4	1040–1450 (1245)	36.6	7.7
II	North East Alluvial Plain	Sandy loam, Clay loam	6.5–7.8	1200–1700 (1450)	33.8	8.8
III	Southern East andWest Alluvial Plain	Sandy loam, Clay, loam, Clay loam	6.8–8.0	990–1240 (1115)	37.1	7.8

Note: Figures in parenthesis indicates average

Table 4.3: Geographical area and population of Kishanganj district, Bihar and India (Area in sq. km., population in lakhs)

Particulars	Area (km sq.)	Population			Population density
		Male	Female	Total	
Kishanganj	1,884	8.67 (53.18)	8.23 (46.82)	16.90 (100.00)	898
Bihar	94,163	542.78 (52.14)	498.22 (47.86)	1040.99 (100.00)	1106
India	32, 87, 263	6,237.24 (51.54)	5,864.69 (48.46)	12,101.93 (100.00)	382

Source: Census of India, 2011
Note: Figures in parentheses represent the percentage to total

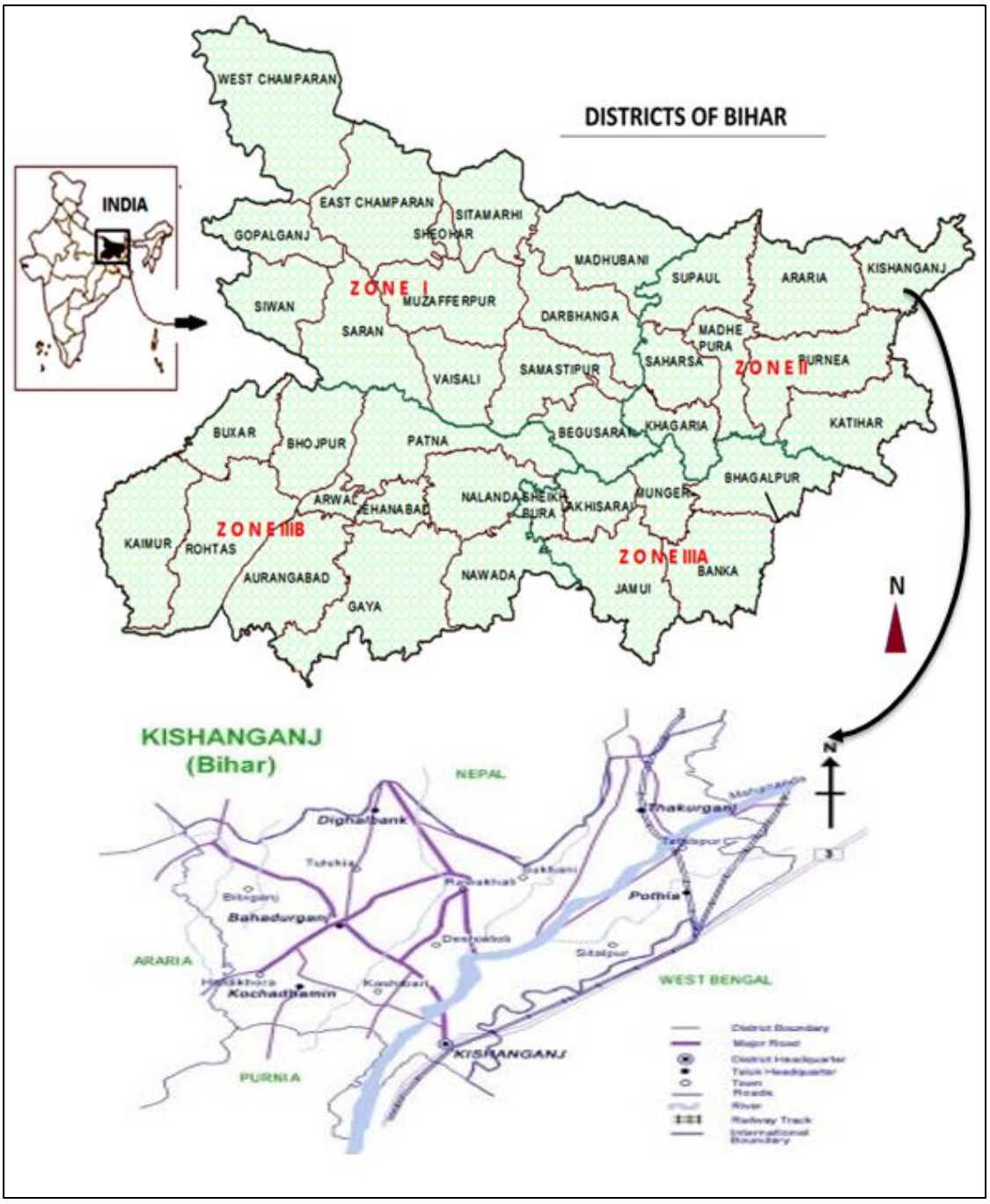

Fig. 4.1: State and district map of Bihar

Almost 68.11 percent people of Bihar still reside in rural areas and dependent on agriculture directly or indirectly. Bulk of the farm holdings are under small and marginal category. Besides this, a number of these holdings are scattered and fragmented. The cropping intensity has reached up to 138 percent.

Out of total geographical area, 57.12 lakh hectare is under cultivation which is around 60 per cent of the total. 23.58 lakh hectare area is put to cultivation more than once in a year. Therefore the Gross cropped area is 78.82 lakh hectares.

There are around 1.04 crore landholdings in the State of which around 83 percent are marginal holdings of size less than 1 hectare. With around 90 percent of the total population living in rural areas, agriculture as the primary feeder of rural economy continues to operate not only on margins of land but also on the margins of human enterprise. Without increasing returns to these margins, not much can be done realistically to develop the agricultural sector. Thus, agriculture continues to define both the potentialities and constraints to development in Bihar

Following are the major crops of Bihar: paddy, wheat, lentils, sugarcane, jute (hemp, related to the marijuana plant, but a source of tough fibers and "gunny bags"). Also, cane grows wild in the marshes of West Champaran. The principal fruits are: mangoes, banana, pineapple, jack fruit and litchis. This is one the very few areas outside China which produces litchi.

Out of the Gross cropped area of 78.82 lakh ha. Area under assured irrigation is about 45.60 lakh hectares. Tube well is the major source of irrigation which irrigates 63 percent (28.3lakh hectare) of the area under assured irrigation. Area under canal irrigation is 13.7 lakh hectares (30 percent).

The Cropping pattern of the state in dominated by cereals. Rice-wheat cropping system occupies more than 70% of the gross cropped area. Pulses occupy around seven per cent of the gross cropped area. The important cropping sequence of different zones is:

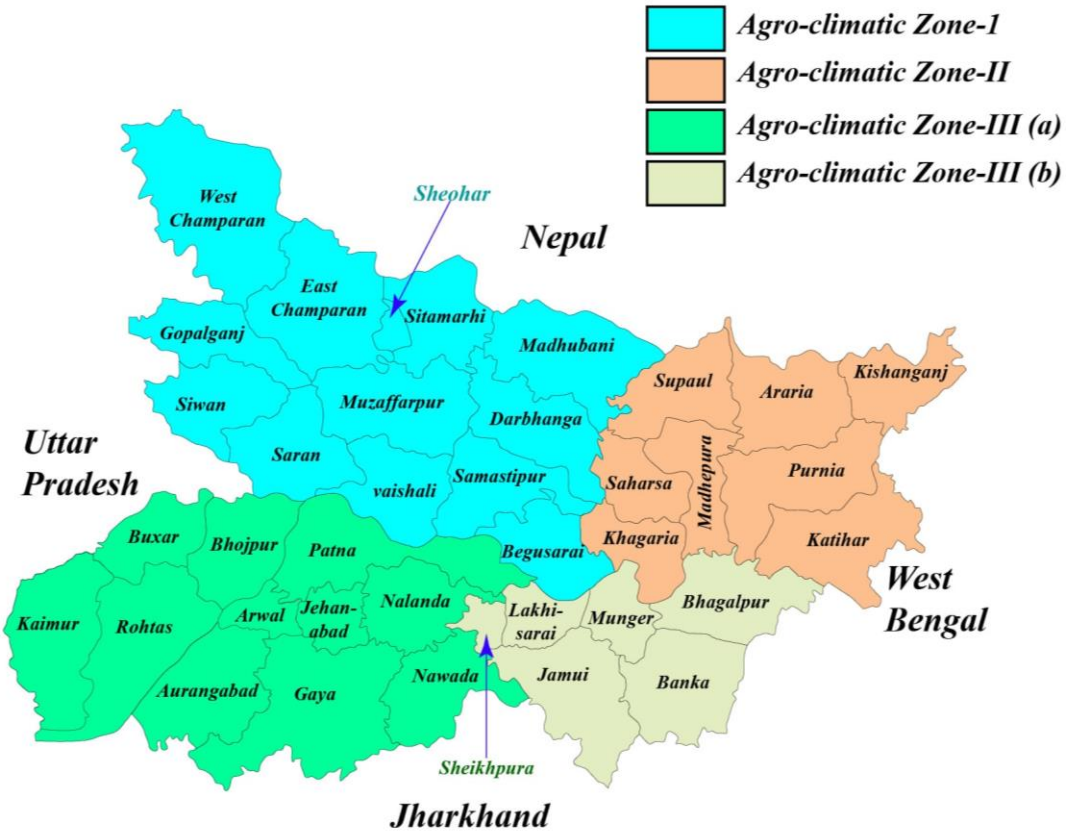

Fig 4.2: Agro-climatic zones in Bihar

Zone I: Rice – Wheat, Rice – Rai, Rice – Sweet Potato, Rice – Maize (Rabi), Maize – Wheat, Maize – Sweet Potato, Maize – Rai, Rice – Lentil, Rice-linseed

Zone II: Jute – Wheat, Jute – Potato, Jute – Kalai, Jute – Mustard, Rice – Wheat–Moong, Rice – Toria

Zone III: Rice – Wheat, Rice – Gram, Rice – Lentil, Rice – Rai

4.2 DISTRICT PROFILE

Origin- The name Kishanganj is a misnomer of Krishna-Kunj. Kishanganj district was part of Nepal during the Mughal period and was known as Nepalgarh. During the reign of Mughal Emperor, Nepalgarh was taken. In honour of Shah Alam, the town was renamed Alamganj. Khagara was made the administrative headquarter. Every year, the historical "Khagra Mela" is hosted here at the administrative headquarters. Mohammed Fakiruddin, the Khagda nawab, welcomed a Hindu saint who

was tired and wanted to rest in this place. But when he heard that the place was named Alamganj, the name of the river was Ramazan and the name of Jamindar was Fakiruddin, he refused to enter Alamganj. Then Nawab decided and announced part of Kishanganj Gudri to Ramzan Pool Gandhi Ghat as KrishnaKunj. Over time, the name became Kishanganj.

District formation: Kishanganj was an ancient and important sub-division of Purnea. On January 14, 1990, after the long-term hard work of the Kishanganj people including social workers, politicians, journalists, entrepreneurs, and farmers, Kishanganj District was established after 17 years of hard work,.

Geography: Kishanganj district covers an area of 1884 square kilometers. Kishanganji District is bounded by Araria District in the west, Purnia District in the southwest, Dinajpur District in the north of West Bengal in the east, and Darjeeling District in West Bengal and Nepal in the north. A narrow West Bengal belt about 20 kilometers wide separates it from Bangladesh. The Kishanganj district is located between 25.20 to 26.30 north latitude and 87.7 to 88.19 east longitude. The main rivers flowing through the area are Mahananda, Kankai, Mechi, Donk, Ratua and Ramzan Sudhani.

Demographics: There are 107,076 residents in Kishanganj district (2011 Census). Among the 107,076 residents, 55,688 are men and 51,388 are women. The male and female literacy rates are 78% and 68% respectively, and the average literacy rate is 74.71% (as of the 2011 census). It is one of the few areas with a Muslim majority.

Transportation: Kishanganj has an important railway hub connecting major cities in India. Kishanganj Station is part of the Northeast Frontier Railway (NFR). National Highway No. 31 also passes through Kishanganj. The railway station and NH 31 connect northeastern India with the rest of India. The station has some direct trains to some major cities in India, such as New Delhi, Mumbai, Patna, Kolkata, Guwahati, Bangalore, Chennai, Trivandrum, etc. Rajdhani Express also has stoppage in Kishanganj, runs between New Delhi and Guwahati.

Kishanganj district age relatively new in existence and is considered one of the most backward district of Bihar. The primary occupation is agriculture get relax behind

in literacy and has evidence of poverty .Main crops include wheat, maize, chana, paddy etc. Pineapple has been developed as a primary crop at commercial scale recently and is proved to be a boon for the poverty ridden district.

In the year 2006, the Ministry of Panchayati Raj declared Kishanganj as one among the the 250 most backward districts. It receives grant under the Backward Regions Grant Fund Programme (BRGF). Agriculture is people's principal occupation. Paddy, wheat, maize, sorghum, gram, lentil, green-gram, pea, mustard, linseed, sesame, jute, and sunflower are the principal crops farmed in the district. Horticulture is also practised in some parts of the district. Kishanganj is Bihar's only tea-producing district. The ply-wood industry, tea processing plants, jute industry, poultry farming, cottage industry, and silk industry are the district's principal industries. The Oil and Natural Gas Commission expects a large oil resource in Kishanganj district and, after preliminary oil exploration at two sites in the district's Kochadhaman and Bahadurganj blocks, it is set to begin drilling operations in Narkali site.

Table 4.4: Details of blocks in district Kishanganj

S.N.	**Name of the block**	**Geographical area**	**No. of Gram Panchayat**	**No. of villages**
1.	Kishanganj	14981.44	10	72
2.	Bahadurganj	27168.58	20	106
3.	Dighalbank	25235.48	16	81
4.	Kochadhaman	28357.83	24	150
5.	Thakurganj	38782.63	22	133
6.	Pothiya	35033.44	22	149
7.	Terdhaganchh	19122.94	12	82
	Total	**1,88,682.34**	**126**	**773**

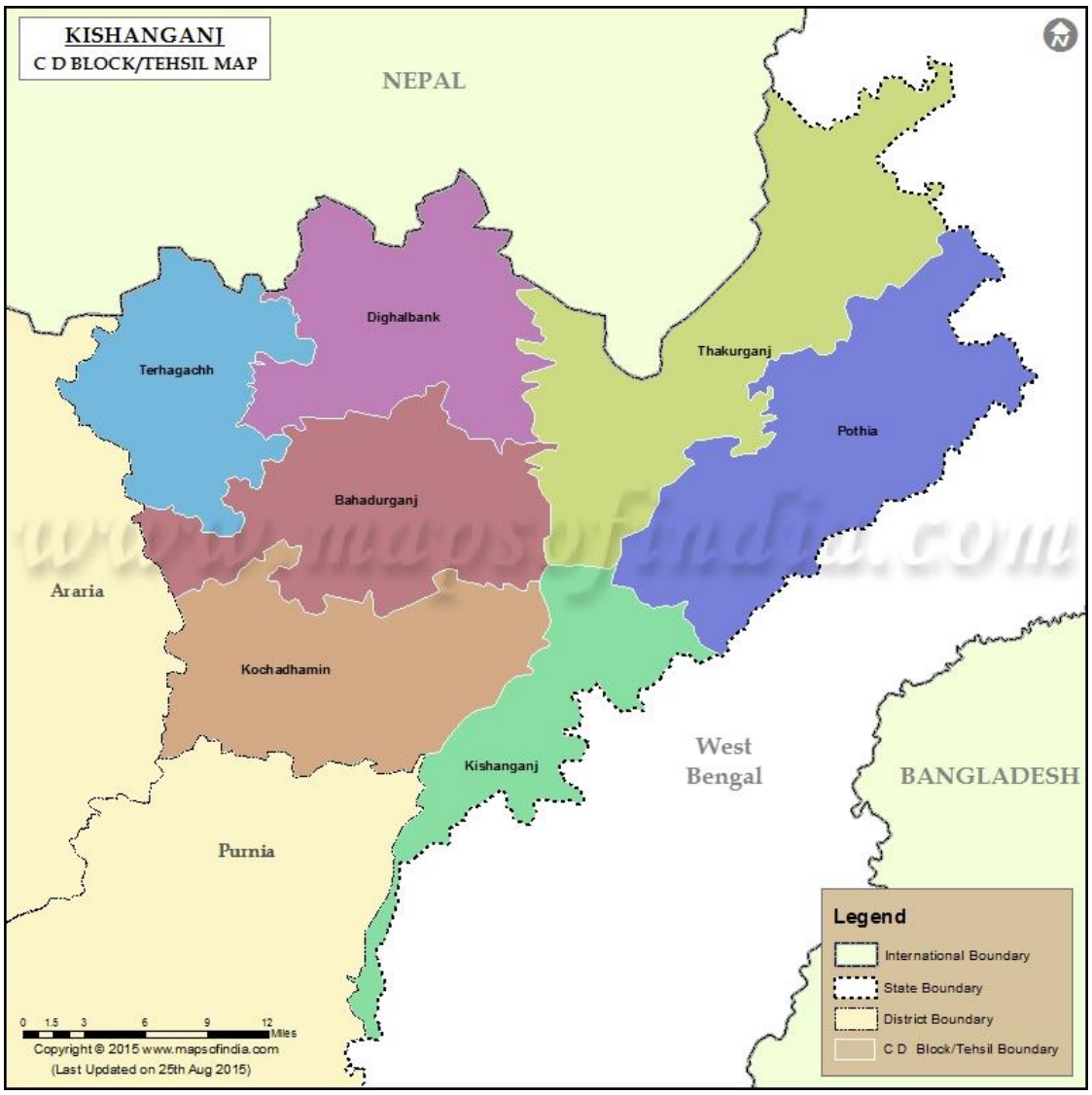

Fig. 4.3: Blocks in Kishanganj district

Concluding remarks

This chapter showed a detailed discussion of the study area. The complete view of the state in terms of demographics, population, topography etc. was presented. It enables us to understand the overall position and situation of the study area. It can be concluded from the chapter that the study area is basically dependent on agriculture as major contributor in the economy.

Chapter V

RESULTS AND DISCUSSION

In this chapter, the results of the study conducted are presented and discussed under different headings. The cost of cultivation of pineapple crop and their return was determined. This chapter is necessary because the collected data is discussed in a logical sequence consistent with the main objective or focus of the research question. This chapter also involves the interpretation of the true meaning of the stated facts and the purpose of the investigation in the form of data. The purpose of explanation and generalization is to find the broadest meaning of these answers by connecting them with other available knowledge. In summary, this chapter is said to imply an empirical statement of the research objectives. The assessments of the productivity of different farm inputs used in the production of suckers and commercial crop were worked out, and the same were compared with their respective acquisition cost. The data was collected from 2 Blocks of Kishanganj district. The data were analysed as per the methodology and the final results are presented and discussed in this chapter.

In this chapter, the findings of the study in accordance with the set objectives are presented under the following headings.

5.1 General characteristics of the sample farmers

5.2 Costs and returns of Pineapple production

5.3 Resource use efficiency in pineapple cultivation

5.4 Disposal pattern of pineapple

5.5 Marketing analysis of pineapple

5.6 Constraints in Pineapple production

5.1 GENERAL CHARACTERISTICS

The general characteristics of farmers reflect the decision-making process, planting patterns and investment patterns, which the major factors that influence the level of technology and the adoption of practices to obtain the maximum agricultural profitability of their farms. General characteristics include family structure and

agricultural structure. The study attempts to analyse some of the important characteristics of a sample of farmers. Table 5.1 lists general characteristics of the respondents. The farmers in the sample are divided into marginal farmers with a land area less than 1 hectares, small farmers with a land area of 1-2 hectares, and semi-medium farmers with a land area of 2-4 hectares.

The size of the farm family and the labour available in the family are considered important factors that affect economic conditions. A family is a unit that includes the total number of members in a given work area. It can be seen in Table 5.1. that the average size of households is 6, 6 and 5 members, in the case of marginal, small and semi-medium agricultural households. The study reveals that, according to the data, the average family of each pineapple producer is 5.67 people.

Farmers often make important decisions about farm operations based on the age and education level regarding input use, planting patterns, and other farm management practices. The data is shown in Table 5.1.

The average ages of the farmers were 47, 45 and 46 years old for marginal, small and semi-medium farmers respectively. The age factor plays an important role in taking on long and hard work in one way and the ability to make decisions in another way. The table shows that the average age of pineapple growers is about 46 years old. The study also showed that in this group, the minimum age of the respondents was 23 years and the maximum age of the respondents was 74 years

In terms of education, it can be observed that 8.34 % of farmers are illiterate, and the remaining 13.34%, 21.67%, 38.30%, 11.68% and 6.68% of farmers have completed Primary, Higher primary, High school, PUC and degree respectively. Education is directly related to agriculture because it promotes a rapid adoption of improved technology and improves decision making. However, this may depend on the quality and nature of the education and training received. The table shows the distribution of farmers by educational level. Statistics show that small farmers have the largest number of pineapple growers who can read. They have received primary education, secondary education, public school and degree education. Maximum illiterate farmers belong to the class of marginal farmers and that is 16.67%. In the marginal class maximum number of farmers have primary education. Maximum degree

holders belongs to the class of semi-medium farmers (11.12%). Overall maximum number of farmers that is 23(21.67%) have high school education. The minimum degree holders are present in the class of marginal and small farmers.

Table 5.1: General characteristics of pineapple farmers

Sl. No	Particulars	Marginal	Small	Semi-medium	Overall (average)
1.	Average size of Family (no)	6	6	5	5.67
2.	Age	47	45	46	46
3.	Education				
	Illiterate	3 (16.67)	1 (4.17)	1 (5.56)	1.67 (8.34)
	Primary	3 (16.67)	3 (12.5)	2 (11.12)	2.67 (13.34)
	Higher Primary	2 (11.12)	5 (20.83)	6 (33.34)	4.34 (21.67)
	High school	7 (38.89)	11 (45.83)	5 (7.78)	7.67 (38.30)
	PUC	2 (11.12)	3 (12.5)	2 (11.12)	2.34 (11.68)
	Degree	1 (5.56)	1 (4.17)	2 (11.12)	1.34 (6.68)
4.	Size of Farm (acre)	1.62 (0.648ha)	3.613 (1.44ha)	6 (2.4ha)	3.74 (1.49ha)

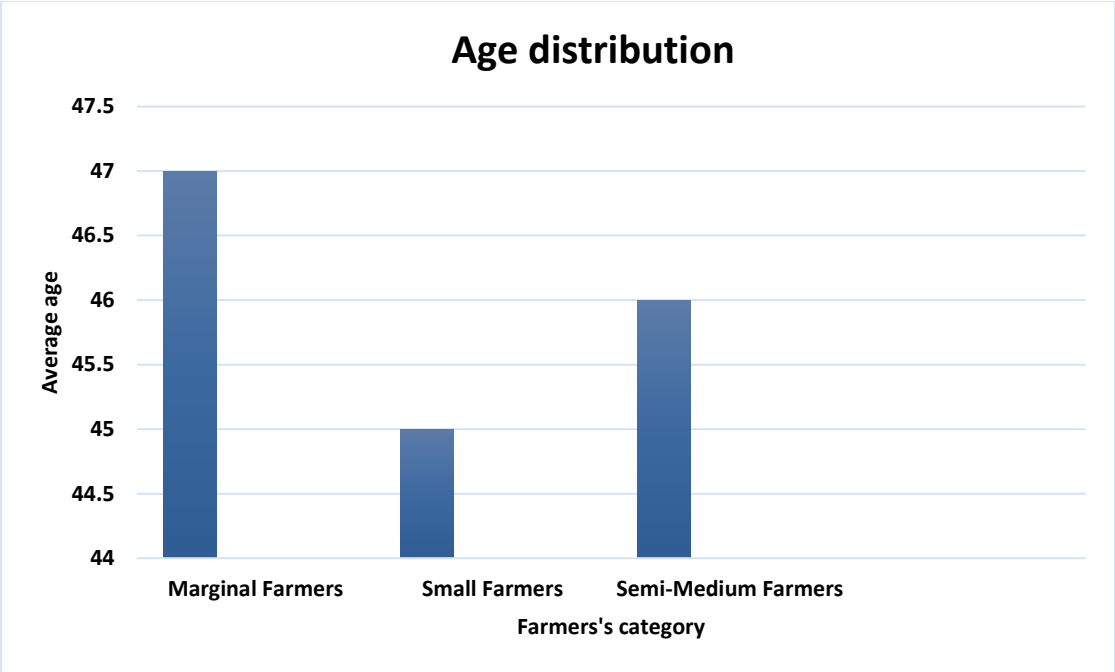

Fig. 5.1: Graphical representation of age distribution among pineapple farmers

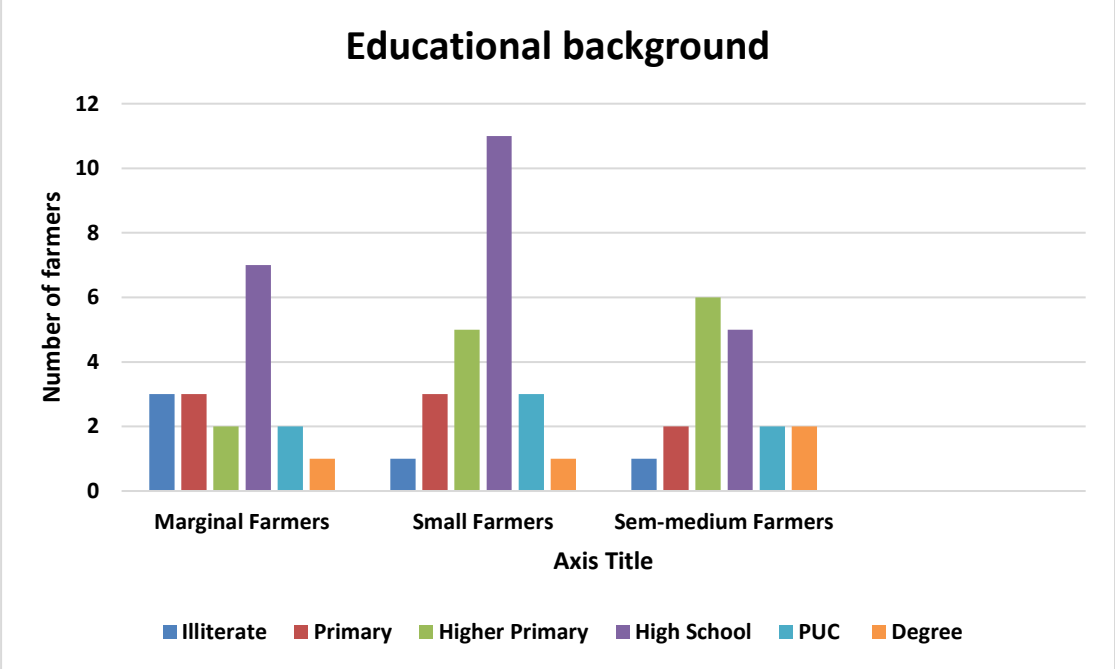

Fig. 5.2: Educational distribution of pineapple farmers in the study area

5.2 COSTS AND RETURNS

The improved method of growing pineapple is a capital and labour intensive process that requires sound investment decisions. It is the main objective of farmers to change and improve technology and resources to maximize profits. To achieve the goal of maximizing profits with technologies and resources at different levels, scientific and intelligent decision-making about the state of technology is required. Taking this fact into account, it is necessary to examine the cost structure of pineapple cultivation. Research on the economics of pineapple cultivation is important to know its profitability in order to select the best alternative resources, cultivation methods and scale of production. Second, it provides an estimate of the amount of cultivation (funding requirements) at different levels of technology adoption. The estimated cost and returns per acre from suckers and commercial crop of pineapple are presented in tables below. Pineapple was taken as annual crop for analysis and hence cost of cultivation for single output cycle is calculated.

In addition to the cost of cultivating pineapple per acre, the performance of yield analysis is a relevant tool, in which the main motivation of the activity is the measurement of profits in the production process. For obvious reasons, economists have not developed adequate methods for evaluating costs, returns and profits, rather than measuring them in money, because the main reason is that production fluctuates with various biological and non-biological factors. In the current study, yield is also considered a comparative profitability parameter, because ordinary farmers want higher yields from their farms.

As discussed above, many economists have suggested that returns should be measured in currency, it is still difficult to measure returns in agriculture. In essence, the difficulty lies in correctly estimating the quantity (yield) and market price of the product at all levels of time, place and method involved in the marketing process. To avoid these difficulties, this study analyzed the return of pineapple cultivation in the form of a total return of "rupees per acre".

Table 5.2.1: Cost of cultivation of pineapple in case of marginal farmers

Sl. No.	Items of Expenditure	Quantity/ No. of times	Rs/acre
A.	**Operational cost**		
1.	Land preparation		
(i)	Ploughing (Disc plough)	1 (3.5hrs)	2800
(ii)	Rotavator	1 (4 hrs)	3200
(iii)	Cultivator	2 (7hrs)	4900
(iv)	Land clearing	1	2000
2.	Pit preparation and transplanting	1	8000
3.	Fertilizer application	3	2000
4.	Weedicide application	2	700
5.	Irrigation	3	1750
6.	Harvesting	1	5000
7.	Transportation charges	1	1500
Total operational cost			31850
B.	**Material cost**	**No. of units**	
1.	Suckers	10000	18000
2.	FYM	64 qts.	4000
3.	Fertilisers		
(i)	Urea	8 bags	3440
(ii)	SSP	3 bags	2100
(iii)	MOP	3 bags	3300
(iv)	NPK	4 bags	4800
(v)	DAP	4 bags	4700
4.	Weedicide	750gm	750
Total material cost			41090
c.	**Other costs**		
1.	Interest on working capital	@7.5p.a	5470.5
2.	Depreciation		100
Total other cost			5570.5
Total cost (A+B+C)			78510.5

The farmers were segregated into 3 categories based on actual classification of farmers as per land holding. The segmentation revealed that 30 percent of farmers belong to marginal category having land holding less than 1ha (2.5acre). 40% of farmers represented small farmers category with 1-2ha (2.5-5acre) land holding and remaining 30% belonged to Semi-medium category of farmers with 2-4ha (5-10acre) of land holding. The area had a predominance of small farmers owing to consecutive land fragmentation.

The estimated per acre cost and returns of pineapple by marginal farmers are presented in Table 5.2.1. Pineapple crop was taken as annual crop for final analysis of cost of cultivation. The data revealed that per acre cost of cultivation of pineapple Rs 78510 which included Rs 31850 operational cost and Rs 41090 material cost. The highest investment was done in fertilizers (Rs 18340) and suckers (Rs 18000) per acre.

For sale purpose the fruit were graded according to their weight by commission agents and village traders. Grade 'A' fruits weighed around 1.5 kg or more. Less than 1.5 kg fruits were put in grade 'B' criteria. The price received was different for different grade of fruits. Suckers generated from each plant were also sold as by product and it also contributed towards the return generated.

Table 5.2.2: Per acre cost and returns in case of marginal farmers

Sl. No.	Particulars	Total Produce		
		Grade 'A'	Grade 'B'	Byproduct (Suckers)
1.	Production(No. of units)	5000	500	1000
2.	Price/unit	25	10	2
3.	Return (Rs)	125000	5000	2000
	Total return (Rs)	132000		
	Total cost (Rs)	78510.5		
	Net return (Rs)	53489.5		

The estimated per acre return from cultivation of pineapple of marginal farmers is presented in table 5.2.2. The gross income generated per acre was Rs 132000. The return from grade 'A' was Rs 125000, while for grade 'B' and by-product (suckers)

were Rs 5000 and Rs 2000 respectively. The net return thus calculated was found to be Rs. 53489.5 per acre. Marginal farmers often realised a lower remuneration per acre when compared to small and semi-medium farmers due to various constraints and limiting factors as mentioned in table 5.4.1 and table 5.4.4.

Table 5.2.3: Cost of cultivation of pineapple in case of small farmers

Sl. No.	Items of Expenditure	No. of times	Rs/acre
A.	**Operational cost**		
1.	Land preparation		
(i)	Ploughing (Disc plough)	1 (5 hrs)	4000
(ii)	Rotavator	1 (5 hrs)	4000
(iii)	Cultivator	2 (10 hrs)	7000
(iv)	Land clearing	1	3000
2.	Pit preparation and transplanting	1	12000
3.	Fertilizer application	3	2400
4.	Weedicide application	2	1000
5.	Irrigation	3	4500
6.	Harvesting	1	6000
7.	Transportation charges	1	1500
	Total operational cost	45,400	
B.	**Material cost**	**No. of units**	
1.	Suckers	12000	21600
2.	FYM	80 qts.	5000
3.	Fertilisers		
(i)	Urea	8 bags	3440
(ii)	SSP	3 bags	2100
(iii)	MOP	3 bags	3300
(iv)	NPK	5 bags	5875
(v)	DAP	5 bags	6000
4.	Weedicide	1 kg	1000
	Total material cost	48,315	
c.	**Other costs**		
1.	Interest on working capital	@7.5p.a	7028.63
2.	Depreciation		250
	Total other cost	7278.63	
	Total cost (A+B+C)	1,00,993.63	

The cost of cultivation estimated per acre for pineapple by small farmers was Rs.100993.63. The operational cost amounted to Rs. 45400 and the material cost was determined to be Rs. 48315. For small farmers, the major portion of investment was attributed to suckers and fertilizers.

Table 5.2.4: Per acre cost and returns in case of small farmers

Sl. No.	Particulars	Total Produce		
		Grade 'A'	Grade 'B'	By-product (Suckers)
1.	Production(No. of units)	5500	700	1000
2.	Price/unit	28	10	2
3.	Return (Rs.)	154000	7000	2000
	Total return (Rs.)	163000		
	Total cost (Rs.)	100993.63		
	Net return (Rs.)	62006.37		

Per acre estimated gross return for small farmers was Rs. 163000. Individual contribution of grade A produce was Rs. 154000, while grade B and by-product (suckers) contributed Rs. 7000 and Rs. 2000 respectively. The net return estimated per acre was determined to be Rs. 62006.37. It revealed that there exists a profitable margin in pineapple cultivation. The profit margin realised by small farmers was comparatively higher than marginal farmers owing to better practices and higher expenditure on quality inputs along with greater emphasis on yield enhancing inputs.

Table 5.2.5: Cost of cultivation of pineapple in case of semi-medium farmers

Sl. No	Items of Expenditure	No. of times	Rs/acre
A.	**Operational cost**		
1.	Land preparation		
(i)	Ploughing (Disc plough)	1 (5 hrs)	4000
(ii)	Rotavator	1 (5 hrs)	4000
(iii)	Cultivator	2 (12 hrs)	8400
(iv)	Land clearing	1	3000
2.	Pit preparation and transplanting	1	12500
3.	Fertilizer application	3	2600
4.	Weedicide application	2	2100
5.	Irrigation	3	4500
6.	Harvesting	1	6000
7.	Transportation charges	1	1500
	Total operational cost	48,600	
B.	**Material cost**	**No. of units**	
1.	Suckers	12500	22500
2.	FYM	100 qts.	6000
3.	Fertilisers		
(i)	Urea	9 bags	3870
(ii)	SSP	3 bags	2100
(iii)	MOP	3 bags	3300
(iv)	NPK	6 bags	7050
(v)	DAP	5 bags	6000
4.	Weedicide	1.2 kg	1200
	Total material cost	52,020	
c.	**Other costs**		
1.	Interest on working capital	@7.5p.a	7546.5
2.	Depreciation		500
	Total other cost	8046.5	
	Total cost (A+B+C)	1,08,666.5	

The data revealed that the cost of cultivation per acre for pineapple in case of semi-medium farmers was Rs. 108666.5 in which the operational cost and material cost was calculated to be Rs. 48600 and Rs 52020 respectively. The expenditure of semi-medium farmers were found to be higher in inputs like fertilizers, manure and suckers.

Table 5.2.6: Per acre cost and returns in case of semi-medium farmers

Sl. No.	Particulars	Total Produce		
		Grade 'A'	Grade 'B'	Byproduct (Suckers)
1.	Production(No. of units)	7000	700	2000
2.	Price/unit	25	6	1.80
3.	Return (Rs.)	175000	4200	3600
	Total return (Rs.)	182800		
	Total cost (Rs.)	1,08,666.5		
	Net return (Rs.)	74133.5		

The estimated net return per acre for cultivation of pineapple in the case of semi-medium farmers was Rs. 74133.5. The gross return amounted to Rs. 182800 where the contribution of grade A, grade B and by-product (sucker) were Rs 175000, Rs 4200 and Rs 3600 respectively.

The data revealed that there was an increasing trend in cost of cultivation with an increase in land holding. It may be attributed to higher expenditure on costly inputs and minimizing the use of less costly inputs. The expenditure by small and semi-medium farmers on farmyard manure, fertilizer and suckers was comparatively higher and marginal farmers lagged in this aspect due to unavailability of liquid money.

The estimated net return was higher for small and semi-medium farmers when compared to marginal farmers owing to the fact that they made a higher expenditure on quality suckers and yield enhancing resources like manure and fertilizers. Due to availability of resources, small and semi-medium farmers applied irrigation more number of times as opposed to marginal farmers who were mostly dependent on rainfall for irrigation purposes. The charge levied for harvesting the fruits was also found to be higher for small and semi-medium farmers due to more number of fruits produced per acre.

5.3 RESOURCE USE EFFICIENCY

The production function analysis was performed to test the resource utilization efficiency in pineapple cultivation, following are the results of the analysis together with the coefficient of multiple determination value defining the goodness of fit. The analysis was carried out for two separate cases, one grouping marginal and small classes of farmers together and the other combining all the classes of farmers viz. marginal, small and semi-medium present in the area.

Table 5.3.1: Estimates of multiple linear regression fitted for pineapple crop in case of marginal and small farmers

	Coefficients	**Standard Error**	**t Stat**	**P-value**
Intercept	106645.14	16441.34	6.5	0.000
Expenditure on suckers	-0.903	0.443	-2.036	0.491
Expenditure on manure	1.906	0.981	1.942	0.059*
Expenditure on fertilizers	0.816	0.998	0.817	0.418
Expenditure on labour	0.496	0.545	0.910	0.368
Expenditure on irrigation	6.181	1.563	3.952	0.00034**

$R^2 = 0.907$
*Significant at 10.0 percent level of probability
**Significant at 5.0 percent level of probability

Table 5.3.1 depicts the resource utilisation efficiency in pineapple cultivation as per the production function analysis for marginal and small farmers. The value of coefficient of multiple determination, R^2 clearly showed that the fitted function explained 90.73 percent of the change in total income from pineapple cultivation was due to the included variables. The expenditure on manure was found to be significant at 10 percent level of probability and irrigation was found to be significant at 5 percent level of probability respectively. It was found that the expenditure on all the resources except that made on suckers had positive contribution to the gross income. Expenditure on suckers had a negative impact on the gross income generated per acre in cultivation of pineapple.

Table 5.3.2: Estimates of multiple linear regression fitted for pineapple crop in case of marginal, small and semi-medium farmers

	Coefficients	**Standard Error**	**t Stat**	**P-value**
Intercept	66868.77	17042.9	3.92	0.0002
Expenditure on suckers	-0.619	0.472	-1.305	0.197
Expenditure on manure	2.322	0.996	2.329	0.023**
Expenditure on fertilizers	2.501	1.018	2.456	0.017**
Expenditure on labour	0.855	0.509	1.677	0.099*
Expenditure on irrigation	4.270	1.387	3.078	0.0033**

$R^2 = 0.912$
*Significant at 10 percent level of probability
**Significant at 5 percent level of probability

The fitted function explained 91.23 percent of variations as the value of coefficient of multiple determination (R^2) was calculated to be 0.912. This implied that the change in estimated gross income per acre for pineapple cultivation in case of marginal, small and semi-medium farmers was due to the included variables. In this case also expenditure on suckers had a negative impact on the gross income generated per acre in cultivation of pineapple. The increase in expenditure in suckers would cause a decrease in gross income generated per acre. Expenditure on labour was found to be significant at 10 percent level of probability and expenditure on manure, fertilizer and irrigation was found to be significant at 5 percent level of probability.

The R^2 also known as goodness of fit was close to 1 (0.907 and 0.912) for both the cases which implied that our independent variables were good at defining the dependent variable.

5.4 DISPOSAL PATTERN OF PINEAPPLE

Table 5.4.1: Disposal pattern of grade 'A' fruits

Farm-size	November-December	February-March	June-July
Marginal	38.60%	18.01%	43.39%
Small	31.25%	14.87%	53.88%
Semi-medium	20.72%	17.52%	61.76%
Average	30.19%	16.80%	53.01%

Table 5.4.1 shows the sales pattern of grade 'A' pineapple produce in the market for different class of farmers. During the post-harvest season of June to July, farmers often sold a large portion of their fruit surplus. When compared to farmers of the large farm size class, marginal farmers sold almost equal portion of their harvest in the month of November-December and June-July, whereas Small and semi-medium class of farmers sold their substantial portion of produce in the month of June-July (53.88% and 61.76% respectively). All the groups of farmers had minimum percent of sale in the month of February-March with small farmers having the least sale (14.87%) in these months. Small farmers sold greater portion (53.88%) of their produce in the month of June-July if compared to the sale in November-December (31.25%) and in the case of semi-medium farmers the sale was near to that of thrice of their produce in the respective months.

The following data revealed that semi-medium class of farmers focus primarily on the month of June-July (61.76%) for selling off their produce and their sale in the other two sale period is not significantly different. Similarly in the case of small farmers, their focus was divided between two sale periods, with a major chunk of sale in the month of June-July (53.88%) with November-December (31.25%) also being a significant business period. As for the marginal class of farmers, their focus was equally divided in both November-December (38.60%) as well as June-July (43.39%) period of sale. In all class of farmers, the February-March (16.80%) period of sale has almost similar trends observed.

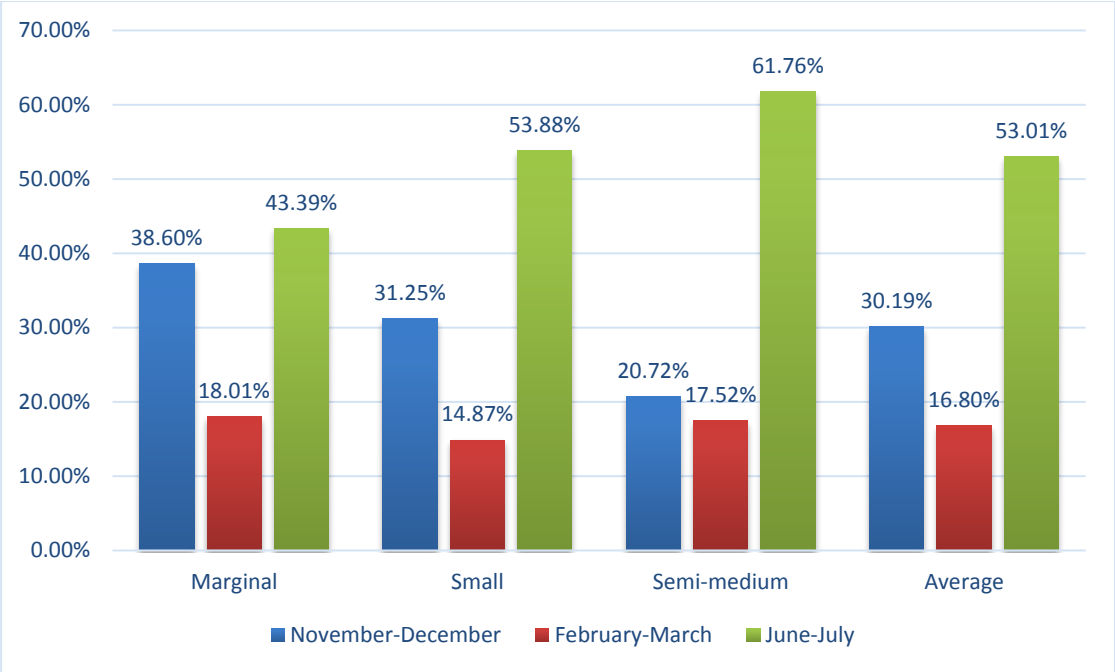

Fig. 5.3: Disposal pattern of grade 'A' fruits

Table 5.4.2: Disposal pattern of grade 'B' fruits

Farm-size	November-December	February-March	June-July
Marginal	24.07%	22.98%	52.95%
Small	38.28%	13.92%	47.80%
Semi-medium	31.64%	21.25%	47.11%
Average	31.33%	19.38%	49.29%

Similarly the disposal pattern for grade 'B' fruits is presented in the table 5.4.2. It revealed that major portion of fruits were sold in the period of June-July (49.29%) followed by November-December (31.33%). February-March (19.38%) period saw minimum sale of the fruits by farmers. Marginal class of farmers sold maximum fruits in the month of June-July (52.95%) followed by almost similar sale in the both the sale period of November-December (24.07%) and February-March (22.98%). Small farmers sold most of their fruits in the month of June-July (47.80%) followed by November-December (38.28%). There was a drastic decrease in the sale of fruits in the month of February-March (13.92%). As for the semi-medium class, the least sale was

also in the month of February-March (21.25%) with June-July (47.11%) being the highest sale period.

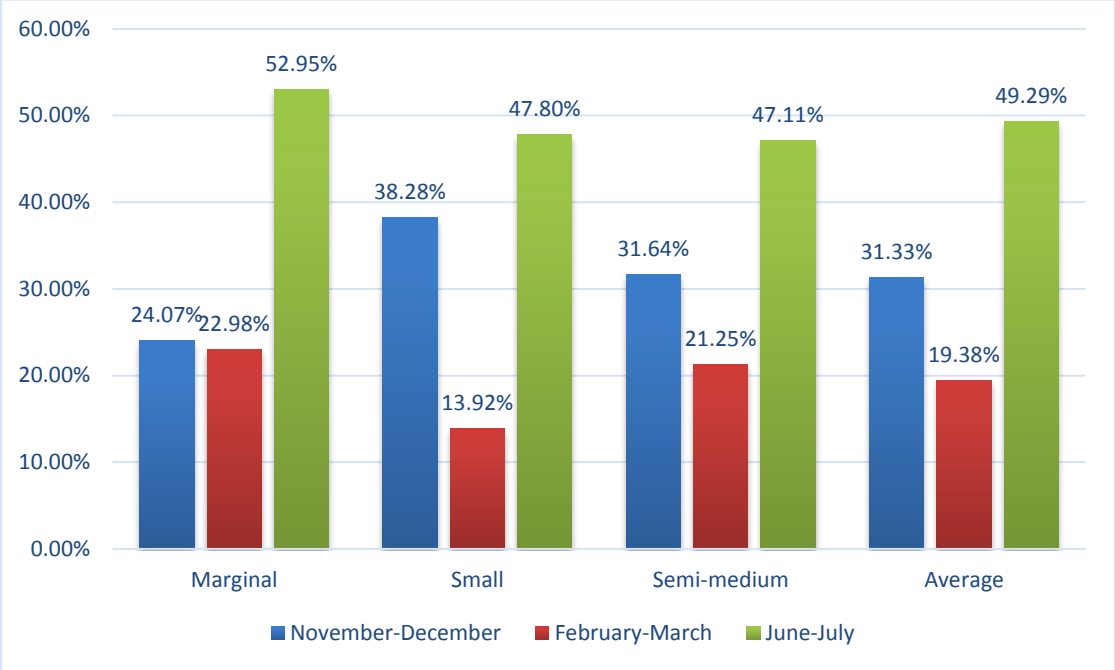

Fig. 5.4: Disposal pattern of grade 'B' fruits

Table 5.4.3: Disposal pattern of by-product (suckers)

Farm-size	November-December	February-March	June-July
Marginal	21.58%	12.98%	65.44%
Small	16.53%	9.02%	74.45%
Semi-medium	28.86%	10.47%	60.67%
Average	22.32%	10.82%	66.85%

Table 5.4.3 depicts the sale pattern of suckers by the various class of farmers of pineapple establishing that the largest portion of sale happens in the month of June-July (66.85%) with small portions divided between the months of November-December (22.32%) and February-March (10.82%). Marginal farmers sold maximum of their suckers in the month of June-July (65.44%) followed by sale of a small proportion in November-December (21.58%) and February-March (12.98%). Similarly small farmers also sold most of their by-products in the month of June-July (74.45%)

followed by little sale in the months of November-December (16.53%) and February-March (9.02%). In the case of semi-medium farmers, the highest sale of suckers was observed in June-July (60.67%) with sale being almost halved in the month of November-December (28.86%) and least in the month of February-march (10.47%).

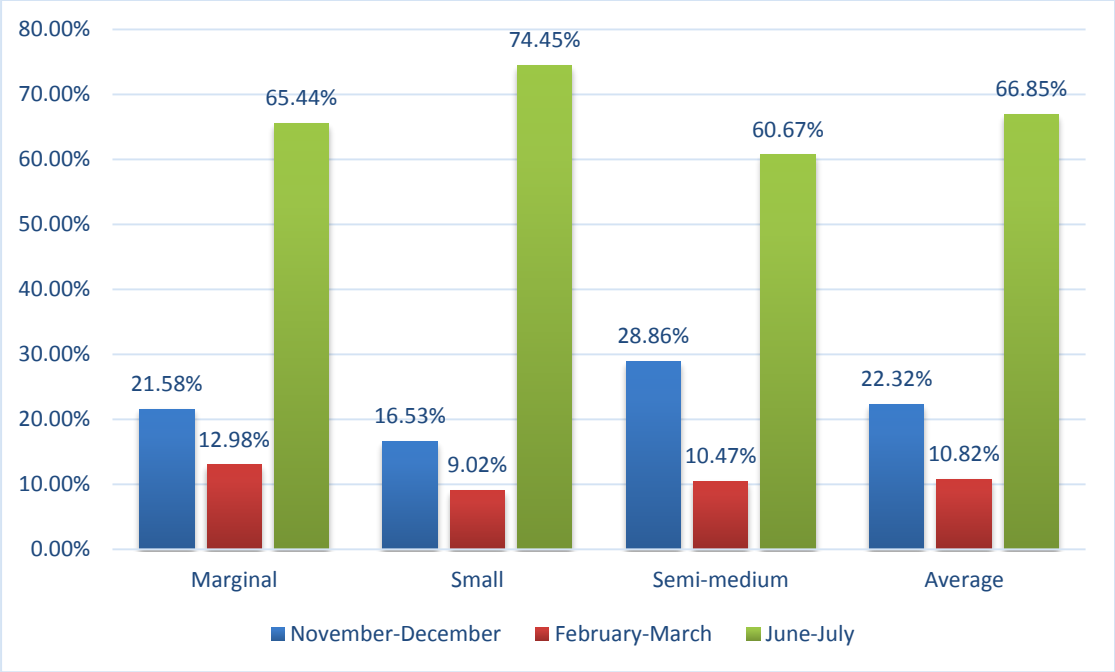

Fig. 5.5: Disposal pattern of by-product (suckers)

Table 5.4.4: Marketing channel employed by pineapple farmers

Sl. No.	Marketing Channel	Number (60)	Percent
1.	Contractor	28	46.67
2.	Middlemen	32	53.34

The marketing channel majorly employed was middlemen. 53.34% of farmers used middlemen for marketing their produce. The unavailability of markets in the vicinity often forces farmers to depend on middlemen for marketing their produce. 46.67% of farmers sold their produce directly to the contractor. Contractor and middlemen are responsible for harvesting, picking, grading and transportation of the fruits. This saved the cost of these processes from producers' side.

5.5 MARKETING ANALYSIS OF PINEAPPLE

Table 5.5.1: Price spread through channel 1

Channel 1: Producer Z Pre-harvest contractor Z Wholesaler Z Retailer Z Consumer

Sl. No.	Particulars	(Rs./100 fruit)	Percentage
1.	Producer's sale price/pre-harvest contractor's purchase price	2500	41.67
2.	Marketing cost incurred by pre-harvest contractor	185	3.08
	(a) Transportation charges	125	2.08
	(b) Harvesting, loading and unloading	50	0.83
	(c) Commission to commission agent	10	0.17
3.	Pre-harvest contractor's margin	415	6.92
4.	Pre-harvest contractor's sale price/purchase price of wholesaler	3100	51.67
5.	Marketing cost incurred by wholesaler	300	5.00
	(a) Transportation charges	200	3.33
	(b) Loading and unloading	20	0.33
	(c) Miscellaneous	80	1.33
6.	Wholesaler's margin	600	10.00
7.	Sale price of wholesaler/purchase price of retailer	4000	66.67
8.	Marketing cost incurred by retailer	400	6.67
	(a) Transportation charges	180	3.00
	(b) Loading and unloading	20	0.33
	(c) Miscellaneous	200	3.33
9.	Retailer's margin	1600	26.67
10.	Retailer's sale price/Consumer's purchase price	6000	100.00

Table 5.5.2: Price spread through channel 2

Channel 2: Producer Z Village trader Z Wholesaler Z Retailer Z Consumer

Sl. No.	**Particulars**	**(Rs./100 fruit)**	**Percentage**
1.	Net price received by farmers	2500	35.71
2.	Marketing cost incurred by producer	163.75	2.34
	(a) Harvesting	50	0.71
	(b) Loading and unloading	50	0.71
	(c) Transportation	63.75	0.91
3.	Producer's sale price/village trader's purchase price	2663.75	38.05
4.	Marketing cost incurred by village trader	350	5.00
	(a) Transportation charges	300	4.29
	(b) Loading and unloading	50	0.71
5.	Village trader's margin	486.25	6.95
6.	Village trader's sale price/purchase price of wholesaler	3500	50.00
7.	Marketing cost incurred by wholesaler	270	3.86
	(a) Transportation charges	200	2.86
	(b) Loading and unloading	20	0.29
	(c) Miscellaneous	50	0.71
8.	Wholesaler's margin	830	11.86
9.	Sale price of wholesaler/purchase price of retailer	4600	65.71
10.	Marketing cost incurred by retailer	450	6.43
	(a) Transportation charges	180	2.57
	(b) Loading and unloading	20	0.29
	(c) Miscellaneous	250	3.57
11.	Retailer's margin	1950	27.86
12.	Retailer's sale price/Consumer's purchase price	7000	100.00

Net price received by the producer was noted to be same in both the marketing channels as shown in table 5.5.1 and 5.5.2. This was dependent on the price of the fruit in the particular sale season. In channel 2 though the farmer received a higher gross remuneration i.e Rs. 2663.75 per 100 fruits (table 5.5.2), extra costs in harvesting, transportation and loading and unloading incurred to farmer thereby reducing the income to a net return of Rs. 2500 per 100 fruits. Owing to different intermediaries the final purchase price of consumer changed. In channel 1 the consumer purchase price was Rs. 60 per fruit (table 5.5.1) whereas it changed to Rs 70 per fruit (table 5.5.2) in second channel. The tables revealed that retailer has the highest margin. The pre-harvest contractor had a margin of 6.92% (table 5.5.1) and a village trader was able to earn a margin of 6.95%. In channel 1 the pre-harvest contractor handed over the produce to the wholesaler through a commission agent. It is clearly shown in the tables that highest charge was paid in the form of transportation cost. In channel 1 the charge for harvesting, loading and unloading was borne by pre-harvest contractor. It saved the producer from pay extra out of pocket cost and also assured a sale at the end of the season. Labour cost in case of loading and unloading was marginal in all the stages of marketing. The huge difference in purchase price of consumer and sale price of producer was due to excess margin of retailer.

Table 5.5.3: Marketing cost borne by different marketing agencies

Sl. No.	**Particulars**	**Rs/100 fruit**	
		Channel I	**Channel II**
		Amount	**Amount**
1.	Marketing cost incurred by producer	-	163.75 (13.27%)
2.	Marketing cost incurred by pre-harvest contractor/village trader	185 (20.90%)	350 (28.37%)
3.	Marketing cost incurred by wholesaler	300 (33.90%)	270 (21.88%)
4.	Marketing cost incurred by retailer	400 (45.20%)	450 (36.47%)
Total cost incurred		885 (100%)	1233.75 (100%)

Marketing cost incurred by retailer is highest in both the channels as depicted in table 5.5.3. The marketing cost incurred by retailer amounts to 45.20% in channel 1 whereas it was about 36.47% in channel 2. In channel 2 marketing cost incurred to producer also (13.27%) as producer has to transport the produce to the village trader.

Table 5.5.4.1: Marketing margin (Rs. / 100 units of fruits)

Channel: 1 Producer Z Pre-harvest contractor Z Wholesaler Z Retailer Z Consumer

Sl. No.	Particulars	Absolute margin	Net margin	Percent margin	Mark-up
1.	Pre-harvest contractors margin	600 (17.14%)	415 (15.87%)	19.35	24.00
2.	Wholesalers margin	900 (25.71%)	600 (22.94%)	22.50	29.03
3.	Retailers margin	2000 (57.14%)	1600 (61.19%)	33.33	50.00
Total marketing margin		3500 (100%)	2615 (100%)	75.19	103.03

Table 5.5.4.2: Marketing margin (Rs. / 100 units of fruits)

Channel: 2 Producer Z Village trader Z Wholesaler Z Retailer Z Consumer

Sl. No.	Particulars	Absolute margin	Net margin	Percent margin	Mark-up
1.	Village traders margin	836.25 (19.29%)	486.25 (14.88%)	23.89	31.39
2.	Wholesalers margin	1100 (25.37%)	830 (25.41%)	23.91	31.43
3.	Retailers margin	2400 (55.35%)	1950 (59.70%)	34.29	52.17
Total marketing margin		4336.25 (100%)	3266.25 (100%)	82.09	115.00

The total net margin when calculated was more in case of channel 2 (Rs.3266.25 per 100 fruits) as shown in table 5.5.4.2. Retailer's margin was also higher in second channel amounting Rs.1950 per 100 fruits which was 59.70% of the total net margin (table 5.5.4.2). In channel 1 retailer was able to earn a net margin of Rs.1600 per 100 fruits (61.19%) as shown in table 5.5.4.1. It can be deducted from the tables that though the amount of margin for retailer in channel 1 was lower but it was bale to earn a higher percentage of net margin when compared to retailer in channel 2.

Table 5.5.5: Producer's share in consumer's rupee

Sl. No.	Particulars	Rs./100 fruits	
		Channel I	Channel II
		Amount	Amount
1.	Price received by producer	2500	2500
2.	Total marketing cost	885	1233.75
3.	Total marketing margin	2615	3266.25
4.	Price paid by consumer	6000	7000
5.	Producer's share in consumer's rupee	41.67%	35.71%

From table 5.5.5 it can be concluded that producer's share in consumer's rupees is higher in case of channel 1 which is 41.67% whereas it was 35.71% in case of channel 2. The difference can clearly be seen due to higher total marketing margin in case of channel 2 which is Rs.3266.25. The purchase price of consumer is also increased in case of channel 2 amounting Rs.7000 per 100 fruits.

Table 5.5.6: Marketing efficiency of various channels

Sl. No.	Particulars	Rs./100 fruits	
		Channel I	**Channel II**
		Amount	**Amount**
1.	Consumer's purchase price	6000	7000
2.	Total marketing cost	885	1233.75
3.	Total marketing margin	2615	3266.25
4.	Marketing efficiency (%)	171.43	155.56

Marketing efficiency for channel 1(171.43%) is higher when compared to channel 2 (155.56%) as shown in table 5.5.6. It can be attributed to higher marketing cost (Rs.1233.75) and marketing margin (Rs.3266.25) per 100 fruits in case of channel 2 which ultimately reduced the producer's share in consumer's rupees.

5.6 CONSTRAINTS FACED BY THE PINEAPPLE FARMERS

Pineapple cultivation in Kishanganj district is governed by many factors. Identification of constraints is an important step in development processes which aim to improve the crop productivity. The productivity of marginal and small farmers is limited to a large extent by biotic and abiotic constraints. However, they have adopted strategies to mitigate the various constraints faced by them. Garret ranking analysis was employed to assess the severity of these constraints by ranking them according to their impact on the production and marketing of pineapple by the different classes of farmers.

The constraint faced in production process of pineapple and marketing of the produce varied to a larger extent. The production constraints as mentioned by the various class of farmers were namely fluctuation in weather, squirrel menace, fluctuation in rate of fertilizer, crisis of labour and occasional floods. Although the constraints remained same for the various class of farmers, the impact that each constraint had in the production differed according to the farmers land holding size.

Similarly the constraint faced in marketing of the produce were higher transportation cost levied, involvement of middlemen, lack of processing units and storage facility, lack of local markets and unavailability of credit system in the locality of the farmer. The transportation cost and lack of local markets remained the most limiting constraint for all classes of farmers in marketing of pineapple.

The ranking of various constraints depended on the availability of funds, strategies to mitigate the impact and land holding of the farmers. The constraints were analysed using the Garrett ranking analysis method allotting a final ranking to each constraint as per the class of farmer showing the impact of each constraint on them. The results which came out of the analysis has been presented in tabular and graphical format.

Table 5.6.1: Constraints faced by marginal farmers in production of pineapple

Factors	**Average score**	**Final Rank**
Weather Fluctuations	65.5	1
Squirrel menace	43.3	4
Fluctuation in Fertiliser rate	57	2
Labour crisis	54.4	3
Floods	28.8	5

Marginal farmers were affected most by the weather fluctuations as revealed in table 5.6.1. Fluctuations in fertilizer rate and prices of labour during the peak period followed by squirrel menace and occasional floods were other major constraints that affected the production of pineapple in case of marginal farmers.

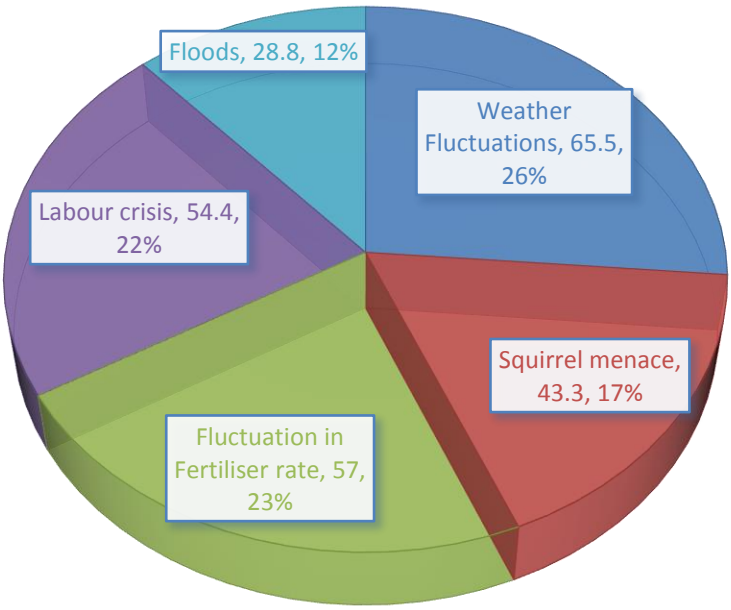

Fig. 5.6: Graphical representation of constraints faced by marginal farmers in production of pineapple

Table 5.6.2: Constraints faced by small farmers in production of pineapple

Factors	**Average score**	**Final Rank**
Weather Fluctuations	68	1
Squirrel menace	55.3	2
Fluctuation in Fertiliser rate	41.8	4
Labour crisis	53.5	3
Floods	30.4	5

The data in table 5.6.2 shows that the biggest constraint faced by small farmers in production of pineapple is the weather fluctuation. Intermittent rain and intense sunlight with a sudden rise in temperature affects the quality of fruits. Squirrel menace ranked second among the major constraints which often deteriorates the quality and selling property of the fruit. These constraints are followed by crisis of labour, fluctuation in fertilizer rate and occasional floods as the limiting factor in production of pineapple by small farmers.

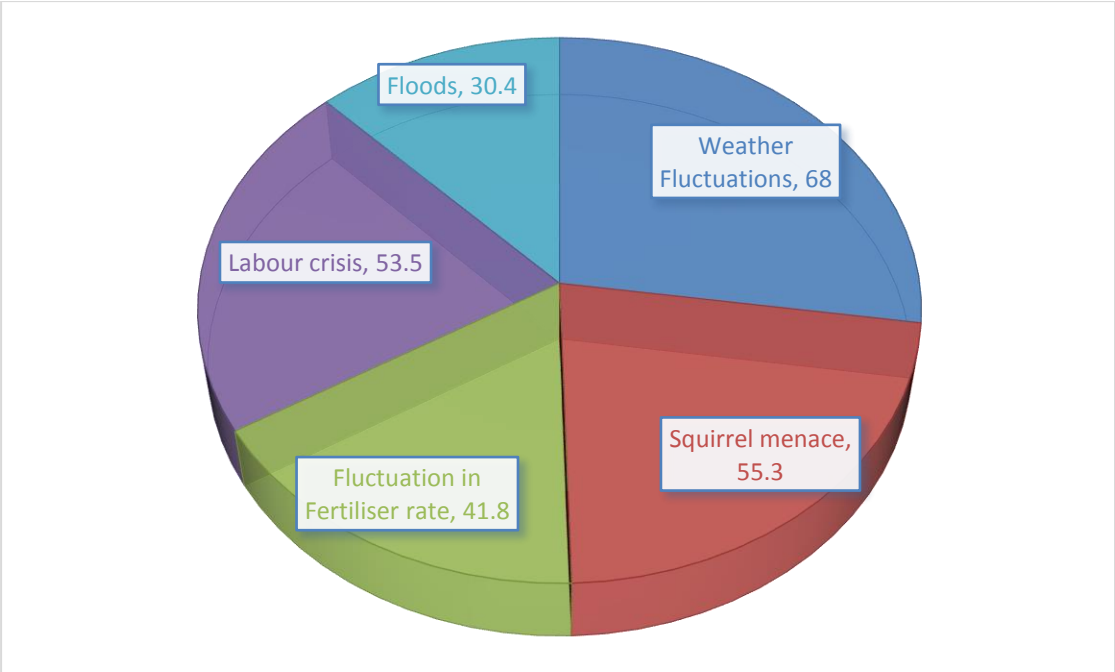

Fig. 5.7: Graphical representation of constraints faced by small farmers in production of pineapple

Table 5.6.3: Constraints faced by semi--medium farmers in production of pineapple

Factors	**Average score**	**Final Rank**
Weather Fluctuations	68	1
Squirrel menace	48.9	3
Fluctuation in Fertiliser rate	42.4	4
Labour crisis	62.5	2
Floods	27.2	5

As seen in the earlier class of farmers, semi-medium farmers also faced fluctuation in weather as the most limiting constraint in the production of pineapple. The sudden rise in temperature often resulted in smaller fruit size leading to lower remuneration. The unavailability of labour during transplanting season was ranked as second major constraint by the semi-medium farmers. Squirrel menace was the third major constraint faced which was often dealt with the help of squirrel management

specialist who are usually tribal people of the locality. These were followed by fluctuation in the rate of fertilizer and occasional flood as other constraints affecting production of pineapple by semi-medium farmers.

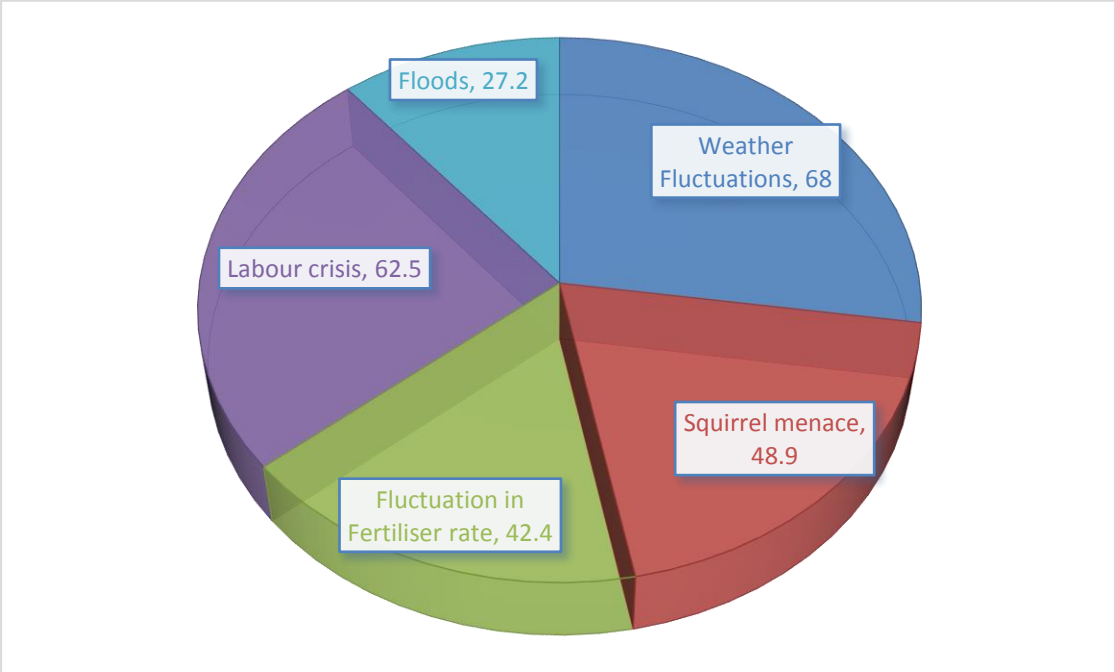

Fig. 5.8: Graphical representation of constraints faced by semi-medium farmers in production of pineapple

Table 5.6.4: Constraints faced by marginal farmers in marketing of pineapple

Factors	**Average score**	**Final Rank**
Transportation cost	67.3	1
Lack of Processing unit	35.7	5
Lack of storage facility	30	6
Involvement of Middlemen	54.4	3
Lack of local market	65.7	2
Unavailability of credit system	46.9	4

Table 5.6.4 revealed the ranking of various constraints as faced by marginal class of farmers in marketing of pineapple. The higher cost of transportation was the

most limiting constraint followed by lack of local market and involvement of middlemen. Middlemen often charged higher rate and thus reduced the profit margin of the producer. They are also responsible for a lower producer share in consumer's price. For the marginal farmer unavailability of credit system in the vicinity is also a major constraint as they sometimes do not possess enough liquid money required in the production cycle and thereby retort to money lenders and other informal sources of credit. Lack of processing unit and a proper storage facility were the constraints that sometimes led to distress sale and lower remuneration in case of higher production.

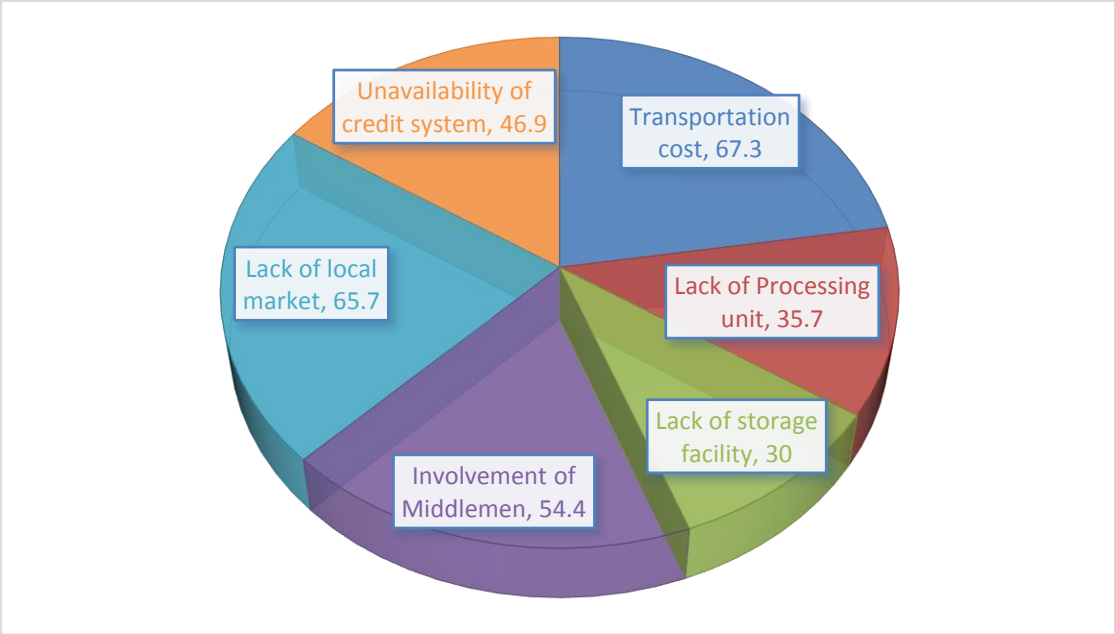

Fig. 5.9: Graphical representation of constraints faced by marginal farmers in marketing of pineapple

Table 5.6.5: Constraints faced by small farmers in marketing of pineapple

Factors	**Average score**	**Final Rank**
Transportation cost	68.2	1
Lack of Processing unit	44.7	4
Lack of storage facility	33.2	6
Involvement of Middlemen	62.7	3
Lack of local market	63.1	2
Unavailability of credit system	35.5	5

The constraints faced by small farmers in marketing of pineapple are listed in table 5.5.5. Transportation cost also ranked first in the case of small farmers as being the major constraint during the marketing of produce followed by unavailability of local markets. These two factors have a major negative impact on the price remuneration to the farmers. Middlemen often charged a greater price and hence has been ranked third among the constraints followed by lack of processing unit. Small farmers are not as much affected as the marginal class of farmers due to unavailability of credit system as they have a greater extent of disposable income. Lack of storage facility ranked sixth among the constraints for small farmers as they were able to sell their produce as and when required.

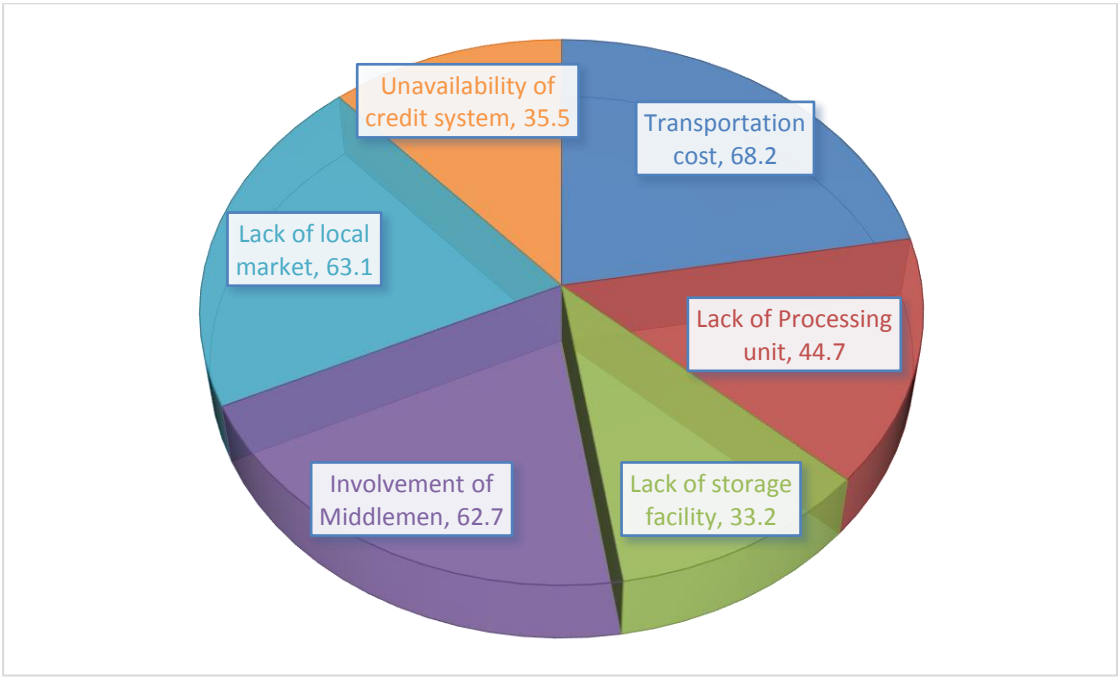

Fig. 5.10: Graphical representation of constraints faced by small farmers in marketing of pineapple

Table 5.6.6: Constraints faced by semi-medium farmers in marketing of pineapple

Factors	**Average score**	**Final Rank**
Transportation cost	64.8	1
Lack of Processing unit	56.6	3
Lack of storage facility	33.1	5
Involvement of Middlemen	54.6	4
Lack of local market	58.3	2
Unavailability of credit system	32.6	6

The ranking of constraints by semi-medium farmers in marketing of pineapple varied from the previous two classes except for the transportation cost and lack of local market being the most limiting factor in marketing of produce. As represented in table 5.5.6 lack of processing unit was ranked third among the constraints due to the fact that semi-medium farmers were able to produce a greater yield and required a suitable market and processing unit for better price realisation. The middlemen often charged a higher rate depending upon the yield, hence was a major constraint causing a reduced net return. Lack of storage facility was a constraint as the produce needed to be sold from the field directly and sometimes led to distress sale. The lack of credit system was ranked last and was not a major limiting factor in case of semi-medium class of farmers.

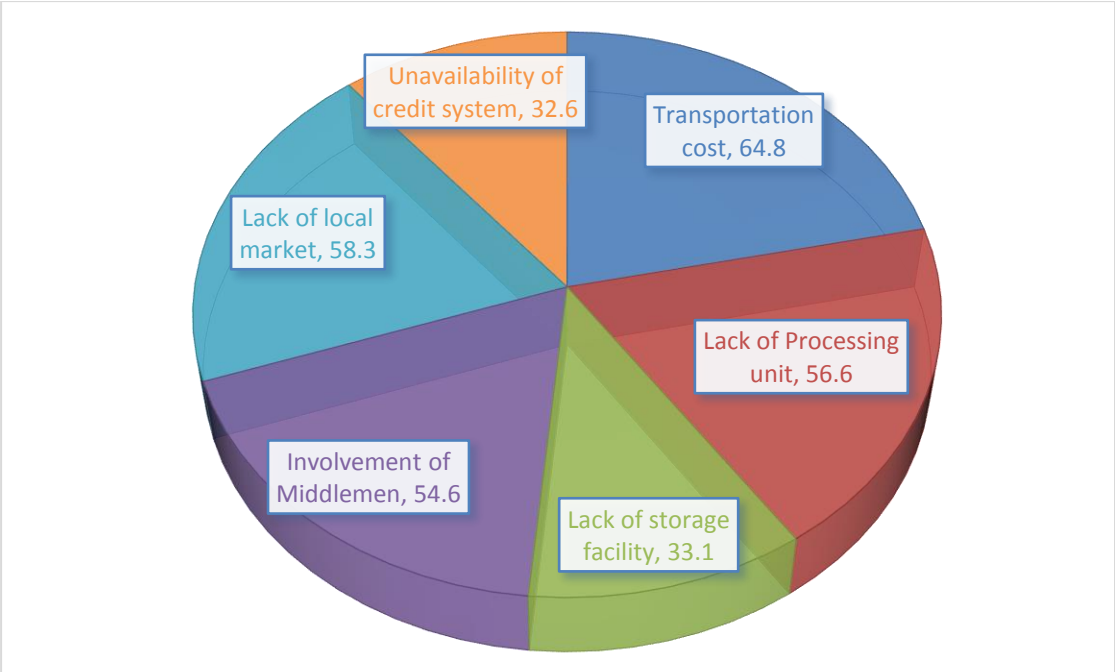

Fig. 5.11: Graphical representation of constraints faced by semi-medium farmers in marketing of pineapple

Table 5.6.7: Ranking of various constraints faced by pineapple farmers (overall)

Factors	Percent position	Garrett value	Total	Average score	Final rank
Fluctuation in fertilizer rate	6.25	80	1773	27.70	7
Squirrel menace	18.75	67	1740	27.18	8
Unavailability of credit	31.25	60	2214	34.59	6
Transportation facilities and cost	43.75	53	3849	60.14	2
Marketing problems	56.25	47	3474	54.28	4
Lack of processing units	98.75	41	3149	49.20	5
Weather fluctuation	81.25	32	3841	60.01	3
Involvement of middlemen	93.75	20	3966	61.96	1

High transportation cost was the major constraint faced by the local farmers. Non-availability of local market forced the farmers to transport the produce to closest market available. The farmers with more than 3 acres of land opted to send the produce to the big markets of Bidhan Nagar, Kolkata and Patna. The transportation cost incurred by the farmers was thus a huge constraint. There was no processing unit located in the area that could process large quantities of pineapple. During glut season farmers were forced to go for distressed sale.

Involvement of midllemen was also one of the major constraint faced by the pineapple growers as they were not able to avail the market price benefits. Often middlemen were accused of purchasing at lower rates when compared to market price. Transporation facilities were another major concern as there was unavailability of transporation facilities to the larger markets. Cultivators were forced to sell their produce to the midllemen as they could not afford to transport the produce to the big markets.

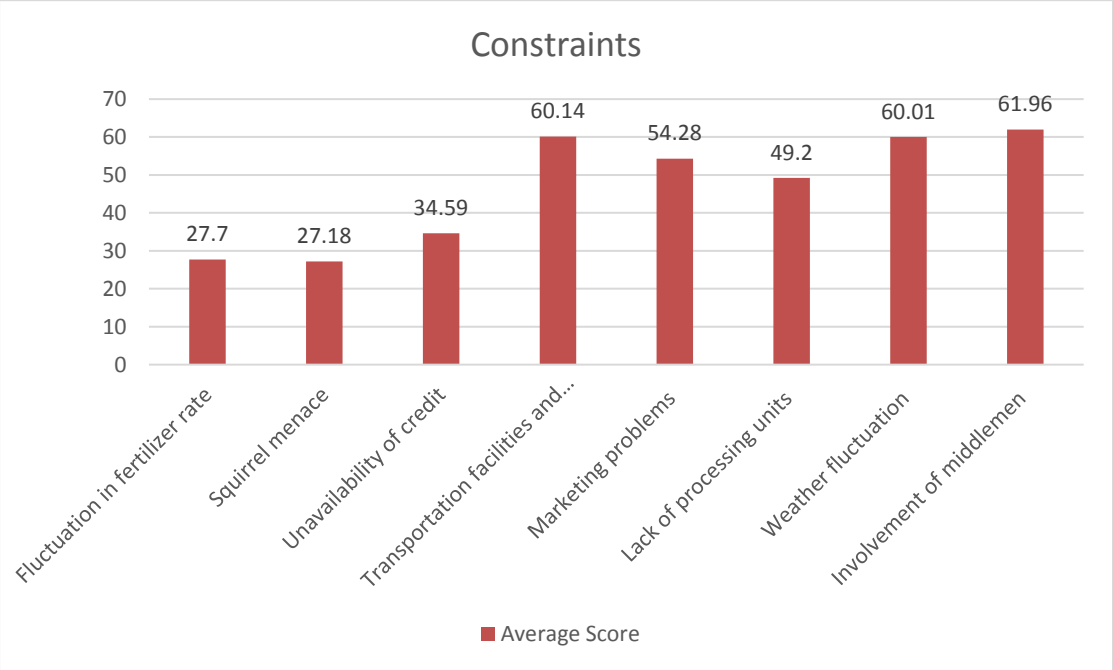

Fig. 5.12: Graphical representation of Constraints faced by the pineapple farmers

Fig. 5.13: Pineapple fruit produced in the field

Fig. 5.14: Row wise plantation of Pineapple crop

Fig. 5.15: Field ready for harvesting

Chapter VI

SUMMARY AND CONCLUSIONS

Pineapple often referred to as the queen of fruits, is rich in vitamins and minerals especially vitamin C containing 79% vitamin C per 100gm. It is a tropical fruit and is one of the most important tropical fruit in the world. Being herbaceous in nature it grows from 1.1 to 1.5m tall. It is also a rich source of manganese having around 44% daily value. It also contains minerals like calcium, potassium, magnesium and iron. It is the source of digestive enzyme Bromelain. The water content in raw pineapple is 86% with 13% carbohydrates, 0.5% protein and almost no fats. It is good in supplying energy as it can provide with 50 kilocalories of food energy in 100gm raw fruit. The latest data of 2019 revealed that the world produced 28.2 million metric tonnes pineapple with Costa Rica leading followed by Philippines, Brazil and Indonesia. India ranks 6^{th} in pineapple production contributing about 8% in the overall world production.

Bihar has emerged as an important centre for commercial pineapple production where Kishanganj district is a major contributor. Starting just a few years ago, the cultivation of pineapple has become a major source of income for the marginal, small and semi-medium farmers of the area. Due to lack of substantive data about the pineapple production in the district, government has not been able to decide required policies and address the need of the farmers. This promotes for a research question of enhanced profitability of commercial pineapple production in the area. Therefore the study has been conducted under the following heads:

1. To estimate the costs and returns of pineapple production
2. To examine the resource use efficiency of pineapple production
3. To study the disposal pattern of pineapple
4. To study the marketing of pineapple in delineated area
5. To document the constraints in production and marketing of pineapple in study area

Multistage random sampling technique was adopted for conducting the survey and collection of data. Kishanganj district lies in Zone II agro climatic zone of Bihar. It is comparatively a new district and is considered to be one of the most backward district of Bihar. Primary and Secondary sources were referred to for collection of data. Thakurganj and Pothia block were selected as these blocks showed predominance of pineapple cultivation in Kishanganj district.

MAJOR FINDINGS

- The area consisted of marginal farmers (30.0%), small farmers (40.0%) and semi-medium farmers (30.0%). Farmers' division was more or less equal in the blocks selected. The smaller size of land holding was due to subsequent fragmentation of land owing to family divisions carried on lineage basis.
- The age factor played an important role in decision making of farmers. Major portion of pineapple cultivators belonged to middle-age group. As presented in table 5.1 the average age lies at 47 years for marginal farmers, 45 years for small farmers and 46 years for semi-medium farmers. Overall average age of pineapple cultivators is found to be 46 years. The farming experience gained by the farmers owing to their age shows a cumulative effect on the adoption of a new crops. The age range was visibly a factor for adopting a relatively new commercial crop in the area.
- Education also represented an important aspect when considered for adoption of new commercial crop. Marginal farmers had maximum number of illiterate farmers (16.67%) as depicted in table 5.1. Evident conclusion could not be drawn on direct relation of education with pineapple cultivation. Profit generating ability of the crop was more evident factor regarding its adoption at a faster rate.
- Marginal pineapple farmers were able to earn a net income of 53489.5 rupees per acre. It may be subjected to slight ups and downs owing to seasonal variability. The gross income generated was rupees 132000 whereas the total cost incurred was calculated to be rupees 78510.5 per acre. The study hence concluded that there was a visible profit margin in pineapple cultivation. The

increased farmers' participation in cultivation of pineapple was mainly due to the evident profit margin shown in the process. Pineapple cultivation has emerged as one of the most important factor that has led to the growth and prosperity of farmers in Kishanganj district of Bihar. The net income clearly depicted its profitability. Owing to its greater marketable surplus and low maintenance requirement, it encourages farmers to adopt pineapple cultivation for a profitable venture.

- The gross income per acre earned by small farmers is rupees 163000 whereas the total cost incurred was rupees 100993.63 (table5.2.3). The net income earned was rupees 62006.37 (table5.2.4). Small farmers spent more on costly inputs like manures and fertiliser when compared to marginal farmers. Plant protection materials like weedicide was used to a greater extent on per acre basis to provide for better production and yield.

- Semi-medium farmers spent a total cost of rupees 108666.5 per acre (table 5.2.5) and the gross income generated was 182800 per acre (table5.2.6). The net income thus received by semi-medium farmers was 74133.5 rupees per acre. The amount spent was higher on land preparation as semi-medium farmers were able to arrange for larger disposable income for cultivator and other land preparation operations. When compared to marginal farmers the semi-medium farmers employed rotavator and cultivator for longer hours which resulted in higher total cost of cultivation per acre.

- The resource use efficiency was found to be well within the profitable range of the farmer. The resources used had their effect directly on the income generated. The regression analysis revealed that expenditure on sucker had negative impact on gross income for pineapple farmers. It also revealed that the regression coefficients for fertiliser, manure and irrigation turned out to be positive and significant (table 5.3.2). The regression coefficient of fertiliser is positive and non-significant in case of marginal and small farmers (table 5.3.1).

- The disposal pattern of pineapple was studied which revealed that the produce was sold in three major periods which were November-December, February-

March and June-July. The disposal pattern of various grades of pineapple fruits depicted that grade 'A' fruits were sold mostly in the month of June-July followed by November-December. In the case of grade 'A' fruits, the marginal class of farmers sold most of their produce in June-July, and almost a similar percentage sale observed in November-December. The semi medium class of farmers sold most of their produce in June-July, with disposal coming down to almost one-third of its produce in November-December, and more or less similar percentage sale was observed in February-March. As for the small class of farmers, a trend with the highest sale in June-July, followed by November-December, and the least in February-March was observed. In the case of grade 'B' fruits and their disposal pattern, the basic pattern which was observed was that most of the produce was sold in the month of June-July, followed by November-December and the least in February-March. In case of individual class of farmers, the marginal class of farmers sold their maximum produce in June-July which almost halved in the month of November-December and February-March. In the case of small class of farmers the sale in the month of June-July and November-December differed slightly with the sale in June-July being higher as compared to November-December. In the case of semi medium farmers a simple trend was observed where the produce was sold highest in the month of June-July, followed by November-December and the least in February-March. After grade 'A' and Grade 'B' fruits, the by-product (suckers) was also sold. Most of the suckers were sold in the month of June-July followed by November-December and the least in February-March. The marginal class of farmers sold most of their suckers in the month of June-July which decreased down to almost one-third in the month of November-December. In the case of semi medium farmers the maximum number of suckers were sold in the month of June-July which just got halved in the month of November-December. The trend observed in the case of small farmers showed that almost three-fourth of the produce was sold in the month of June-July followed by November-December and the least in February-March.

- On the basis of the study conducted it was evident that farmers depended on middlemen and contractors for the sale of their produce. Absence of markets and lack of proper transportation network were the basic reason behind their dependence on external sources for sale of their produce. Majority of farmers depended on middlemen in the village for sale of their produce. Semi-medium farmers having larger areas were often under contract farming which secured a market for them. As shown in table 5.4.4 around 46.67 percent of farmers were under contract farming whereas 53.34 per cent farmers employed middlemen for sale of their produce.

- Channel 1 that is Producer Z Pre-harvest contractor Z Wholesaler Z Retailer Z Consumer is found to be more efficient when compared to the other channel that is Producer Z Village trader Z Wholesaler Z Retailer Z Consumer (table 5.5.6). The producer's share in consumer's rupees was also higher in case of channel 1 as shown in table 5.5.5. Retailers earned a higher margin in channel 2 (5.5.4.2). The total marketing cost incurred was Rs.885 and Rs.1233.75 in case of channel 1 and channel 2 respectively (table 5.5.3)

- Even though there was a visible profit range in cultivation of pineapple, still farmers were hesitant in adopting the practice on an even larger scale. Constraints faced by farmers were the major factor responsible for this. Marginal farmers were greatly affected by weather fluctuations during the cultivation of pineapple followed by fluctuation in rate of fertilisers (table 5.6.1). Labour shortage was determined to be one of the constraints that affected the yield of pineapple. Squirrel menace and occasional floods were also reported to be limiting factors.

- Table 5.6.2 revealed that small farmers were also affected by weather fluctuations like sudden rise in temperature and intermittent rainfall. Squirrel menace was listed as second major constraint by the small farmers especially because the fruits were destroyed by the squirrel which resulted in reduced yield and lower remuneration.

- The semi-medium farmers were faced by weather fluctuation similar to small farmers and also shortage of labour during land preparation, pit preparation and transplanting and harvesting was important limiting factor for them. Destruction of quality of fruits and lowering of yield due to squirrel infestation caused a serious decline in net return per acre in case of semi-medium farmers (table 5.6.3).

- Marketing of produce included its share of constraints. Each class of farmers were faced with more or less similar kinds of constraints. High transportation cost was the most limiting factor faced by all the three classes of farer viz. marginal, small and semi-medium. The second major constraint faced by the farmers was lack of local markets due to which they were force to sell the produce to contractor or middlemen. Involvement of middlemen was ranked as third major constraint by marginal (table5.5.4 and small farmers (table 5.6.5) whereas it was ranked fourth by the semi-medium farmers. Middlemen were often accused of paying less price and were thus responsible for lower price realisation by farmers. Lack of processing unit was a major constraint for semi-medium farmers (table 5.6.6) as they were forced for distress sale during glut season. Unavailability of credit facility was a constraint for the marginal class of farmers (table 5.6.4)

- The major constraints were listed out by farmers where it was clearly seen that involvement of middlemen was most important issue faced by the pineapple growers (table 5.6.7). The middlemen were often accused of harassing the farmers and paying much less than the actual market price that led to discomfort among pineapple farmers. The absence of transportation and marketing facilities in the precinct was yet another cause for lower price realisation among the pineapple growers. The networking channel often depends on the contractors and middlemen. The transportation facility was made available by the middlemen majorly the contractors or the village merchants.

- The major markets were far from the area of production and lack of proper transportation network resulted as a major constraint for farmer in pineapple production. Absence of government support and absence of processing units

were also the cause for lower remuneration generated. Farmers were well acknowledged with the package and practice of pineapple cultivation and the traditional knowledge was not considered as a constraint (table 5.6.7).

POLICY IMPLICATION

1. The pineapple cultivation is profitable venture and can be encouraged on a larger scale.
2. The major issue faced by the farmers are of middlemen and lack of transportation and marketing facilities. Farmers are concerned with absence of any governmental support. With proper development of marketing facility and transportation network the pineapple cultivation can become a profitable venture for Bihar and can lead to Bihar being the top producer of pineapple.
3. Establishment of processing plant in nearby area can sustain the pineapple farmers a handsome price in addition to infrastructure development of the area. The setting up of processing plant can enhance the living standards of the village and in overall Bihar.

FUTURE SCOPE

The intercropping of Pineapple and Banana is fast gaining popularity in the region. Block Thakurganj has few farmers who have shown the greater profitability in intercropping rather than mono-cropping. Its subsequent study and proper economic analysis can reveal future aspect of the intercropping developed. The economic analysis of pineapple along with resource use efficiency and constraints studied can create a positive impact on devising policies and further profit enhancing steps. Determining the region's specific technology according to its resource endowment to achieve maximum performance potential and identifying the main limiting factors impeding growth and policy options to solve the problem require further scientific attention. Assessing gaps in technology development and diffusion to farmers and providing suitable alternatives requires realigning existing policies to promote farmers' livelihoods, and more research is needed. The implementation of terrain modelling technology is very extensive.

Fig. 6.1: Banana as intercrop in pineapple crop

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APPENDIX

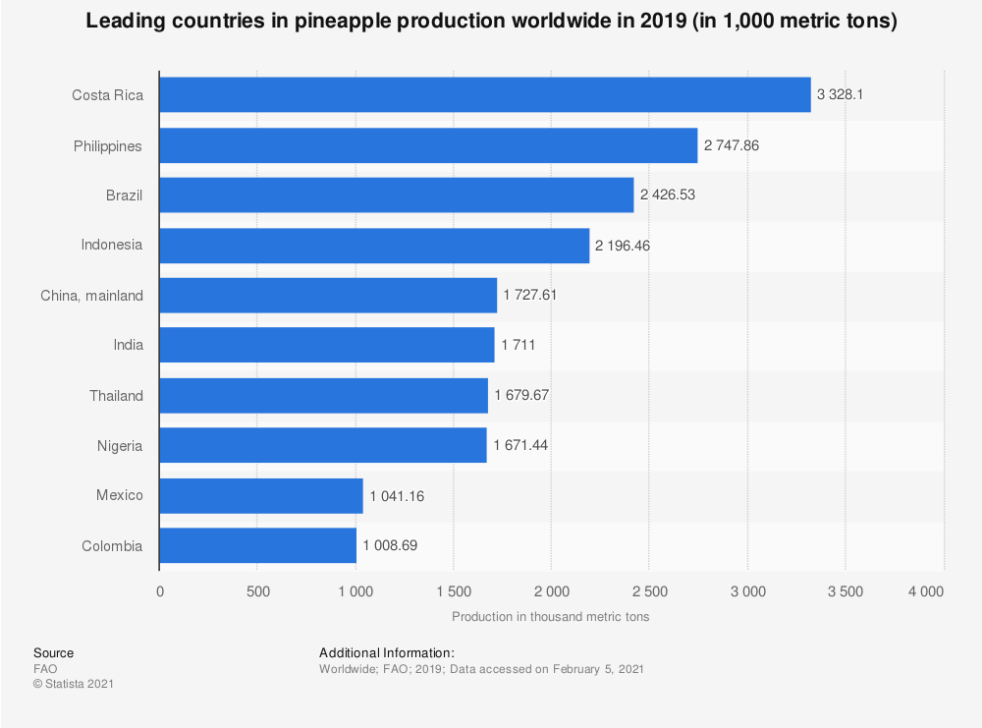

Fig. 1: Worldwide production of pineapple

Table 1: Concentrated pockets of Pineapple in India

States	Districts
West Bengal	Darjeeling, Jalpaiguri, Dakshin Dinajpur, Uttar Dinajpur, Cooch Behar
Assam	Karbi-Anglong, Nagaon, Cachar, N.C.Hills
Bihar	Purnia, Kishanganj, Saharsa, Madhepura
Manipur	Senapati, Thoubal, Charchandarpur, Bishnupur, East Imphal,
Tripura	West Tripura, North Tripura, Dhalai Tripura
Karnataka	Shimoga, Kodagu, Uttar Kannada, Udupi

Table 2: Catchment areas of market for pineapple

Bihar	Purnia	Amour, Qasba, Banmankhi, Barhara, Kothi, Dhamdaha, Bhawanipur, Rupauli
	Kishanganj	Dighalbank, Bahadurganj, Kochadhaman, Pothia, Thakurganj
	Saharsa	Mariches, Nauhata, Mahishi, Chapram, Salkhua, Sonbarsa Raj, Sour Bazaar
	Madhepura	Kumarkhad, Singheshwar, Sankarapur, Murliganj, Alamnagar, Chausa, Puraini

National Horticultural Board has released the following data regarding area, production and productivity of pineapple growing states.

Table 3: Area, Production and Productivity of Leading Pineapple growing states in India

State	Area	Production	Productivity	% Share of Production
West Bengal	9.90	303.70	30.60	21.5
Assam	14.00	220.70	15.80	15.6
Karnataka	3.00	186.10	62.00	13.1
Tripura	6.80	153.30	22.60	10.8
Bihar	4.90	129.40	26.50	9.1
Manipur	12.2	104.40	8.60	7.4
Meghalaya	9.70	86.00	8.90	6.1
Kerala	10.20	85.50	8.40	6.0
Nagaland	3.70	57.50	15.50	4.1
Arunachal Pradesh	10.90	34.40	3.20	2.4
Others	3.50	54.50	15.60	3.9
Total	88.70	1415.40	15.90	100.0

DEPARTMENT OF AGRICULTURAL ECONOMICS
INSTITUTE OF AGRICULTURAL SCIENCES
BANARAS HINDU UNIVERSITY

ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF PINEAPPLE IN KISHANGANJ DISTRICT, BIHAR

Investigator: Sharina Nasreen **Date of investigation:**

Farmer Schedule

1. **General information**:
   a) Name :
   b) Village :
   c) Block :
   d) Main occupation :
   e) Subsidiary occupation :
2. **Socio-economic character of farmer:**
   a) Education level: Illiterate/Primary/ Higher primary/ High school/ PUC/Degree/PG
   b) Family size: 1) Male……..2) Female……..3) Children…….....….. 4) Total……

c) Household assets:

Sl. No.	**Asset**	**Number**	**Year of purchase/ construction**	**Present value (Rs)**
1	Dwelling house			
2	Radio			
3	Television			
4	Bicycle			
5	Scooter			
6	Car/Jeep			
7	Other(Specify) a) b) c)			

d) Farm assets:

Sl. No.	**Particular**	**Number**	**Year of purchase/construction**	**Purchase price (Rs.)**	**Economic life**
1	Farm building Cowshed Godown Pump house				
2	Irrigation well				

3	Irrigation pumpset				
4	Tractor				
5	Tractor accessories a) disk plough b) harrow c) peddler d) leveller				
6	Power tiller				
7	Bullock cart				
8	Sprayer				
9	Duster				
10	Farm animal				
11	Others (specify) a) b) c)				

Farm land	**Area**	**Value**
a) dry land b) irrigated land c) canal irrigated land		

Wage rate

Men (Rs. /day): Women (Rs/day):

Tractor (Rs/hour): Bullock pair (Rs/day):

3. Cost and return of Pineapple

a) Area: e) No. of plants/acre:

b) Spacing: f) No. of yielding plants/acre:

c) Yield/plant: g) Year of planting:

d) Variety: h) Duration:

Establishment of pineapple garden

Sl. No.	**Operation**	**No. of times**	**Labour input**						**Machine labour**	
			Men		**Women**		**Bullock**			
			F	**H**	**F**	**H**	**F**	**H**	**O**	**H**
1.	Land preparation									
A	Clearing the land									
B	Ploughing									
C	Clod crushing									
D	Harrowing									
E	Digging of pits									

F	Filling the pits									
G	Fencing									
2	FYM/compost a)Transportation b) Application									
3	Planting									
4	Chemical fertilizer application a)Urea b)SSP c)MOP d)complex									
5	Weeding									
	a)Manual									
	b)Herbicides									
6	PPC application a) b) c)									
7	Irrigation									
8	Watch and ward									
9	Mulching									
10	Any other (specify)									

F: Family labour H: Hired labour O: Own

Fixed cost

Sl. No.	**Particular**	**Unit**	**Quantity**	**Unit cost (Rs)**	**Total value (Rs)**
1	Land revenue				
2	Rental value of land				
3	Any other specify				

Variable cost

Sl. No.	**Particular**	**Unit**	**Quantity**	**Unit cost (Rs)**	**Total value (Rs)**
1	FYM/compost	Tones/cart			
2	Planting material	No			
3	Chemical fertilizer	kg			
	Urea				
	DAP				
	SSP				
	Complex				
	Any other				
4	Bio-fertilizer	kg			
5	Micronutrients	kg			
6	PPC	kg/lit			
	a.				
	b.				

	c.					
7	Weedicides	Lit/kg				
8	Irrigation charge	No of times				
9	Electricity charge	kWh				
10	Labour	F	C			
	a) Own labour					
	b) Hired labour					
11	Any other					

Gross return

Sl. No.	**Particular**	**Quantity(no.)**	**Unit price (Rs/100 fruit)**	**Total value (Rs)**
1	Main product			
2	By product			

Net return= Gross return- Total cost

●

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ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF PINEAPPLE IN KISHANGANJ DISTRICT, BIHAR

Investigator: Sharina Nasreen **Date of investigation:**

Marketing Schedule

Post-harvest operations

Operation	**Materials used**	**cost**	**Labour employed**	**Cost**
Sorting				
Grading				
Packing				
Loading				
Unloading				

Name: **Designation**:

Producer/ Village traders/ Pre harvest contractors/ Commission agents/ Wholesalers/ Retailers/ Consumers.

Detail about selling of pineapple in 2020

Total production (in numbers)	**Total quantity sold (in numbers)**	**Variety**	**Rate (Rs/100 fruits)**	**Total receipt (Rs)**	**Distance from orchad**	**Remarks**

1. To whom sold? Whether direct to contractors/ by auction of orchard:
2. Whether he is your permanent contractors: Yes/No
3. If not directly to contractors then give the details about type of consumer-price received:

Type of purchaser	**Variety**	**Quantity**	**Rate (Rs/100 fruits)**	**Total value**	**Remarks**
Pre-harvest contractor					
Village trader					
Commission agent					
Retailer					

4. Type of communication facility:

Name of communication	**Distance from village**
a. kachcha road	
b. Pucca road	
c. Railway	

5. Do you grade / standardized your produce? Yes / No

6. If yes then

Type of grade	**Price at which sold**	**Remarks**
1.		
2.		
3.		

7. Do you follow any packing practices in transportation: Yes /No
8. If yes

Containers	**Size**	**System of packing**	**Packing charges**	**Labor charges**	**Remarks**
1.					
2.					
3.					

9. Cost involved in packing per hundred of Pineapple / Box/ or Basket:
10. Processing of Pineapple, if any:
11. Transportation cost: Yes/No
12. Market fee paid, if any:
13. If there any marketing co-operative society in your village: Yes / No
14. If yes, are you member of this society? Yes/ No

15. If yes, what type of marketing facility received during 2020:

Type of facilities	**Charges**	**Terms and conditions**	**Remarks**
a. Credit			
b. Storage			
c. Transportation			
d. Purchasing of input			
e. Selling of product			
f. Others, if any			

16. If there any financial agency other than cooperative society which extend credit for marketing of Pineapple? Yes/No

19. If yes, then

Source/Agency	**Amount received**	**Terms and condition of loan**	**Distance**	**Remarks**
1. Pvt. Money lender				
2. Commercial bank				
3. RRB				
4. Any other				

20. At what rate Pineapple sold to other middle man:

a) Type of Agent :

b) Rate :

21. Profit :

22. Cost :

23. Any suggestion :

●

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DEPARTMENT OF AGRICULTURAL ECONOMICS

INSTITUTE OF AGRICULTURAL SCIENCES

BANARAS HINDU UNIVERSITY

ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF PINEAPPLE IN KISHANGANJ DISTRICT, BIHAR

Investigator: Sharina Nasreen **Date of investigation:**

Disposal pattern and constraint schedule

1. **General information:**

   a. Name :

   b. Village :

   c. Block :

2. **Disposal pattern of various grades of pineapple:**

	Month/Season	**Total Sale**	**Grade 'A'**	**Grade 'B'**	**By-product**
1st Sale					
2nd Sale					
3rd Sale					
4th Sale					

3. **Marketing channel employed by pineapple farmers**

   Producer

   Village traders

   Pre-harvest contractors

   Commission agents

Wholesalers

Retailers

Consumers

Other……

4. Constraint faced by farmers in production of pineapple:

Sl. No.	**Factors**	**Ranking**
1.	Weather Fluctuations	
2.	Squirrel menace	
3.	Fluctuation in Fertiliser rate	
4.	Labour crisis	
5.	Floods	
6.		
7.		
8.		

5. Constraint faced by farmers in marketing of pineapple:

Sl. No.	**Factors**	**Ranking**
1.	Transportation cost	
2.	Lack of Processing unit	
3.	Lack of storage facility	
4.	Involvement of Middlemen	
5.	Lack of local market	
6.	Unavailability of credit system	
7.		
8.		
9.		
10.		

6. Ranking of various constraints faced by pineapple farmers

Sl. No.	**Factors**	**Ranking**
1.	Fluctuation in fertilizer rate	
2.	Squirrel menace	
3.	Unavailability of credit	
4.	Transportation facilities and cost	
5.	Marketing problems	
6.	Lack of processing units	
7.	Weather fluctuation	
8.	Involvement of middlemen	
9.		
10.		