ECONOMICS OF PRODUCTION AND MARKETING OF BANANA IN SOLAPUR DISTRICT OF MAHARASHTRA

by

Miss. Rede Bharati Harishchandra
(Reg. No. K-18/212)

AGRICULTURAL ECONOMICS SECTION
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In partial fulfilment of the requirements for the degree

of

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EXPORT PROSPECTIVE AND COMPETITIVENESS OF PADDY FROM INDIA

By

Miss. Atla Jyoti Sukaru
(Reg. No. Ph.D./ 015/47)

A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH
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2021

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part
thereof has not been submitted
by me or other person to any
other University or Institution
for a Degree or
Diploma

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The assistance and help received during the course of this investigation have been duly acknowledged.

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Place : MPKV, Rahuri

Date : / /2021 (P. N. Rasal)

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Now as I carry this thesis in my hand, I carry with me memories that will enrich my nostalgia.

Place : MPKV, Rahuri (Jyoti S. Atla)

Date : / /2021

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LIST OF ABBREVIATIONS

$	:	Dollar
%	:	Per cent
₹	:	Rupees
Acre	:	43560 sq. feet/ Acre
AVC	:	Average Variable Cost
C.V.	:	Coefficient of variation
CGR	:	Compound Growth Rates
CDVI	:	Cuddy Della Valle Instability Index
EPR	:	Export performance ratio
et al.	:	et alli (and other)
EVMP	:	Estimated Value of Marginal Product
FAO	:	Food and Agriculture Organization
GAA	:	Growth Accounting Approach
GDP	:	Gross Domestic Product
GoI	:	Government of India
ICAR	:	Indian Council of Agricultural Research
IRR	:	Internal Rate of Return
K	:	Kilogram
m.ha		Million Hactores
KI	:	Kendrick Index
m.tons	:	Million Tonne
N to P ratio	:	Nitrogen to Phosphorous ratio
NARS	:	National Agricultural Research System
NEPZ	:	North Eastern Plane Zone
NPV	:	Net Present Value
PFA	:	Production Function Approach
PPP	:	Purchasing Price Parity
q	:	Quintal
R&D	:	Research and development
S.E. ±	:	Standard Error
SCH	:	Single cross Hybrids
SI	:	Solow Index
t	:	Tonne
TFP	:	Total Factor Productivity
TFPI	:	Total Factor Productivity Index
TII	:	Total Input Index
TLI	:	Translog Index
TOI	:	Total Output Index
TTI	:	Tornqvist-Theil Index
U.K	:	United Kindom
U.S.	:	United States
U.S.A.	:	United States of America
WTO	:	World Trade Organisation

ABSTRACT

EXPORT PROSPECTIVE AND COMPETITIVENESS OF PADDY FROM INDIA

By

Atla Jyoti Sukaru

A candidate for the degree of
DOCTOR OF PHILOSOPHY (AGRICULTURE)
in
AGRICULTURAL ECONOMICS
2021

Research Guide	:	**Dr. V.G. Pokharkar**
Department	:	**Agricultural Economics**

The present study was conducted to evaluate the export prospective and competitiveness of paddy from India by the way of studying the changes in area, production and productivity of paddy, growth rate and instability in area, production and productivity of paddy during pre-WTO period (1970-71 to 1994-95), post-WTO period (1995-96 to 2017-18) and overall period (1970-71 to 2017-18). The polynomial function was used for anaylzing trends in domestic and international prices of paddy. In addition to this export competitiveness of paddy, structural changes in paddy export and determinants of paddy export were also examined. The area of paddy in the world during 1970-71 was 132.66 m.ha which increased to160.76 m.ha in 2017-18. The production increased to 729.10 m.tons in 2017-18 from 316.40 m.tons in 1970-71. The productivity of paddy was also increased to 4535 kg/ha in 2017-18 from 2385 kg/ha in 1970-71. The area of paddy in India during 1970-71 was 37.59 m.ha which increased to 42.95 m.ha in 2017-18. The production increased to 111.01 m.tons in 2017-18 from 42.22 m.tons in 1970-71. The productivity of paddy also increased to 2584.63 kg/ha in 2017-18 from 1123.17 kg/ha in 1970-71. In Maharashtra, the area of paddy in 1970-71 was 1.36 m.ha which increased to 1.45 m.ha. in 2017-18. The production increased to 2.66 m.tons in 2017-18 from 1.66 m.tons in 1970-71.The productivity of paddy also increased to 1834.48 kg/ha in 2017-18 from 1220.59 kg/ha in 1970-71. The area, production and productivity of paddy increased at the rate of 0.33, 2.22 and 1.88 per cent per annum,

respectively, in India during the entire period. In India, the growth rates of area, production and productivity were positive and significant in Uttar Pradesh, West Bengal, Karnataka, Maharashtra, Punjab and Assam and the growth rate in area was negatively significant while, that for the production and productivity was positively significant in Andhra Pradesh and Tamil Nadu for entire period.

Trend in international prices of paddy more fluctuated than domestic prices of paddy during the entire study period. Fluctuations in domestic and international prices of paddy due to time factor was to the extent of 97 and 70 per cent respectively, as indicated by R^2. Growth rate estimated for domestic prices i.e. 8.21 per cent per annum is higher than for international prices i.e. 7.02 per cent per annum during entire period (1970-71 to 2017-18). Instability index of domestic and international prices of paddy shown that domestic prices were more consistent than international prices of paddy, i.e. 37.99 and 53.23 per cent respectively, during overall period.

India's total export share in the World total export has been ranging from 1.03 to 1.30 per cent, the average share of India's agricultural export was less than 4 per cent in the World agricultural export, India's paddy export share in World agricultural export was less than 1 per cent, India's agricultural export share in India's total export has declined, While India's paddy export share in the India's agricultural export trade gradually increased from 1.43 to 12.60 per cent and India's paddy export share in paddy production has continuously increased from 1990-91. Direction of trade in World total export-import was negative during the entire study period shown positive. India's total export-import shown negative balance of trade during entire study period, trade balance of India's agricultural export-import was negative during initial study period but it was changed to positive trade balance from 1970-71 to 2017-18 and the World paddy export-import shows negative trade balance over the study period.

On an average the Nominal Protection Coefficient (NPC) and Export Performance Ratio were 0.62 and 11.74, which means that Indian paddy production was competitive in international market during study period.

The trade direction has been explored by Markov chain analysis using export quantity and value. It was observed that UAE and USA were the most stable markets among the major importers of Indian paddy and they retained their original export quantity and value share of 67.93 and 76.34 per cent, respectively. Trade direction of basmati paddy export was observed that UAE was the most stable market among the major importers of basmati paddy and it retained its original export quantity and value share of 79.37 and 79.62 per cent, respectively. Belgium and Kuwait were the most stable markets among the major importers of Indian non-basmati paddy and they retained their original export quantity and value share of 44.09 and 42.90 per cent, respectively.

The factors determining paddy export indicate that the domestic production, wholesale price of paddy and exchange rate were significantly declined whereas international price of paddy and EPR were significantly increased during the study period.

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1. INTRODUCTION

Agriculture is the mainstay of the Indian economy. Agriculture and allied sectors contribute nearly 17.32 and 18 per cent of Gross Domestic Product (GDP of India) during 2016-17 and 2017-18, respectively (Economic Survey 2018-19). The agricultural output, however, depends on monsoon as nearly 55.7 per cent of area sown in India is dependent on rainfall. Agriculture contributes approximately one-fifth of total Gross Domestic Product (GDP). It provides the means of livelihood to about two-thirds of the country's population (Central Statistical Organisation). The sector provides employment to 50 per cent of the country's work force and is the single largest private sector occupation. Agriculture accounts for about 10 per cent of the total export earnings and provides raw material to a large number of industries. Besides, the rural areas are the biggest markets for consumer goods, including consumer durables, apart from a major source of domestic savings. Above all, agriculture is the only source of food security for the nation.

Historical evidence suggests that paddy (*Oryza sativa* L.) was originated either in southern parts of India or in the parts of India and Burma. It is also being cultivated in China since ancient times and occupies the first place in paddy production in the World. The region of India, Burma, Thailand and Cambodia is the centre for many wild paddy varieties. Paddy is not a tropical plant but is still associated with a wet, humid climate. It is generally believed that the domestication of paddy began somewhere in the Asian arc. From its place of birth, lost forever in the mists of time, the plant and its grain spread all over the world.

From India, the plant spread to China and then onwards to Korea, the Philippines (about 2000 B.C.), Japan and Indonesia (about 1000 B.C.). The Persians are known to be the importers of this grain. From there its popularity spread to Mesopotamia and Turkistan. It is believed that when Alexander the Great invaded India in 327 B.C., one of the priced possessions he carried back with him was paddy.

1.1 Global Scenario

Paddy is the most widely grown cereal in the World and is staple food for more than 60 per cent of World's population. World paddy production has increased steadily but at a slow pace from about 400 million tonnes to 477 million tonnes in the past 15 years.

Paddy is believed to be the first cultivated crop in the World. Asia dominates in paddy production accounting for over 90 per cent of the total World's production. It is the second largest cereal produced in the World after corn.

China is the largest producer of paddy contributing for over 30 per cent of the World's paddy output. India occupies the second position accounting for about 22 per cent followed by Indonesia with 8 per cent, Bangladesh with 7 per cent and Vietnam with 6 per cent of total paddy production in the World.

In terms of consumption also, China and India occupied the first two places contributing for about 31 and 20 per cent, respectively. Indonesia accounts for about 8.4 per cent of World's rice exports followed by Bangladesh for about 7.4 per cent and Vietnam for about 4.3 per cent to the total paddy consumption in the World.

There exists a high degree of volatility in the world paddy market because a small change in production or consumption brings a relatively large change in its total trade. Since most of the paddy is produced, consumed and traded by Asian countries and main Asian exporters are Thailand, Vietnam, India, Pakistan and China. Now, the international trade under World Trade Organisation (WTO) rules is free from quantitative restrictions. A country's trade is mostly based on its comparative and competitive advantage in international trade. So, obviously every country faces a tough competition in international market and tries not only to maintain but also to increase its share in market.

India has emerged as the major paddy exporter since 2017-18 onwards replacing Thailand and accounts for about 26.3 per cent of total paddy exports in the World. Apart from India, exports from Vietnam also increased significantly from the year 2017-18 onwards, taking it to the second position with about 7.5 per cent share in the total paddy exports.

1.2 National Scenario

India is the second largest producer as well as consumer of paddy in the World. Similar to the trends in world production, paddy production in India has also increased at a slow pace with 109,000 thousand tonnes in the year 2018-19 primarily due to rise in yields.

Export estimates of paddy have also gone up steadily from about 13000 thousand tonnes in 2017-18. India maintains buffer stocks as per the norms specified to meet the domestic requirements. In view of the comfortable domestic stock position and surplus production, export of non-basmati rice was liberalised and exports have gone up to 10 million tonnes during the past few years.

1.3 State-wise Production

West Bengal has been the largest producing state accounting for about 14 per cent of total paddy output in the country followed by Uttar Pradesh and Andhra Pradesh competing for the second position with about 12-13 per cent share in production. Tamil Nadu, Bihar and Orissa are the other major paddy producing states contributing together to about 20 per cent of country's rice output.

1.4 Importance of paddy in the Economy

World trade figures are very different to those for production, as only about 5-6 per cent of paddy produced is traded internationally. In economic terms, the global paddy trade was a small fraction of 1 per cent of world mercantile trade. Many countries consider paddy as a strategic food staple, and various governments subject their trade to a wide range of controls and interventions.

Developing countries are the main players in the world paddy trade, accounting for 83 per cent of exporters and 85 per cent of imports. While there are numerous importers of paddy, the exporter of paddy are limited. Just five countries viz.,Thailand, Vietnam, China, the United States and India – in decreasing order of exported quantities, accounted for about three quarters of world paddy exports in the year 2002. In the year 2010, the three largest exporters of paddy, in decreasing order of quantity exported were Thailand, Vietnam and India. Together, they accounted for nearly 70 per cent of the world paddy exports. The primary variety exported by Thailand and Vietnam was Jasmine paddy, while exports from India included aromatic Basmati variety. China, an exporter of paddy in early 2000s, was a net importer of paddy in the year 2010. Major importers include Nigeria, Indonesia, Bangladesh, Saudi Arabia, Iran, Iraq, Malaysia, Philippines, Brazil and some African and Persian Gulf countries.

Although China and India are the two largest producers of paddy in the World, both countries consume the majority of the paddy produced domestically, leaving little to be traded internationally.

International trade plays an important role in the economic development of a country. The participation of India in international trade is largely confined to primary products, especially of the agricultural sector. Indian trade policy for agricultural commodities is guided by the twin objectives of ensuring national food 2012-13. The major markets for export of Indian paddy were: United Arab Emeritus, Saudi Arabia, Iran, Kuwait and Iraq.

Improving productivity and quality are the key challenges facing farmers today, in an effort to increase their income from limited land under cultivation. Selection of the right type of seed, growth of weeds, onset of insect pests & diseases in the crop, inefficient water management and unpredictable weather conditions are the main factors which affect yield of the paddy crop and it turn the export of paddy. It is very important to use good quality seed and protect the crop from weeds, insect pests and diseases and thus to increased crop production.

The new multilateral trade regime coupled with the policy changes adopted by the most nations aiming towards globalization, provided new opportunities as well as posed several challenges for expanding trade in agricultural products. India too has been able to derive significant benefits from the changed global environment. Since global trade environment is highly dynamic and export is influenced by both micro and macro policies, it is important to understand the product-specific dynamics to improve export performance of agricultural commodities. The global markets for Indian paddy are highly dynamic and the barriers to trade are being lowered gradually all around the world (Singh, 1993). The export of paddy is also related with the buffer stock of paddy held by the government. Because of comfortable buffer stock, India became a major exporter of paddy in 2018. There is a strong demand for Indian paddy in the international markets. The increasing consumer demand for paddy and India's strength for production of basmati as well as non-basmati paddy, coupled with liberal export policy, and large public stock have created ample scope for paddy export. In recent years, the African countries have also shifted to Indian non-basmati paddy because of price competitiveness (Nethrayani *et al.*, 2012).

The future performance of any product in international markets can be judged in the light of its past performance. Therefore, evaluation of past performance of paddy is necessary to work out its export potential, challenges and opportunities. The present study has analysed major markets for Indian paddy, in terms of its future share. Paddy export from India is determined by various factors and therefore, reliable estimates of determinants of export are essential for the formulation of appropriate policies. The present study *viz.*, export prospective and competitiveness of paddy from India has examined the growth performance and instability of paddy, direction of trade, with competitiveness for export in future and determinants of export of paddy in India.

1.5 Objectives of the study

1. To estimate the growth rates of area, production and productivity of paddy in India.
2. To estimate the trends in domestic and international prices of paddy.
3. To examine the competitiveness of Indian paddy.
4. To analyze the direction of trade of paddy export from India.
5. To study the determinants of export of paddy from India.
6. To suggest the policy measures for export of paddy.

1.6 Hypothesis

1. The production of paddy increased due to both area expansion and productivity improvement in India.
2. Domestic and international prices of paddy are fluctuating.
3. Indian paddy is competitive in the international markets.
4. The dynamics in the direction of paddy export is changing.

1.7 Need of the study

Communication has encouraged trade in the pre-historic times, but in the present century, import-export of paddy business is essential for survival. Now, both import and export are fundamental aspects of any international trade, but a country should have more focus on export of paddy so, the top five reasons are given as follows:

1.7.1 Economic Stability

A good export rate of paddy helps to minimize excessive fluctuations in the financial system of the country. In such a scenario, people gain confidence in their economy and investment increased in the country thus ensures economic stability.

1.7.2 Foreign Investment

A good export rate of paddy encourages investors to invest in countries, especially developing countries like India. Again, foreign investment is vital to fill up the gap between national savings and investment in an economy to have a high economic growth rate.

1.7.3 Inflation Rate

A high export rate keeps the inflation rate under a check and a low inflation rate does not allow the export of goods to slump. Thus, as said earlier, export of a country has a strong co-relation to the inflation rate. For example, India has performed well in the export of paddy in the recent years to control the inflation rate, which has increased the capacity to create widespread public protest.

1.7.4 Internal Trade

It may sound surreal that export promotes internal or domestic trade within a country, but it is true. When there are more paddies of international standards in a surplus amount that an industry can export, a sense of competitiveness encourages industries in the domestic market to become more productive and internal trade prospers.

1.7.5 Foreign Currency

Lower export of paddy of a country mean less foreign exchange, *i.e.* less foreign currency to make necessary imports from other countries, which could prove disastrous. For India, having an adequate foreign currency reserve is a matter of great significance.

Apart from all the above reasons, a country needs to focus on export of paddy to contribute a big share of the country's GDP growth.

1.8 Scope and utility of the study

India exports paddy to various countries around the globe. India had export tradition, especially in agricultural and allied sectors. The expansion of export sector helped India to integrate into the World economy as a supplier of many agricultural commodities and raw material. The instability in prices of agricultural commodities has been one of the major factors affecting the income levels of the farmers as well as tempo of agricultural production.

The study which focuses on growth performance, export performance, trends in domestic and international prices and structural changes in paddy export from India may help to formulating alternative management strategies and policies to boost paddy export in India.

The findings of this study would be useful to the farmers for making an appropriate decision or planning regarding when to grow and when to sell. It helps to understand the dependence of paddy markets with respect to fluctuation in prices. It would be useful for planers for formulating appropriate paddy export and import policies. Thus the findings of the study would also be useful to all paddy cultivators, exporters, export and import agencies.

1.9 Limitation of the study

The study is depicted only on single crop paddy during the year 1970-71 to 2017-18 and it is focused on trends in domestic and international prices, instabilities, export competitiveness in the World market and direction of trade. One thing that limits the quality of the study is that absence of imports of paddy. Also the study was mostly based on the secondary data collected from various published sources. Often data from various sources may not agree with each other and some efforts to choose the better among them are inevitable. Care has been taken to avoid personal bias in such decisions. However, the limitations inherent in the secondary data are to be recognized.

1.10 Organization of thesis

This thesis shows that, the whole study has been depicted in five chapter, Chapter I highlights the introduction to the topic, Global and national scenario of paddy, importance of paddy in the economy, objective of the study and hypotheses of the study.

Chapter II includes the review of earlier studies connected with present investigation.

Chapter III explains the methodology *i.e.* description of the study area, nature and source of data, and the tools and techniques of analysis adopted for evaluating the objectives of the study.

Chapter IV the of results obtained in consistence with the objectives of the study which are discussed and presented in detail.

Chapter V is the a last chapter which summarizes the entire study and brings about the major policy implications.

2. REVIEW OF LITERATURE

The review of the past literature forms an integral part of any systematic research work. Moreover, it becomes imperative on the part of a research worker to have knowledge of research work carried out by previous researchers in a specific research area of interest so as to plan for his own research work on more systematic lines. This requires review of findings of closely related previous research studies from various sources. The knowledge obtained through such review of literature enables the research to gain insight in respect of the manner in which a given research problem has been tackled, the nature of results obtained and the conclusions drawn. Many times, it may be true that the previous research work might have been carried out under different set of conditions. Nevertheless such knowledge is always useful for improving efficiency and effectiveness of all relating to designing of research problems, adopting suitable methodology and interpreting research results. This chapter reviews in brief available literature on different methodological issues and empirical research results given by various research scholars from similar studies. For the sake of the convenience, the reviews collected from the various sources have been grouped under the following major headings.

2.1 Growth rates of area, production and productivity of paddy in India

2.2 Trends in domestic and international prices of paddy

2.3 Competitiveness of paddy

2.4 Direction of trade of paddy export

2.5 Determinants of paddy export

2.6 Policy measures for export of paddy

2.1 Growth rates of area, production and productivity of paddy in India

Ananthi (2000) analysed the growth of area, production, productivity and export of Indian Non-basmati and basmati rice. The compound growth rates were calculated by exponential function. The area, production and productivity were shown positive trend during first period *i.e.*1949-50 to 1969-70 and second period *i.e.* 1970-71 to 1997-98. The growth rates of export of basmati and non-basmati rice were positive and significant during the period 1980-81 to 1998-99.

Rajesh *et al.* (2002) studied the trend in export of major spices in India for the period 1970-71 to 1999-2000 and found that black pepper registered a positive annual growth rate of 2.38 per cent in quantity and 12.78 per cent in value. While large cardamom registered 12.76 per cent of export quantity and 21.4 per cent export value, ginger registered 4.05 per cent growth in quantity and 10.15 per cent in value. Turmeric export registered 4.14 per cent in quantity and 13.08 per cent in volume during the study period.

Shivaraya and Hugar (2005) evaluated the compound growth rate in export of tomato in quantity and value with the help of exponential function. The results have shown that growth in both quantity and value of exports increased significantly during both pre-liberalised an post-liberalised periods. The growth in quantity of exports (77.85 %) was found to be higher than their value of export (74.19 %) due to impact of globalisation of Indian economy.

Mohalkar (2005) estimated the state wise compound growth rates of area, production and productivity of rice in India during the period (1989-90 to 2001-2002). The area under rice was highest with significantly increased at 5.58 per cent per annum in Haryana state but growth rate of production and productivity of rice were highest and significantly increased with 5.10 and 6.93 per cent per annum in Mizoram and Karnataka respectively.

Kumar *et al.* (2008) estimated the annual compound growth rates for production and export of cucumber and gherkin for India and the World for the period 1991- 2005. The production of cucumber and gherkin has increased at the per annum rate of 0.97 per cent in India and 6.32 per cent for the World. Similarly, growth in area and yield has also increased, though at a slower rate in India than the World. India has registered a significant ACGR in the export of all the three categories of cucumber and gherkin products in comparison to the World. In the case of 'fresh' cucumber and gherkin, India has achieved an ACGR of 33.37 per cent in physical terms and 30.85 per cent in value terms, whereas export growth in the World was of only 3.13 per cent in physical and 4.25 per cent in value terms. Among all the three categories of cucumber and gherkin, the preserved category had registered the highest ACGR of 48.17 per cent in physical and 43.76 per cent in value terms, followed by provisionally preserved category.

The unit value of export in all the three categories had registered a significantly negative growth rate of 3.7 per cent per annum on overall basis, while for the World it had increased by 0.37 per cent per annum, though it is non-significant.

Nethrayani *et al.* (2012) estimated compound growth rates of Indian basmati and non-basmati rice export from 1998-99 to 2009-10. The study reveals that quantity and value wise compound growth rates of basmati rice export at an annual rate of 10.23 per cent and 15.98 per cent per annum, respectively and these growth rates were statistically significant at 1 per cent level of significant. In case of non-basmati rice, both quantity as well as value wise it shows negative growth rate and statistically non-significant.

Acharya *et al.* (2012) analyzed the growth in the area, production and productivity of different crops in Karnataka was estimated using the exponential function for the period 1982-83 to 2007-08. Growth rates showed a significant and positive growth in area under pulses, vegetables, spices, fruits and nuts while cereals showed significant and negative growth. The area under rice has recorded a mild annual increment. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly the production of cereals, pulses, vegetables and fruits showed a significant positive growth. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits, productivity of oilseeds recorded moderately positive growth. The productivity of commercial crops registered insignificant positive growth and for vegetables the growth in productivity was insignificant and negative.

Naik *et al.* (2013) examined the production and export performance of turmeric in India for the period 1974-75 to 2009-10 by using exponential form of growth function. The results of the study revealed that, there were significant growth rates in production and export of turmeric. Instability index has been worked for the production and export for pre-WTO and post-WTO periods. Instability has been observed high for production, export quantity and export value.

Prabakaran and Sivapragasam (2013) the growth pattern in area, production and yield of rice showed an upward trend at state and regional level except in Rayalaseema region which showed a decline in area and production. Telangana region showed highest growth rates in area, production and yield during the study period. Coastal Andhra region showed highest growth rates in terms of area, production and yield next only to Telangana region. In case of sorghum the growth rates of area and production showed a downward trend in all the regions and the state as a whole. The growth of yield in sorghum crop Rayalaseema region was highest during 1970-80 and total period followed by state as a whole and Telangana region.

Kusuma and Basavaraja (2014) analyzed the compound growth rates of mango production, area and yield, export quantity and export value during the period 2001-02 to 2010-11. The results revealed that both area 6.77 per cent and production 3.70 per cent exhibits positive growth, while productivity -0.72 per cent of mango found to be negatively growing. The study also depicted the growth in export quantity and value of export where in growth of value of export was increasing at 9.98 per cent per annum than quantity of export 5.65 per cent.

Patil and Yeledhalli (2016) analyzed the growth instability in area, production and productivity of different crops in Bengaluru division.The results revealed that Bengaluru urban had the highest CAGR which was 24.26 per cent in productivity was significant at 5 per cent level. In Bengaluru Rural the highest CAGR was 22.26 per cent in productivity significant at 1 per cent level. Production of chrysanthemum had growth of 22.36 per cent was the highest annual growth and 4 per cent (area of tamarind) was found to be lowest instability for selected crops in Chitradurga, In Davanagere the highest CAGR was observed in productivity of tomato (9.12 %). In Kolar district, 19.65 per cent instability observed in production was significant at one per cent. In Shivamogga district highest CAGR observed in production of sunflower to an extent of 29.57 per cent. In Tumkuru area under green chillies was growing at rate of 34.46 per cent per annum.

Adhikari *et al.* (2016) analysed compound growth rate, instability index of rice export to different countries. The higher growth observed in value of basmati rice export (15.87 %) was due to higher growth in unit value than quantity of export (7.55 %) during 1980-81 to 2012-13. The growth rate of unit value of rice export was higher in period I (13.48 %) than period II (5.06 %). The growth rates in export of non-basmati rice in terms of quantity, export earnings and unit value were 10.87, 17.74 and 6.20 per cent, respectively during the study period. The instability index has been found highest for quantity (43.37 %) in case of basmati rice and value (141.36%) in case of total rice during the entire period.

Jain (2018) analysed 41 years data (1970-71 to 2011-12) on area, production and yield under paddy to understand the question of instability in rice production in India. The analysis shows that at all India level compound annual growth rates of area, production and yield of rice were positive but it had been declining gradually over the periods. In the recent decade (2000-01 to 2011-12) there is increase in instability at all India level in area, production and yield of rice. The possible reasons for increase in instability were low percentage of irrigated area to total cropped area, decline in use of seeds and manure and other inputs necessary for agriculture. In the post reform period (1990-91 to 2016-17) the instability has increased in case of wholesale price of paddy across various states while instability has declined in case of farm harvest price of paddy.

Samal *et al.* (2018) analysed the decadal growth in an area, production and yield of rice in India and for different states were computed and compared for the period 1970-71 to 2015-16. It was found that area growth in most of the states has either exhausted or declined. The production growth was mainly from the growth in productivity. Therefore, future growth in rice production has to come from yield growth through technological improvement. This requires more investment in rice research to increase the yield.

Kasula Sekhara (2019) estimated the compound growth rates of area, production and productivity of paddy in the global during 1991-92 to 2015-16. The study period was divided into four periods *i.e.* first period (1991-92 to 1999-00), second period (2000-01 to 2009-10), third period (2010-11 to 2015-16) and overall period (1991-92 to 2015-16). The compound growth rate of the area, production and productivity of paddy was significantly increased with 0.77, 1.99 and 1.21 per cent per annum respectively, during (1991-92 to 1999-2000). But the area, production and productivity were significantly decline with 0.51, 1.61 and 1.09 per cent per annum respectively during (2000-01 to 2009-10). The area and productivity were non-significantly declined with 0.21 and 0.65 per cent per annum respectively and production was significantly decline with 0.93 per cent per annum during (2010-11 to 2015-16). At the overall period (1991-

92 to 2015-16), the compound growth rate of the area, production and productivity of paddy were significantly increased with 0.39, 1.33 and 0.94 per cent per annum respectively.

Myneni Yamini (2019) estimated annual compound growth rates of area, production and productivity of cotton in India. The area of cotton has been increased at the rate of 0.98 per cent per annum during the entire period. The annual compound growth rate in area of cotton in India during period-I (1970-71 to 1994-95) and period-II (1995-96 to 2016-17) was 0.56 and 1.86 per cent respectively. The annual compound growth rate in production of cotton in India during period-I (1970-71 to 1994095) and period II (1995-96 to 2016-17) was 2.57 and 7.01 per cent, whereas the production of cotton in India has been increased with a growth rate of 4.06 per cent per annum during entire period. The annual compound growth rate in productivity of cotton during period-I (1970-71 to 1994-95) and period-II (1995-96 to 2016-7) was 2 and 5.06 per cent, respectively. The productivity has increased with annual growth rate of 3.05 per cent per annum during the entire period.

From the foregoing reviews, it is noted that, the production of paddy was increased highly due to area expansion and slightly due to productivity improvement increased over a study period except in some years where production was declined.

2.2 Trends in Domestic and International Prices

Lekshmi *et al.* (1996) studied that the trend in annual average price of natural rubber in India during the 27 year period from 1968-69 to 1994-95 for the different phases. Natural rubber price in India did not show any significant pattern of consistent movement towards a particular direction in the long run. Two broad phases (1968-69 to 1984-85 and 1985-86 to 1994-95) of natural rubber price movement were identified based on the observed trend. Wide but less frequent fluctuations and mild but frequent fluctuations were the characteristics of the first and second phases respectively. Role of the non-quantifiable factors in price determination could not be ascertained; and therefore, a price forecasting .based on the empirical modelling is less likely to approximate reality.

Guledgudda *et al.* (2002) studied the trend in world tea production and export. They reported that India"s share in the world tea production has slipped gradually from 38.12 per cent in 1960-61 to 28.83 per cent in 1990-91 and further marginally came down to 27.45 per cent in 1999-2000. Whereas its share in world tea exports has been similarly decreased gradually from 36.41 per cent in 1960-61 to 18.33 per cent in 1990-91 and further decreased to 17.86 per cent in 1998-99.

Rajesh *et al.* (2002) studied the trend in export of major spices in India for the period 1970-71 to 1990-00 and found that black pepper registered a positive annual growth rate of 2.38 per cent in quantity and 12.78 per cent in value. While large cardamom registered 12.76 per cent of export quantity and 21.4 per cent export value, ginger registered 4.05 per cent growth in quantity and 10, 15 per cent in value. Turmeric export registered 4.14 per cent in quantity and 13.08 per cent in volume during the period under study.

Reddy *et al.* (2015) examined the production trends of food and non-food crops in India. Before the advent of the British rule, crops such as cotton, tobacco and sugarcane were grown fairly extensively since land revenue had to be paid mostly in cash and the prices of these crops, relative to those of food grains, were much higher at that time. Even during the British rule, the situation did not change much. Indian agriculture recorded a significant acceleration in growth and productivity after independence as compared with the pre-independence period. The contribution of the agriculture and allied sector to total GDP of current prices in 2000-2001 is 23.35 per cent and it gradually reduced and stood at 17.1 per cent by the year 2009-10.

Savitha and Kunnal (2016) analysed the trends in arrival and prices of paddy by orthogonal polynomial regression in the pace and pattern of market arrivals and prices of paddy in Sindhanur and Sirguppa markets. The seasonal variability of price was less when compared to the variability in arrivals of paddy in both the markets. The cyclical variation in arrivals and prices over the years was found to be an uneven cycle which was being observed in both markets. Both the markets have shown an increasing trend for both for arrivals and price. Strong relationship between arrivals and price was ascertained as the co-efficient of correlation and regression between arrivals and prices was positive and significant in both the markets.

Mittal *et al.* (2018) examined the patterns, trends and volatility in domestic and international prices of rice and wheat, and found that although both the international and domestic prices are volatile, the degree of volatility is higher in the international prices. The volatility in domestic prices is mainly due to internal production shocks and is not influenced much by the international prices. This disconnect is attributed to domestic policy measures, such as market support to farmers and public stockholding of food grains for public distribution and price stabilization.

From the above reviews, it is noted that polynomial function is the best function for analysing the trends in domestic and international prices of paddy. Polynomial function shows the more fluctuations in international prices than domestic prices. Therefore, paddy is advantageous crop to export in international market.

2.3 Competitiveness of Indian Paddy

Jayesh (2001) used the Nominal Protection Coefficient technique for the export competitiveness of Indian pepper. The nominal protection coefficient value were found to be lesser than unity (0.849) in Calicut and (0.817) in Sirsi markets, indicating that the Indian pepper is competitive in the international market and which is an efficient export oriented commodity.

Kumar *et al* (2001) computed the nominal protection coefficient under exportable hypothesis in order to measure the export competitiveness of selected livestock products in the global market from the period 1974 to 1998. Their results showed that butter has not been competitive internationally after T.E. 1982. India also lacks international competitiveness in poultry products, but India exhibited international price advantage in beef, pork and mutton. They concluded that beef was highly export competitive in all reference year and its NPCs varied from 0.162 in TE 1994 to 0.414 in TE 1985.

Shivaraya and Hugar (2005) attempted to evaluate the export competitiveness with the help of Nominal Protection Co-efficient (NPC). The NPC (0.60) indicated that tomato was highly potential and competitive over a period of 11 years for its export to other countries. Thus, there is a comparative advantage in the export of these commodities and can be achieved with the concerted efforts of government by developing air conditioned transport facilities to export the fresh tomato.

Sadavati (2006) analyzed export competitiveness of Basmati rice with the help of Nominal Protection Coefficient (NPC) for the period 1980-81 to 1989-99.

Although Basmati rice trend is positive, it is not smooth and steady. Around 60 to 70 per cent of the entire basmati rice exports are going to Saudi Arabia, Kuwait and UAE. The study reveals that there is ample scope for USA, one of the important importers of Basmati rice. The estimated NPC of the basmati rice with respect to USA with an average of 0.82 reveals that basmati rice export is competitive and enjoys advantages in exports. Basmati rice is a good exportable product. There is ample scope to export basmati rice to USA. But there is stiff competition from Pakistan.

Kumar *et al.* (2008) analysed export performance ratio to estimate the competitiveness. The major export destinations for cucumber and gherkin have been identified as France, USA, Russia, Belgium and Spain. An increasing and high value of revealed comparative advantage (RCA) and a positive and increasing value for revealed symmetric comparative advantage (RSCA) have indicated high potential in their export, particularly for the provisionally-preserved and prepared/preserved products. One per cent increase in volume of international trade in cucumber and gherkin may increase the demand from India by 5.96 per cent. This indicates that India is highly competitive in export of cucumber and gherkin and has ample scope to further increase its export. The study has also revealed that exchange rate is a more dominant determinant of export from India than price of commodity.

Thumar *et al.* (2012) analysed the export competitiveness of selected seed spices grown in India by estimating nominal protection coefficient (NPC) for the year 2007-08 under exportable hypothesis. Their finding showed that export of coriander was found moderately competitive to Canada (0.57) and less competitive to South Africa (1.00). The export of cumin was moderately competitive to Japan (0.57), less competitive to Netherland (0.93) and non-competitive to Bangladesh (1.46). The export of fennel found non-competitive indicating that fennel exported from India was not profitable. The export competitiveness for the fenugreek indicated that the NPC values were between 0.75 and 1.00 thereby concluding less profitable export of fenugreek.

Guledgudda *et al.*(2014) analysed export competitiveness of Indian cashewnut calculated by nominal protection coefficient. India is facing tough competition from Vietnam and Brazil in the exports of Cashew Kernels. The NPC for the period 2004 under exportable hypothesis was 0.98, which also revealed that the domestic prices received by the farmers were lower than the international prices, which also implied that the domestic producers were dis-protected or rather taxed compared to a situation prevailing under free trade condition.

Kanaka and Chinnadurai (2015) computed Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), Effective Rate of Protection (ERP) and Domestic Resource Cost (DRC) to reveal the trade competiveness. Trade competitiveness was estimated using the aforesaid measures for groundnut for the period from 2000-01 to 2009-10. EPC estimates showed that it was less than unity like DRC in the entire study period. However it could be seen that these had been an increasing trend in the values of EPC and DRC from 2003-04.Since NPC value are more than unity it indicates that the state resorted to protection at the state level. The estimates of DRC revealed that the state had comparative disadvantage in groundnut export. The main conclusion is that the usefulness of the policy analysis matrix might be substantially enhanced by simulating profitability after efficiency-improving managerial decisions have been adopted.

Makama *et al.* (2016) calculated the Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), and Domestic Resource Costs (DRC) of rice export using the policy analysis matrix for the period 2010 to 2013. The average value of NPC for the years 2010, 2011, 2012 and 2013 were less than unity (0.47) which indicates that the domestic prices received by the farmers in the country were below the international prices. The average nominal protection coefficient was 0.48 thus indicates that Rice producers in Karnataka (India) were disprotected and the average effective protection coefficient was 0.44 indicating a high export competitiveness of the India Rice. However, the average domestic resource cost was found to be less than one (0.37) this means that domestic resources were efficiently utilized in case of rice crop in above mentioned state of the country and also indicated that they have comparative advantage in the production of rice crop. All the indicators (NPC, EPC and DRC) were less than unity thus a reflection that the domestic price of Rice in the country is lower than the world market price and hence competitive worldwide.

Yamini (2019) calculated the Nominal Protection Coefficient (NPC) of export of cotton was found to be lower than unity for almost all the years, indicating that the domestic prices received by the farmers were lower than the international prices. This implies that the domestic producers were disprotected. It also indicate that cotton have a high degree of comparative advantage in international market. However during 1996-97 and1998-99 NPC was observed to be more than unity.

Above reviews reveals that, the major destinations for Indian paddy were Saudi Arabia, UAE, Kuwait, Yemen Arab Republic and USA. Indian paddy was more competitive in all these markets which is measured by Nominal protection coefficient (NPC). In the World market Indian paddy was more competitive except some years which is measured by Nominal protection coefficient and Export performance ratio during the study period 1970-71 to 2017-18.

2.4 The Direction of Trade of Export From India

Mahadevaiah *et al.* (2005) analysed the dynamics of changes have been measured in the export of raw cotton from India to different export markets employing the Markov-Chain model. The results have shown China as the sole stable destination for our cotton exports. This implied that the share of import by china increased from 8.32 per cent during the pre-reforms period to 31.55 per cent during the post-reforms period. The other traditional importing countries such as Bangladesh, Germany, Indonesia, The UK, Japan and Korea have recorded low retention probabilities during pre- and post-economic reforms periods, indicating unstable export share to these markets.

Nethrayani *et al* (2012) studied the direction of trade and changes in the export of rice. The collected data for the period 1998-99 to 2009-10 was analysed using markov chain analysis. The results of markov chain analysis revealed that UAE is the most stable importer of the Indian basmati rice as reflected in probability of retention at 1.00 and the major gainers among importers of Indian basmati rice are other countries. In case of non-basmati rice, South Africa is one of the most stable importer of the Indian non-basmati rice as reflected in probability of retention at 0.792 and the major gainers among importers of Indian non-basmati rice are other countries.

Naik and Hosamani (2013) examined the production and export performance of turmeric in India using markov chain analysis for the period 1974-75 to 2009-10. The results of the Markov Chain analysis revealed that, during pre-WTO period other countries and UK were the stable importers of Indian turmeric as they have retained their share to the tune of 59.74 and 39.91 per cent over the years respectively. Whereas, during the post-WTO period, other countries, Iran, UAE and UK were the stable importers of Indian turmeric as they retained 83.18, 51.13, 32.93 and 332.40 per cent of their share over the years, respectively.

Kusuma and Basavaraja (2014) studied the Markov chain analysis through linear programming method to assess the transition probabilities for the major mango markets. The major Indian mango export markets were categorized as stable market (Banladesh, U.K. and U.A.E.) and unstable market (Nepal, Saudi Arabia) based on the magnitude of transitional probabilities. The major export markets for Indian mangoes are Bangladesh 46.22 per cent, U.A.E. 33.26 per cent, Nepal 6.06 per cent, Saudi Arabia 3.63 per cent and UK 3.06 per cent. The increasing share of other countries clearly shows the need to explore and exploit the market potential of other countries.

Pavithra *et al.* (2016) analysed the dynamics of changes in the export of floriculture products from India to different export markets employing the Markov-Chain model. The results have been shown that the Netherlands is the stable destination with retention 0.5350 and UAE is the most unstable destination with zero retention for Indian export in floriculture. The USA, UK and Germany were the least stable markets for Indian floriculture products export. The exports may be oriented towards least stable markets and stabilizing the export of floriculture products should be made.

Satitshkumar *et al.* (2016) studied that the dynamics of changes in terms of value of exports of basmati and non-basmati rice from India to different export markets. It has been measured by employing the Markov-Chain model. Iran and Saudi Arab are found to be stable destinations for Indian basmati rice export from Markov-Chain results. Whereas, Benin, Bangladesh and Senegal are found to be major destinations for non- basmati rice importing countries were South Africa and Liberia with the zero per cent retention. So the policies should aim at developing good trade relations with the stable destinations to benefit from it.

Golappanavar and Patil (2017) analysed the direction of structural changes in area of major fruit crops using Markov chain analysis through linear programming method to assess the transition probabilities for major fruit crops. The results revealed that mango crop showed highest retention of area (99.23 %) in Dharwad taluka. In Hubli taluka also mango crop showed highest retention of area (86.44 %). In Navalgund taluka, guava crop showed highest retention of area (93.69 %). In Kalghatagi taluka also guava crop showed highest retention of area (88.42 %). In Kundgol taluka, sapota crop showed highest retention of area (86.95 %).

Above reviews reveals that, the major destinations for Indian total paddy, Basmati paddy and non-basmati paddy were Saudi Arabia, Kuwait, UK, UAE, Yamen Arab Republic, USA, Canada and Belgium. However share of Canada and Belgium were decreasing over the study period. For future strategy should aim to depict the new markets.

2.5 The Determinants of Export of Paddy in India

Shende *et al.* (1999) fitted Cobb-Douglas type of demand function in order to identify the factor affecting export of tea, coffee and tobacco using time series data for the period from 1970 to 1993. They had taken India's export of tea, coffee and tobacco as a dependent variable and export price (Rs./mt), India's share in world production (%), total world import (mt), ratio of domestic consumption to production, exchange rate (Rs./US dollar) and ratio of domestic price to world export price as independent variable. It had seen that vary high values of coefficient of multiple determination were noticed in all three commodities. Tea export was observed to be influenced by three factors *i.e.* export price, ratio of domestic consumption to production and exchange rate. Similarly in case of coffee ratio of domestic consumption to production and exchange rate found highly significant. In tobacco three 14 factors were highly significant to export *i.e.* export price, world total import and ratio of domestic price to world price.

Haleem *et al.* (2005) had tried to estimate an export supply function for citrus fruit in Pakistan. Annual time series data from 1975-2004 was used for the analysis. Quantity of citrus exported depends upon export unit value index, domestic production, and domestic price index, GDP of Pakistan, and exchange rate. Tabulation method was used to determine export performance. Co-integration was used to estimate elasticity of price for citrus. Dickey Fuller test was used to check unit root. All series were stationary at first difference except domestic production which was stationary at level. Johansen co-integration method was used. Each variable had correct sign except citrus production. Domestic price index was negatively significant. Export price, exchange rate and GDP were positively affecting citrus exports. All variables were significant.

Kumar *et al.* (2008) identified the factors affecting the export of cucumber and gherkin from India. On the basis of best fit, log linear form was selected. The three basic determinants, *viz.* world market size, exchange rate, and Indian export price, could together explain 96 per cent of the total variation in export of cucumber and gherkin from India. The coefficients for all the variables, except Indian export price were found highly significant. The estimate for international trade volume has shown that for 1 per cent increase in the world trade marketing of these products more economical. Establishment of infrastructure for various sanitary measures will also help in better price realization of Indian cucumber and gherkin in the international market. Gherkin is a short-duration (75-90 days) labour-intensive and highly profitable crop and therefore, its cultivation should be expanded to enhance its export in the world market. The study has also revealed that exchange rate is a more dominant determinant of export from India than price of commodity.

Abolagba *et al.* (2010) tried to determine the factors that can influence the agricultural exports of Nigeria with reference to cocoa and rubber. Time series data from 1970-2005 had been used for this purpose. OLS method was applied. Export of specific commodity was taken as dependent whereas domestic output, domestic consumption, exchange rate, average producer price, average world market price, interest rate and average total rainfall were independent. For Rubber Semi-log and for cocoa linear function were used. Domestic production and average producer prices were positively while exchange rate and domestic 15 consumption were negatively significant. Interest rate and world market prices were positive for rubber and negative for cocoa. In findings output, domestic consumption, average producer price and exchange rate play key role in export.

Sengupta and Roy (2011) analyzed the export behavior of eleven horticultural products by fitting non linear regression model for the period 1961 to 2005(45 years). They assumed that export behavior of horticultural products depend on production, export price, world unit price, world demand and producer price. They had incorporated dummy variable in the model to indicate the structural break in the export behavior. The result showed that exports of chilli and pepper have responded significantly to producer prices, relative export price and world demand in long run. But, exports of most of other horticultural commodities are found to be responsive to relative export price. Like chilli and pepper, exports of banana and walnut are inversely related to producer prices in the long run. The results also showed that most of the horticultural exports were not significantly determined by world demand in long run except in case of chilli and pepper, mango and walnut. The production is not also significant for long run behaviour of most of the horticultural exports except banana, coffee and spices.

Kannan (2013) examined the factors that influence agricultural production and export with specific reference to the natural rubber in India. The Ordinary Least Squares (OLS) technique was used in analyzing the relevant data. The OLS findings revealed that natural rubber production is significantly ($P<0.05$) by export of natural rubber ($\beta=0.21$). For export of natural rubber, the OLS shows that stock of natural rubber ($\beta=0.29$), World market price ($\beta=15.96$), domestic price ($\beta=-18.47$) and World population ($\beta=88.37$) significantly ($p<0.05$) influence in export of natural rubber.

Bilal and Rizvi (2013) analysed the determinants of rice exports from Pakistan for the period of 1980 to 2010. All variables have been used in log form. For stationary of data Augmented Dickey-Fuller test has been used. All the variables are stationary at their first difference. Johansen co-integration method has been used to check for long run relationship. Rice production, domestic consumption as a proxy for domestic demand, world's total rice exports as a proxy for international demand, rice yield, domestic price and export price have been used as rice exports determinants. Results suggest that production, yield and international demand are positively significant while export price and domestic price are negatively significant. Domestic demand is insignificant. Vector error correction model (VECM) was used to check long run to short run equilibrium adjustment of the model. VECM shows that model is converging 0.56 per cent annually. Finally, they recommended that government should take necessary steps to improve the yield per hectare and also production of rice in order to increase its exports because these are found to be the most effective determinants.

Adhikari *et al.* (2016**)** identified determinants of rice exports from India with special reference to basmati rice during the period 1980-81 to 2012-13. The time series data were made stationary before estimating the determinants of Indian rice export. The estimated regression model has shown that export price, international price, lagged production, domestic consumption, and exchange rate are the major determinants of rice export from India. In order to sustain in the international market, Indian export price needs to be competitive besides improvement in quality and sanitary standards. Export price and international price are significant at 1 per cent level of significance. However, other three variables, *viz.* exchange rate, domestic production, and lagged production, are non- significant. In model I, quantity exported was the dependent variable and export price, exchange rate, international price and domestic consumption were independent variables. In model II, export price, exchange rate, international price and lagged production were independent variables.

Above reviews reveals that, the multiple regression model where quantity export regressed against domestic production, Wholesale price, international price, World production, exchange rate, NPC and EPR. The study indicates that, the share of paddy in India's total export was more than share of paddy in the World total export.

2.6 Policy measures for export of paddy

Mahadevaiah (2001) conducted study entitled export trade performance of Indian cotton revealed that cotton prices in the domestic and international market are integrated. This implies that domestic market is responsive to changes in the international market prices and producers would benefit from increases in the international market prices. However, this benefit has not been fully exploited by the farmer because the Indian cotton exports are regulated by the governments by export quota system so that farmer can be benefited from price increase in the international market. This will encourage cotton production especially quality cotton, which will also meet the requirement of cotton textile mills who are currently importing the quality cotton.

Barah (2005) reported that rice is the most important crop in India, which plays a critical role in food security. More importantly, it is a choice crop of the millions of poor and small farmers not only for income but also for household food security. However, the rice sector has witnessed rapid dynamism in production processes. After climbing a height of four-fold increase in production during past four decades, the production curves have started showing downward trend and productivity decelerating since the latter half of the 1990s. Is it the beginning of the agrarian impasse (particularly in the rice system), not only in the core green revolution state of Punjab, but also in several other states such as Tamil Nadu, Andhra Pradesh and Kerala etc. The productivity decline is experienced in other states also including the rainfed areas. Therefore, an in-depth understanding of the changing production and productivity pattern is essential.

Manitra (2006) Analyzed reforms in the global rice market during and after the URUGWE negotiation and states that rice market was highly segmented with a lot of distortions. Rice policy has been based on protecting same social groups at the expense of others. For developing countries, food security concerns, especially the desire to provide cheaper rice to urban consumers, which often have more political power, have been the reasons in the tacking rice farming. These strategies have cased distortions in prices and resource allocation and in trade pattern.

Clarkson *et al.* (2007) conducted protectionist trade policy actions in 2008 resulting from food shortage concerns potently appeared to increase national welfare and limit the transmission of higher world prices to Indian consumers. However, India's greater use of export restrictions vs. export tariffs and its monopoly power in the production of rice could have limited the full effect of the price decrease. Plus the trade restrictions have lowered the overall economic welfare even though consumers benefited by forcing the produces sell product strictly in the domestic market. This paper evaluates the economic effects of such trade policy in the framework of comparative static model that explains the costs and benefits of tariffs and subsidies.

Kerutagi *et al.* (2009) studied on Belgaum and Dharwad district of Northern Karnataka to identify the constraints in Sapota marketing. The study revealed that the major problems in Sapota marketing were lack of storage facility (99.44 %), collection of higher commission charges (83.33 %) and higher transportation cost due to lack of nearer markets and non-availability of proper market information.

Clarkson (2013) observed that India consumed 95 per cent of the rice she produces, rice prices are an integral part of national welfare to both consumers and producers. Protectionist trade policy actions in 2008 resulting from food shortage concerns potently appeared to increase national welfare and limit the transmission of higher world prices to Indian consumers, the evaluated economic effects of such trade policy in the framework of comparative static model that explains the costs and benefits of tariffs and subsidies.

Neha (2013) reported two channels used for procuring rice are custom-milling of rice and levy. In the rest, the government buys paddy directly from farmers at the minimum support price (MSP) and gets it milled from private millers; while in the second, it purchases rice from private millers at a pre-announced levy price thus providing indirect price support to farmers. Secondary data reveal that although levy imposes a lower unit cost per quintal of paddy procured, over the last decade, custom milling has become predominant, partly on the argument that it provides minimum price support to farmers. We analyze data from auctions of paddy from a year when levy was still important to investigate its impact on farmers' revenues. They use semi-non parametric estimates of millers' values to simulate farmers' expected revenues and these to be rather close to the MSP; a closer analysis shows that bidder competition is critical to this result.

Adhikari (2014) Export of rice from India: performance and determinants. He suggested that quality is an important factor for export competitiveness. So, quality maintenance is prime importance. Most of the pesticides commonly used on paddy in India are not registered in importing countries. Therefore, to capture the higher share in the World trade, much emphasis need to be given on sanitary measures and standardization, packaging and simplification in export procedure so as to gain access of export to the countries, where rice can fetch better price. The growth rate in export of basmati rice increased over a period and is export competitive product. Thus, country has a comparative advantage in the export of basmati rice. There should be efforts by the government for improvement on processing facilities, transportation facilities, and handling and lading facilities at ports in order to facilitate export. Minimum export price of rice should be fixed in such a way that it enables the exporter to compete in international market and also have gain to producer.

Pal *et al.* (2015) observed that the export of pomegranate fruit is around 35000 tonnes per annum in India. Exquisite fruit quality, enriched nutrition values, enormous medicinal values, huge demand in domestic and international market, besides extended shelf life enables it to emerge as an eminent fruit crop of recent times. They also suggested certain policies to boost pomegranate export such as adoption of scientific management practices, evolving disease free hybrid, use of appropriate post harvest technology, food safety and pesticide residue management.

Above reviews reveals that, the policy's suggest that improvement of quality, price and food security were most important factors to increasing paddy export from India.

3. METHODOLOGY

This chapter explains the characteristics of the study area and sources of data, the study period the statistical tools and techniques employed for analysing the data under the following headings.

3.1 Description of the study area

3.2 Nature and sources of data

3.3 The study period

3.4 Analytical tools and techniques

3.1 Description of the study area

In India the area is suitable for cultivation of paddy and scattered in all over India. West Bengal state ranks first in area and production, and it contributes about 14 per cent of the total production of the country. The total area of paddy in India was about 42909.8 '000 ha and the production was 165017 '000 tonnes during the year 2017-18 and this production depends on the climate, soil condition and management aspects in different states. Hence the export performance and competitiveness of paddy was examined at National level.

3.2 Nature and sources of data

The study is completely based on secondary data, Therefore required data for the present study was collected from various reports *viz.*, APEDA, Agricultural statistics at a glance 2015, https://www.indexmundi.com/commodities/?commodity=rice & months=36, Maharashtra at A Glance, Economic Survey (GOI), Ministry of Agriculture and Co-operation (Agricoop), Food Corporation of India (FCI), Commission for Agricultural Costs and Prices (CACP), International Monetary Fund (IMF), Food and Agricultural Organization (FAO), World Trade Organization (WTO), International Food and Policy Research Institute (IFPRI), International Rice Research Institute (IRRI), Rice Board of India, Ministry of Food, and various government sector reports etc. was used for the study. The data collected from secondary sources was subjected to appropriate analytical technique in order to arrive at a meaningful conclusion. The data on area, production, and productivity of paddy, domestic and international prices and export etc. was collected for the period 1970-71 to 2017-18.

3.3 The study period

The study period was divided into two periods based on the policy of the government on WTO and of trade at different periods. However, for better understanding, growth rates in area, production and productivity were computed for the period from 1970-71 to 2017-18 which was further divided into two sub periods.

Period-I : Pre-WTO Period (1970-71 to 1994-95)

Period-II : Post-WTO Period (1995-96 to 2017-18)

Overall Period : (1970-71 to 2017-18)

3.4 Analytical Techniques

Keeping in view the objectives of the study, data collected were subjected to analysis through the following statistical techniques.

3.4.1 Compound growth rate analysis

Growth rate on area, production, yield and exports of paddy were computed for a period of 57 years from 1970-71 to 207-18. The linear, log-linear, exponential and power functions are some of the important functional forms employed to study the growth rates. Different functional forms were tried in the past for working out of growth rates in area, yield and production. Some of the important forms tried were the linear growth model ($Y = a+ bt$), exponential function ($Y = ab^t$) and quadratic function ($Y = a+bt+ct^2$). However, it was found that the exponential form of the function $Yt = ab^t$ is the better and most frequently used one. In the present study, compound growth rates in area, production, productivity export of paddy in the country as a whole were estimated by using the exponential growth function of the form,

$$Y = ab^t$$

Where,

Y = Area, production, productivity and export

t = Time period

b = Regression coefficient

a = Intercept

$$CGR (\%) = (\text{Antilog } b - 1) \times 100$$

3.4.2 Instability analysis

The extent of variability in area, production, productivity and export of paddy were analyzed through coefficient of variation and Cuddy and Della Index.

a. Coefficient of variation

$$C.V. = [S.D./(\bar{X})] * 100$$

Where,

C.V.= Coefficient of variation

S.D.= Standard deviation

X = Mean

b. Cuddy and Della instability index (CV_t)

$$CV_t = CV \sqrt{1 - R^2}$$

Where,

CV = Coefficient of variation

R^2 = Coefficient of multiple determination

3.4.3 Trend Analysis

To estimate the trend in domestic prices and international prices for paddy the linear trend were computed for the time series data for the period from 1970-71 to 2017-18.

The linear trend equation of the form.

$$Y_t = a + bT + cT^2 + dT^3 + e_t$$

Where,

Y_t = Price (Domestic/International)

a = Intercept

T = Time period

b, c, d = Partial regression coefficient

e_t = Error term

3.4.4 Export competitiveness of paddy

a. Nominal Protection Coefficient (NPC)

Nominal Protection Coefficient is a direct measure of competitiveness of a country towards a commodity in the context of free trade. The nominal protection coefficient (NPC) is defined as the ratio of the domestic price to the World reference price of the commodity under consideration.

Symbolically,

$$NPC = Pd / Pr$$

Where,

NPC = Nominal protection coefficient of paddy

Pd = Domestic wholesale price of paddy

Pr = World reference price of paddy

If the NPC is less than one, then it indicates that the commodity is competitive compared to the situation that would have prevailed under free trade. However, if the NPC is greater than one, then the commodity is not competitive. NPC equal to one indicates that domestic price is equal to its border price (CIF or FOB) and no protection is given to the commodity. Under the exportable hypothesis, the pre assumption is that Indian paddy would compete in the international paddy market. Hence, the price of Indian paddy must be low enough to make it competitive in the foreign market.

b. Export Performance Ratio (EPR)

The Export Performance Ratio (EPR) was estimated to examine the comparative advantage of India in the export of paddy, following the method suggested by Balassa (1965), using Equation (1).

$$EPR = S_{it} / S_{wt}$$

Where,

S_{it} = Share of paddy in India's total export,

S_{wt} = Share of paddy in World total export,

Since EPR is based on the observed pattern of trade flows, it is also called Revealed Comparative Advantage (RCA). If EPR/RCA is greater than unity, the country has comparative advantage in export of the commodity. As suggested by Laursen (1998), RCA was made symmetric by obtaining the index as (RCA-1/RCA+1). This index is known as Revealed Symmetric Comparative Advantage (RSCA) and varies from -1 to +1.

3.4.5 Markov Chain Analysis

The dynamic nature of trade pattern was analyzed by applying First Order Markov process and examining the gains and losses in export share of paddy in major importing countries. In the context of current application, the major paddy importing countries were considered since the export of paddy from India was highly inconsistent and unstable. The average export of paddy to particular country was considered to be a random variable following the First Order Markov process.

The basic assumption of first order Markov process is that the average export of a commodity (paddy) from a country to its importing countries in any period depends only on export in the previous period and this dependence is the same among all periods.

This is algebraically expressed

$$E_{it} = \sum_{i=1}^{r} E_{it-1}\, Pij + e_{jt}$$

Where,

E_{jt} = Exports from India during the year t to j^{th} country

E_{it-1} = Exports to i^{th} country during the year t-1

P_{ij} = The probability that exports will shift from i^{th} country to j^{th} country

E_{jt} = The error term which is statistically independent of Eij-1 and

R = Number of importing countries

The transitional probability matrix, which can be arranged in a (c × r) matrix, has the following properties.

The diagonal elements of matrix P indicate the probability that the export share of a particular country will remain the same from one period to another. The off-diagonal or transfer probabilities indicate the probability that the export share of a particular country will shift to another country over time. Thus, the export share of a country during the period 't' was obtained by multiplying the actual exports in the previous period (t-1) with transition probability matrix. The transitional probability matrix is estimated in the linear programming (LP) framework by a method referred to as minimization of mean absolute deviation (MAD).

The LP formula is stated as,

$$\text{Min } 〚OP〛^{\wedge} * + Ie$$

Subject to- $XP^* + V = Y$

$GP^* = 1$

$P^* >= 0$

Where,

P^* is a vector in which probability P are arranged,
0 is a vector of zeros,
I is an appropriately dimensioned vector of area,
e is the vector of absolute errors (IUI)
Y is the vector of export to each country
X is a block diagonal matrix of lagged values of Y and
V is a vector of errors.
G is a grouping matrix to add the row-elements of P arranged in P^* to unity.

3.4.6 Determinants of export of paddy in India

To determine the factors affecting the export quantity of paddy from India, export function was estimated. To examine the influence of price and non- price factors on export of paddy, the following variables was selected.

Export Function

To determine the factors affecting the export quantity of paddy from India, export function was estimated by multiple regression model.

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + u$$

Where,

Y	= Export quantity of paddy (Tonnes)
X_1	= Domestic production of paddy (Tonnes)
X_2	= Wholesale price of paddy (₹/q)
X_3	= International price of paddy (₹/q)
X_4	= World production of paddy (Tonnes)
X_5	= Exchange rate
X_6	= NPC
X_7	= EPR
a	= Intercept
bi's	= Regression coefficients
u_t	= Error terms

4. RESULTS AND DISCUSSION

This chapter is devoted to express the results obtained from the present study which are briefly discussed, under following headings.

4.1 Growth and Instability of Area, Production and Productivity of Paddy in India

4.2 Trends in Domestic and International Prices of Paddy

4.3 Export Performance and Competitiveness of Indian Paddy

4.4 Structural Changes in Paddy Export From India.

4.5 Determinant of Paddy Export From India

4.1 Growth and Instability of Area, Production and Productivity of Paddy in India

4.1.1 Changes in area, production and productivity of paddy in the World, India and Maharashtra

The changes in area, production and productivity of paddy in absolute figures for the year 1970-71 to 2017-18 is depicted in Table 4.1.

Table 4.1 reveals that area, production and productivity of paddy in the World during study period were increased gradually from 132.66 m.ha in 1970-71 to 160.76 m.ha in 2017-18. The per cent change recorded over the base period was 21.18 per cent. The production increased to 729.10 m.tons in 2017-18 from 316.40 m.tons in 1970-71. The per cent change recorded over the base period was 130.47 per cent. The productivity of paddy was also increased to 4535 kg/ha in 2017-18 from 2385 kg/ha in 1970-71. The per cent change recorded over the base year was 90.19 per cent.

In case of India, the production and productivity of paddy during study period were increased. However, the area was fluctuating over the base year 1970-71. The area of paddy in India during 1970-71 was 37.59 m.ha which increased to 42.95 m.ha in 2017-18. The production increased to 111.01 m.tons in 2017-18 from 42.22 m.tons in 1970-71. The productivity of paddy also increased to 2584.63 kg/ha in 2017-18 from 1123.17 kg/ha in 1970-71. The per cent change recorded over the base period was 130.12 per cent. There was a sudden increase in production and yield of paddy after 1990-91 and this could be attributed to introduction of high yielding varieties of paddy and adoption of modern technologies.

Table 4.1 Changes in Area, Production and Productivity of Paddy in the World, India and Maharashtra

Area - Million ha.
Production - Million tons.
Productivity- kg/ha

Sr. No.	Year	Area	% Change over (1970-71)	Production	% Change over (1970-71)	Productivity	% Change over (1970-71)
	World						
1.	1970-71	132.66	100	316.40	100	2384.67	100
2.	1980-81	144.40	8.85	397	25.49	2749.17	15.29
3.	1990-91	146.98	10.79	519.5	64.20	3534.22	48.21
4.	2000-01	152.76	15.15	594	87.76	3888.39	63.06
5.	2010-11	158.31	19.34	672.40	112.52	4247.17	78.10
6.	2017-18	160.76	21.18	729.10	130.44	4535.33	90.19
	India						
1.	1970-71	37.59	100	42.22	100	1123.17	100
2.	1980-81	40.15	6.81	53.63	27.03	1335.74	18.93
3.	1990-91	42.69	13.57	74.29	75.96	1740.22	54.94
4.	2000-01	44.72	18.97	84.98	101.28	1900.27	69.19
5.	2010-11	42.86	14.02	95.97	127.31	2239.15	99.36
6.	2017-18	42.95	14.26	111.01	162.93	2584.63	130.12
	Maharashtra						
1.	1970-71	1.36	100	1.66	100	1220.59	100
2.	1980-81	1.50	10.29	2.36	42.17	1573.33	28.90
3.	1990-91	1.58	16.18	2.31	39.16	1462.03	19.78
4.	2000-01	1.51	11.03	1.93	16.27	1278.15	4.72
5.	2010-11	1.52	11.76	2.70	62.65	1776.32	45.53
6.	2017-18	1.45	6.62	2.66	60.24	1834.48	50.29

In Maharashtra, the area, production and productivity of paddy during study period were fluctuating over the base year 1970-71.The area of paddy in 1970-71 was 1.36 m.ha which increased to 1.45 m.ha in 2017-18. The per cent change recorded over the base period was 6.62 per cent. The production increased to 2.66 m.tons in 2017-18 from 1.66 m.tons in 1970-71. The per cent change recorded over base period was

60.24 per cent. The productivity of paddy also increased to 1834.48 kg/ha in 2017-18 from 1220.59 kg/ha in 1970-71. The per cent change recorded over the base period was 50.29 per cent. In Maharashtra, the production and yield of paddy considerably increased after 2000-01. It is the contribution of new improved varieties of paddy in the state.

From the foregoing discussion, it is noted that, the area, production and productivity of paddy was gradually increased in the World and India during different decades. However, the area, production and productivity of paddy were fluctuating over different decades in Maharashtra. The similar observations were reported by Satish Kumar (2016) and Ananthi, (2000).

4.1.2 Compound growth rates of area, production and productivity of paddy in major states of India

An attempt has been made to examine the changes in area, production and productivity of paddy in major states of India. The state wise growth rates in area, production and productivity of paddy were studied by estimating compound growth rates for sub-periods as Pre-WTO period (1970-71 to 1994-95), Post-WTO period (1995-96 to 2017-18) and Overall period (1970-71 to 2017-18). The annual percentage growth rates of area, production and productivity of paddy are presented in Table 4.2.

It is revealed from the Table 4.2 that, the growth rates of area, production and productivity of paddy at National level were observed to be positive and highly significant at one per cent level for the overall period (1970-71 to 2017-18). The area, production and productivity of paddy increased at the rate of 0.33, 2.22 and 1.88 per cent per annum, respectively, during the entire period. It indicates that the production of paddy at National level was increased by both area expansion and productivity improvement. The same trend was observed in Pre-WTO period (1970-71 to 1994-95) at National level where the growth rate of area, production and productivity was positive and highly significant which increased at the rate of 0.54, 3.05 and 2.50 per cent per annum, respectively. However, in Post-WTO period (1995-96 to 2017-18) the production and productivity of paddy was highly significant and increased at the rate of 1.53 and 1.55 per cent per annum, respectively. Whereas, the area under paddy was declined by 0.02 per cent per annum. It indicates that, the production of paddy in Post-WTO period (1995-96 to 2017-18) was mainly increased by productivity improvement.

In major states of India, the growth rates of area, production and productivity of paddy were positive and significant in Uttar Pradesh, West Bengal, Karnataka, Maharashtra, Punjab and Assam for overall period (1970-71 to 2017-18) indicating that, the production of paddy was influenced by both area expansion and productivity improvement in these states. The growth rate in area was negatively significant while, the production and productivity was positively significant in Andhra Pradesh and Tamil Nadu for overall period, indicating that the production of paddy was increased only due to productivity improvement in these two states. However, in Madhya Pradesh and Kerala, the growth rates of area and production of paddy was negatively significant and the growth rates of productivity were positively significant at overall period. The rate of growth decline in area was higher than the positive growth rate of productivity of paddy in Madhya Pradesh and Kerala, that's why the production of paddy was declined in these states, even though, there was a improvement in productivity.

Among the two periods *i.e.* Pre-WTO and Post-WTO period, the growth rates of area, production and productivity was more satisfactory in Pre-WTO period (1970-71 to 1994-95) than Post-WTO period (1995-96 to 2017-18) in all the states under study. In Post-WTO period (1995-96 to 2017-18) the production of paddy was increased due to new hybrid varieties in West Bengal, Uttar Pradesh, Maharashtra and Assam. Whereas, the production of paddy increased by both area expansion and productivity improvement in Punjab state. However, the production of paddy was declined only due to decrease in area in Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu and Kerala. It is due to the diversification in cropping pattern and different competing crops for paddy in these states.

In Pre-WTO period (1970-71 to 1994-95), the production of paddy was significantly increased at the rate of 5.28, 3.31, 3.18, 2.22, 10.34 and 2.75 per cent per annum due to both productivity improvement and area expansion in Uttar Pradesh, West Bengal, Andhra Pradesh, Maharashtra, Punjab and Madhya Pradesh. Whereas, the production of paddy was significantly increased due to only yield improvement in Tamil Nadu and Assam.

Table 4.2. Annual Compound growth rates of area, production and productivity of paddy in major states of India

Sr. No.	State	ACGR %								
		Pre-WTO(1970-71 to 1994-95)			Post WTO(1995-96 to 2017-18)			Overall Period(1970-71 to 2017-18)		
		Area	**Production**	**Productivity**	**Area**	**Production**	**Productivity**	**Area**	**Production**	**Productivity**
1.	Uttar Pradesh	0.92***	5.28***	4.32***	1.1 NS	1.24 NS	0.6**	0.54**	2.97***	2.53***
2.	West Bengal	0.61***	3.31***	2.69***	-0.69 NS	0.81***	1.52***	0.29**	2.45***	2.16***
3.	Andhra Pradesh	0.52**	3.18***	2.64***	-2.96***	-1.64**	1.36***	-0.68***	1.16***	1.85***
4.	Karnataka	1.05**	1.84***	0.78 NS	-0.81*	-0.47 NS	0.55 NS	0.36**	1.41***	0.82**
5.	Punjab	8.97***	10.34***	2.34***	1.22***	2.28***	1.05***	3.85***	5.23***	1.33***
6.	Maharashtra	0.64***	2.22***	1.56***	0.1 NS	0.96**	0.87**	0.2***	1.25***	1.05***
7.	Madhya Pradesh	0.67***	2.75***	2.06***	-4.18***	-0.89 NS	3.43***	-2.73***	-1.28**	1.49***
8.	Tamil Nadu	-1.61***	1.29***	2.96***	-1.18***	-1.05 NS	0.13 NS	-1.03***	0.15 NS	1.19***
9.	Assam	0.46 NS	2.08***	1.61***	-0.27 NS	2.11***	2.43***	0.48***	2.1***	1.62***
10.	Kerala	-2.57***	-1.31***	1.29***	-4.55***	-2.75***	1.89***	-3.84***	-2.53***	1.37***
11.	**India**	**0.54*** **	**3.05*** **	**2.5*** **	**-0.02 NS**	**1.53*** **	**1.55*** **	**0.33*** **	**2.22*** **	**1.88*** **

Note: ***, **, * indicates level of significance at 1 %, 5 % and 10 % respectively.

To sum up in case of yield improvement the pre-WTO period (1970-71 to 1994-95) was more satisfactory than post-WTO period (1995-96 to 2017-18). The sources of growth of paddy crop production have been achieved primarily from yield increases in pre-WTO period as it is a green revolution period. The findings of the study Satish Kumar (2016) and Prabhakaran (2013) aptly support the finding of the study. The hypothesis viz; the production of paddy was increased due to both area expansion and productivity improvement in India has been proved.

4.1.3 Instability indices of area, production and yield of paddy

The coefficient of variation and Cuddy and Della index were used to measure the stability and instability in area, production and yield of paddy.

The study period was divided into three periods, the pre-WTO period (1970-71 to 1994-95), post-WTO period (1995-96 to 2017-18) and overall period (1970-71 to 2017-18). The major paddy cultivating states in India considered for the analysis of instability in area, production and yield of paddy were Uttar Pradesh, West Bengal, Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu, Assam, Kerala, Maharashtra and Punjab.

The results in Table 4.3 show that, the area of paddy is most consistent and stable with 5.47 per cent C.V. for overall period (1970-71 to 2017-18) in India and was followed by productivity (25.61 % C.V.) and production (29.61 % C.V.). In post-WTO period (1995-96 to 2017-18) the area, production and productivity of paddy with 2.52, 11.68 and 11.2 per cent C.V. were more stable and consistent than in pre-WTO period (1970-71 to 1994-95) with 4.62, 23.72 and 19.51 per cent C.V. of area, production and productivity of paddy in India. During the pre-WTO period (1970-71 to 1994-95) the area under paddy cultivation have shown more stability in states *viz.*, Uttar Pradesh, West Bengal, Andhra Pradesh, Madhya Pradesh, Assam, Kerala and Maharashtra with 8.14, 6.35, 9.30, 5.19, 12.26, 18.89 and 5.93 per cent variability respectively, whereas area under paddy in Karnataka, Tamil Nadu and Punjab was fluctuated as observed by coefficient of variation.

During post-WTO period (1995-96 to 2017-18), the area under paddy cultivation have shown more consistency in states *viz.*, West Bengal, Karnataka, Tamil Nadu, Assam, Maharashtra and Punjab as analysed by both coefficient of variation and

Cuddy and Della Wella Index, but in case of Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Kerala, there was inconsistency in area under paddy as shown by Cuddy and Della Wella Index.

At overall period (1970-71 to 2017-18), the area under paddy cultivation have shown more consistency in states *viz.*, Uttar Pradesh, West Bengal, Andhra Pradesh, Karnataka, Assam, and Maharashtra with 17.75, 14.03, 18.37, 18.44, 17.55, 4.74 per cent variability respectively, whereas Madhya Pradesh, Tamil Nadu, Kerala and Punjab have shown fluctuated area under paddy cultivation.

The production of paddy was stable and consistent in states *viz.*, Karnataka, Tamil Nadu, Assam and Kerala with 18.30, 17.34, 17.96 and 10.64 per cent in coefficient of variation whereas in remaining states *viz.*, Uttar Pradesh, West Bengal, Andhra Pradesh, Madhya Pradesh, Maharashtra and Punjab the paddy production were fluctuated during pre-WTO period.

During post-WTO period (1995-96 to 2017-18) , the production of paddy was more consistent in states *viz.*, Uttar Pradesh, West Bengal, Assam, Maharashtra and Punjab with 18.71, 7.39, 17.75, 13.45 and 15.27 per cent respectively, whereas in remaining states *viz.*, Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu and Kerala the paddy production were fluctuated.

At overall period (1970-71 to 2017-18), the production of paddy was not consistent in all selected states as shown by coefficient of variation.

The yield of paddy have been shown consistent in states *viz.*, Andhra Pradesh, Kerala, Maharashtra and Punjab with 19.90, 10.25 18.33 and 17.63 per cent respectively, whereas in remaining states yield of paddy were fluctuated during pre-WTO period as measured by coefficient of variation.

During post-WTO period (1995-96 to2017-19), the yield of paddy have shown consistency in states *viz.*, Uttar Pradesh, West Bengal, Andhra Pradesh, Karnataka, Kerala, Maharashtra and Punjab with 8.46, 13.31, 11.36, 12.57, 16.92,12.31 and 8.01 per cent, respectively as measured by coefficient of variation.

At overall period (1970-71 to 2017-18), the paddy yield was not stable in all selected states except two states *viz.*, Maharashtra and Punjab with 18.73 and 18.49 per cent respectively, measured by coefficient of variation.

The results indicate that there was considerable increase in paddy production followed by paddy yield and paddy area during the study period. The similar findings were reported by Satishkumar *et al.* (2016) and Patil *et al.* (2016).

Table 4.3. Instability indices of area, production and yield of paddy

Sr. No.	State	Particular	Pre-WTO Period (1970-71 to 1994-95)		Post-WTO Period (1995-96 to 2017-18)		Overall Period (1970-71 to 2017-18)	
			C.V.	Cuddy & Della Index	C.V.	Cuddy & Della Index	C.V.	Cuddy & Della Index
1.	Uttar Pradesh	A	8.14	4.70	21.52	20.87	17.75	16.68
		P	39.02	16.41	18.71	17.84	39.86	21.51
		Y	33.01	15.49	8.46	7.42	32.77	15.06
2	West Bengal	A	6.35	4.52	17.26	16.18	14.03	13.10
		P	28.51	14.31	7.39	5.14	32.47	12.20
		Y	22.76	11.16	13.31	9.92	30.00	11.02
3	Andhra Pradesh	A	9.30	8.50	24.89	15.59	18.37	16.19
		P	25.06	11.64	23.15	20.16	27.71	22.75
		Y	19.90	6.84	11.36	6.66	25.35	7.76
4	Karnataka	A	22.34	19.87	12.95	11.92	18.44	17.52
		P	18.30	12.36	21.29	21.02	28.23	19.53
		Y	130.41	129.5	12.57	11.85	93.93	89.34
5	Madhya Pradesh	A	5.19	1.69	59.89	47.89	41.82	27.21
		P	26.46	18.99	59.87	59.57	43.93	41.29
		Y	22.50	18.09	34.05	24.89	33.46	25.58
6	Tamil Nadu	A	23.14	18.39	14.10	11.60	23.22	16.21
		P	17.34	14.85	25.79	25.05	21.91	21.83
		Y	25.88	17.02	21.54	21.53	26.19	21.78
7	Assam	A	12.26	11.94	18.66	18.50	17.55	15.96
		P	17.96	8.76	17.75	10.63	30.81	9.52
		Y	20.61	15.00	20.38	13.65	27.52	14.53
8	Kerala	A	18.89	5.17	35.63	13.76	49.16	11.02
		P	10.64	4.85	20.64	7.59	34.13	8.65
		Y	10.25	3.50	16.92	13.27	22.07	11.45
9	Punjab	A	91.00	32.87	8.63	3.48	55.9	30.05
		P	57.16	16.63	15.27	5.16	51.77	21.72
		Y	17.63	8.37	8.01	4.11	18.49	8.20
10	Maharashtra	A	5.93	3.76	2.35	2.26	4.74	3.89
		P	21.79	17.54	13.45	11.94	21.22	15.49
		Y	18.33	15.77	12.31	11.03	18.73	13.9
11	India	A	4.62	2.37	2.52	2.52	5.47	3.08
		P	23.72	8.20	11.68	5.77	29.61	8.21
		Y	19.51	6.74	11.2	4.05	25.61	6.26

4.2 Trends in Domestic and International Prices of Paddy

The analysis of trend in domestic and international prices of paddy movement during the entire period *viz.*, 1970-71 to 2017-18 was studied. The cubic (polynomial) function was fitted to assess the trend in domestic and international prices of paddy in India due to its superiority over other functions in terms of better coefficient of determination (R^2). The trends during the three broad phases were subjected to a detailed analysis to confirm the results obtained. With regard to fitting of different models for export of paddy, it was found that polynomial function was good fit.

4.2.1 Trends in domestic prices of paddy

The trends in domestic prices of paddy are presented in Table 4.4. It is observed from the Table that, the domestic prices were declined in first stage at the rate of 6.60 ₹/qtl. In second stage it increased at the rate of 0.42 ₹/qtl and in terminal stage domestic prices of paddy significantly increased at the rate of 0.02 ₹/qtl. The overall trend equation was statistically significant, as revealed by F value (483.58) and fluctuation in domestic prices of paddy due to time factor to extent of 97 per cent as indicated by R^2. The polynomial curve of domestic prices of paddy (Fig. 4.4) behaved almost constant in the initial study years. But after 1990-91 it started increasing at increasing rate till the end of the year 2017-18. The volatility of domestic prices of paddy is mainly due to the internal production stocks and is not influenced much by the international prices (Mittal *et al.*, 2018).

Table 4.4. Polynomial trend analysis of domestic price of paddy in India

Sr. No.	Variables	Coefficients	S.E.
1	Intercept	125.77*	83.56
2	T	-6.60	13.70
3	T^2	0.42	0.64
4	T^3	0.02**	0.009
5	R^2	0.97	
6	F	483.58	

$$Y_t = 125.77 - 6.60T + 0.42T^2 + 0.02T^3 + e_t$$

Where, Y= Domestic prices of paddy
T= Time period

4.2.2 Trends in international prices of paddy

The trend in international prices of paddy is presented in Table 4.5. It is observed from the Table 4.5 that, the growth trend in international price increases for first stage at the rate of 31.40 ₹/qtl. Then in second stage decline at the rate of 0.82 ₹/qtl and in terminal stage increase at the rate of 0.04₹/qtl. The overall trend equation was statistically significant, as revealed by F value (34.66) and fluctuation in international prices of paddy due to time factor to extent of 70 per cent as indicated by R^2. The analysis of trend in international prices of paddy movement indicated more fluctuation (Fig.4.5) during the entire period (1970-71 to 2017-18).

Table 4.5 Polynomial trend analysis of international prices of paddy

Sr. No.	Variables	Coefficients	S.E.
1	Intercept	222.94	482.84
2	T	31.40	79.14
3	T^2	-0.82	3.68
4	T^3	0.04	0.049
5	R^2	0.70	
6	F	34.66	

$$\mathbf{Y_t = 222.94 + 31.40T - 0.82T^2 + 0.04T^3 + e_t}$$

Where, Y= International price of paddy (₹/qtl)

T= Time period

4.2.3 Compound growth rates of domestic and international prices of paddy

The exponential growth function was used for estimation of growth in domestic and international prices of paddy. The data related to domestic and international prices of paddy were collected for 48 years from 1970-71 to 2017-18 and results are presented during Pre-WTO (1970-71 to 1994-95), Post-WTO (1995-96 to 2017-18) and over all period (1970-71 to 2017-18) in Table 4.6.

The growth rates of domestic and international prices of paddy have been presented in Table 4.6. The results revealed that during the pre-WTO period the domestic market prices of paddy was estimated significant growth at 5.92 per cent per annum whereas the international prices had a growth rate of 8.71 per cent per annum. However, during post-WTO period, the growth rate in paddy prices was estimated to be 6.71 per cent per annum for domestic prices and 6.84 per cent per annum for international prices. As such growth rate for domestic price is higher than international price *i.e.* for domestic price growth rate was estimated 8.21 per cent per annum and 7.02 per cent per annum for international price during overall period (1970-71 to 2017-18).

Table 4.6 Compound growth rates of domestic and international prices of paddy

Price	Periods		
	Pre-WTO (1970-71 to 1994-95)	Post-WTO (1995-96to 2017-18)	Overall (1970-71 to 2017-18)
Domestic price	5.92***	6.71***	8.21***
International price	8.71***	6.84***	7.02***

Note: *** indicates 1% level of significance

4.2.4 Instability indices of domestic and international prices of paddy

The coefficient of variation and Cuddy and Della index of domestic and international prices of paddy have been presented in Table 4.7. It is revealed from the Table 4.7 that the instability index of domestic (45.95) and international (61.77) prices of paddy was higher in both pre-WTO period and post-WTO (33.77 and 42.03 %) and overall (37.99 and 53.23 %) period, respectively. This indicate that the growth of domestic and international prices of paddy in post-WTO period did not fluctuates more due to less restrictions and growing demand of Indian paddy. In general, domestic prices of paddy were more consistent than international prices of paddy in both pre and post-WTO period.

From the forgoing discussion it is noted that, the international prices of paddy were more fluctuating than that of domestic prices of paddy. The international paddy market is characterised by high volatility with inelastic supply and demand. The global trade of rice is very low in comparison to its production. Similar observations were reported by Adhikar *et al.* (2016) and Mittal (2018). The hypothesis viz; the domestic and international prices of paddy are fluctuating has been proved.

Table 4.7 Instability indices of domestic and international prices of paddy

Indices	Domestic price of paddy			International price of paddy		
	Pre-WTO (1970-71 to 1994-95)	Post-WTO (1995-96 to 2017-18)	Overall (1970-71 to 2017-18)	Pre-WTO (1970-71 to 1994-95)	Post-WTO (1995-96 to 2017-18)	Overall (1970-71 to 2017-18)
C.V.	49.92	45.8	98.98	77.26	58.72	92.33
Cuddy and Della Index	45.95	33.77	37.99	61.77	42.03	53.23

4.3 Export Performance and Competitiveness of Indian paddy

The export performance and competitiveness of Indian paddy has been assessed on the basis of time series data on export, import, its share, trade balance, Nominal Protection Coefficient (NPC), etc., of Indian paddy and the results are discussed in this section.

4.3.1 India's total export share in the World total export

Analysis of the Table 4.8 reveals that, India's total export share in the World total export trade has been registered during the study period at 1.03 per cent in 1960-61 ranging up to 1.30 per cent in 2017-18.

Table 4.8 India's total export share in the World total export

(₹'000 Crore)

Sr. No.	Year	World Total Export	India's Total Export	India's Share in World Total Export (%)
1	1960-61	61.92 (-)	0.64 (-)	1.03
2	1970-71	238.52 (285.21)	1.52 (137.5)	0.64
3	1980-81	1610.84 (575.35)	6.71 (341.45)	0.42
4	1990-91	6117.46 (279.77)	32.53 (384.80)	0.53
5	2000-01	28998.07 (374.02)	201.36 (519.00)	0.69
6	2010-11	69976.50 (141.31)	1142.92 (467.60)	1.63
7	2017-18	156027.63 (122.97)	2022.72 (76.98)	1.30

(Figures in the bracket indicates the per cent change over consequent decade)
Source : www.statista.com; www.indiaagristat.com

India’s total export share *i.e.* 1.03 per cent in the World total export during 1960-61 was declined up to 0.42 per cent during 1980-81 then it increased during 2010-11 *i.e.* 1.63 per cent and again declined during 2017-18 *i.e.* 1.30 per cent. India’s export share in World total export is less than 2 per cent during 1960-61 to 2017-18. The World and India’s total export was fluctuating over a consequent decade.

4.3.2 India’s agricultural export share in World agricultural export

Table 4.9 reveals that India’s agricultural export share in the World agricultural export trade has registered during the period at 1.6 per cent in 1960-61 ranging up to 3.7 per cent in 2017-18.

It is seen from Table 4.9 that India’s agricultural export share in the World agricultural export was increased up to year 1980-81 but declined in 1990-91 at 0.8 per cent, then it continuously increased up to 3.7 per cent during 2017-18. The average share of India’s agricultural export was less than 4 per cent in the World agricultural export during the year 1960-61 to 2017-18.

Table 4.9 India’s agricultural export share in World agricultural export

(₹‘000 Crore)

Sr. No.	Year	World Agricultural Export	India’s Agricultural Export	India’s Share in World Agricultural Export (%)
1	1960-61	16.86 (-)	0.28 (-)	1.66
2	1970-71	15.82 (-6.17)	0.37 (32.14)	2.31
3	1980-81	92.32 (483.57)	2.38 (543.24)	2.57
4	1990-91	725.77 (686.15)	6.01 (152.52)	0.83
5	2000-01	2481.81 (241.96)	28.66 (376.87)	1.15
6	2010-11	6248.87 (151.79)	117.48 (309.91)	1.88
7	2017-18	10168.50 (62.73)	380.66 (224.02)	3.74

(Figures in the parentheses indicates the per cent change over consequent decade)

Source : The State Food And Agriculture 1962, 1970, 1980; Changing Pattern in India’s Agricultural Exports under WTO By Shabana Anjum and Arifa Khan; www.indiaagristat.com

4.3.3 India's paddy export share in World agricultural export

Table 4.10 reveals that India's paddy export share in the World agricultural export was very negligible. It ranged from 0.02 to 0.47 per cent during the period under study.

India's paddy export share in World agricultural export was 0.02 per cent during 1960-61 then it continuously increased up to 1980-81. But it declined from 1990-91 onwards. It is noted that India's paddy share in World total agricultural export was less than one per cent.

India ranks second in the production of paddy after China and accounted for 15.23 per cent of global paddy production in 2017-18. However, the global trade of Indian paddy is very low as compared to its production. It is less than one per cent.

Table 4.10. India's paddy export share in World agricultural export

(₹ '000 Crore)

Sr. No.	Year	World Agricultural Export	India's Paddy Export	India's Share of Paddy in World Agricultural Export(%)
1	1960-61	16.86 (-)	0.004 (-)	0.02
2	1970-71	15.82 (-6.17)	0.004 (0.00)	0.03
3	1980-81	92.32 (483.57)	0.136 (3300.00)	0.15
4	1990-91	725.77 (686.15)	0.452 (232.35)	0.06
5	2000-01	2481.81 (241.96)	2.946 (551.77)	0.12
6	2010-11	6248.87 (151.79)	10.496 (256.28)	0.17
7	2017-18	10168.50 (62.73)	47.968 (357.01)	0.47

(Figures in the bracket indicates the per cent change over consequent decade)

Source : The State Food And Agriculture 1962, 1970, 1980; Changing Pattern in India's Agricultural Exports under WTO By Shabana Anjum and Arifa Khan; www.ricestat.com

4.3.4 India's agricultural export share in India's total export

It is noted from the Table 4.11 that India's agricultural export share in the India's total export trade was 43.69 per cent in the year 1960-61 and it was 18.82 per cent in the year 2017-18.

It indicates that share of service sector was increased than primary sector. After WTO period *i.e.* 1990-91 Onwards, the agricultural export share in total export has been declined.

Table 4.11. India's agricultural export share in India's total export

(₹ '000 Crore)

Sr. No.	Year	India's Total Export	India's Agricultural Export	Agricultural Export Share in Total Export (%)
1	1960-61	0.64	0.28	43.69
2	1970-71	1.52	0.37	24.03
3	1980-81	6.71	2.38	35.41
4	1990-91	32.53	6.01	18.48
5	2000-01	201.36	28.66	14.23
6	2010-11	1142.92	117.48	10.28
7	2017-18	2022.72	380.66	18.82

Source : Export Potential of Indian Agriculture, Editor- Dr. Gurshan Singh Kainth; www.Indiaagristat.com

4.3.5 India's paddy export share in India's agricultural export

It is noted from the Table 4.12 that India's paddy export share in the India's agricultural export trade was gradually increased from 1.43 per cent in 1960-61 to 12.60 per cent in 2017-18.

Table 4.12. India's paddy export share in India's agricultural export

(₹'000' Crore)

Sr. No.	Year	India's Agricultural Export	India's paddy Export	India's paddy Share in Agricultural Export (%)
1	1960-61	0.28	0.004	1.43
2	1970-71	0.37	0.004	1.15
3	1980-81	2.38	0.136	5.74
4	1990-91	6.01	0.452	7.52
5	2000-01	28.66	2.946	10.28
6	2010-11	117.48	10.496	8.93
7	2017-18	380.66	47.968	12.60

Source : www.indiaagristat.com; www.ricestat.com Export Potential of Indian Agriculture, Editor- Dr. Gurshan Singh Kainth

India exported paddy worth ₹ 4.00 crores in 1960-61 which is 1.43 per cent of India's agricultural export. India's paddy export increased up to ₹ 47968 crores which is 12.60 per cent of India's agricultural export. Hence, the share of paddy export in agricultural export is quite satisfactory. It was drastically increased in post-WTO period *i.e.* after 1990-91.

4.3.6 India's paddy export share in India's paddy production

India's paddy export share in the India's paddy production has been presented in Table 4.13.

It is seen from Table 4.13 that, the share of paddy export in total paddy production during 1960-61 was 0.62 per cent while it increased to 11.93 per cent in 2017-18. The per cent share of paddy export in India's total paddy production was increases from 1990-91 to 2017-18. Domestic paddy production is the main determinant of paddy export. Paddy production was continuously increased from the year 1960-61. Whereas, the India's paddy export share in paddy production has continuously increased from post-WTO period *i.e.* after 1990-91.

Table 4.13. India's paddy export share in India's paddy production

(Qty:'000 tonnes)

Sr. No.	Year	India's paddy Production	India's paddy Export	India's paddy Export Share in paddy Production (%)
1	1960-61	34574.00	214.36	0.62
2	1970-71	42225.00	16.00	0.04
3	1980-81	53631.00	919.00	1.71
4	1990-91	74291.00	712.00	0.96
5	2000-01	84976.00	1936.00	2.28
6	2010-11	95970.00	4637.00	4.83
7	2017-18	109000.00	13000.00	11.93

Source: www.ricestat.com; Constraints and potential of Indian rice export-shodhganga

4.3.7 Direction of trade-World total export and World total import

Direction of trade provides critical data on the value of merchandise exports and imports between each country and all its trading partners. It reports total bilateral and multilateral exports and imports aggregates at national or regional level.

Negative values denote countries in deficit, while positive values denote countries with a surplus.

It is seen from Table 4.14 that, in 1960-61, the World total export was worth ₹ 61.92 thousand crores and World total import was worth ₹ 75.53 thousand crores. There was a continuously negative balance of trade up to 2010-11 then it was changed in the year 2017-18. The World total export was worth ₹ 156027.63 thousand Crores and World total import was worth ₹152215.67 thousand crores during 2017-18 and it shown positive trade balance.

Table 4.14. Direction of trade-World total export and World total import

(₹‘000 Crores)

Sr. No.	Year	World Total Export	World Total Import	Trade Balance
1	1960-61	61.92	75.53	-13.61
2	1970-71	238.52	287.85	-49.33
3	1980-81	1610.84	1851.03	-240.19
4	1990-91	6117.46	7635.25	-1517.79
5	2000-01	28998.07	35502.60	-6504.53
6	2010-11	69976.50	84134.05	-14157.55
7	2017-18	156027.63	152215.67	3811.96

Source : www.dataworldbank.org.com

4.3.8 Direction of trade-India's total export and India’s total import

Analysis of the Table 4.15 reveals that in 1960-61, the India’s total export was worth ₹ 0.64 thousand crores and India’s total import was worth ₹ 1.12 thousand crores. The negative balance of trade in India did not change over the last 57 years, in spite of all government policies regarding export promotions. It is important to note that India’s total export- import trade balance was drastically increased after post-WTO period.

Table 4.15 Direction of trade-India's total export and India's total import

(₹ '000 Crores)

Sr. No.	Year	India's Total Export	India's Total Import	Trade balance
1	1960-61	0.64	1.12	-0.48
2	1970-71	1.52	1.62	-0.10
3	1980-81	6.71	12.47	-5.76
4	1990-91	31.75	43.17	-11.42
5	2000-01	203.57	228.31	-24.74
6	2010-11	1142.92	1683.47	-540.55
7	2017-18	2022.72	2684.60	-661.88

Source : Export Potential of Indian Agriculture, Editor- Dr. Gurshan Singh Kainth; www.Indiaagristat.com

4.3.9 Direction of trade-India's agricultural export and import

Table 4.16 reveals that in 1960-61, the India's agricultural export was worth ₹ 0.28 thousand crores and India's total import was worth ₹ 0.30 thousand crores, It denotes negative trade balance. It means that India was deficit during 1960-61. India's agriculture export trade balance was positive from 1970-71 to 2017-18. It means that India was with a surplus trade balance from 1970-71 to 2017-18, in agricultural export.

Table 4.16. Direction of trade-India's agricultural export and import

(₹'000 Crores)

Sr. No.	Year	India's Agriculture Export	India's Agriculture Import	Trade Balance
1	1960-61	0.28	0.30	-0.02
2	1970-71	0.37	0.33	0.04
3	1980-81	2.38	1.02	1.36
4	1990-91	6.01	1.21	4.81
5	2000-01	28.66	12.09	16.57
6	2010-11	117.48	57.33	60.15
7	2017-18	380.66	240.43	140.23

Source : Export Potential of Indian Agriculture, Editor- Dr. Gurshan Singh Kainth www.Indiaagristat.com

4.3.10 Direction of trade-World paddy export and World paddy import

Table 4.17 shows that in 1960-61, the World paddy export was worth ₹ 0.27 'thousand crores and World paddy import was worth ₹ 0.36 thousand crores. It indicates the negative trade balance of World paddy export-import. It continuously remained negative up to year 2017-18. It reveals that there was a continuous demand for paddy in the World.

Table 4.17 Direction of trade-World paddy export and World paddy import

(₹'000 Crores)

Sr. No.	Year	World paddy Export	World paddy Import	Trade Balance
1	1960-61	0.27	0.36	-0.09
2	1970-71	0.89	0.99	-0.10
3	1980-81	3.94	4.22	-0.28
4	1990-91	7.25	8.15	-0.90
5	2000-01	29.23	32.74	-3.51
6	2010-11	92.12	94.81	-2.69
7	2017-18	140.33	145.75	-5.42

Source: www.ricestat.com; The State Food And Agriculture 1962

4.3.11 Direction of trade-India's paddy export and paddy import

Table 4.18 noted that in 1960-61, the India's paddy export was worth ₹ 0.004 thousand crores and India's paddy import was worth ₹ 0.039 thousand crores. The negative balance of trade was in the year 1960-61 and 1970-71. Then it was positive trade balance for remaining period. It means that India was deficit in paddy export during the period 1960-61 to 1970-71 but from the period 1980-81 to 2017-18 India was with a surplus in trade balance of paddy export-import.

Table 4.18 Direction of trade-India's paddy export and paddy import

(₹'000 Crores)

Sr. No.	Year	India's Paddy Export	India's Paddy Import	Trade Balance
1	1960-61	0.004	0.039	-0.035
2	1970-71	0.004	0.060	-0.056
3	1980-81	0.136	0.001	0.135
4	1990-91	0.452	0.038	0.414
5	2000-01	2.946	0.018	2.928
6	2010-11	10.496	0.0005	10.496
7	2017-18	47.968	0.012	47.956

Source : www.ricestat.com; Trends in India's Agriculture Trade, Foreign Agricultural Economic Report No.15

4.3.12 Export competitiveness of Indian paddy

The export competitiveness of paddy in India was estimated by using Nominal Protection Coefficient (NPC) and Export Performance Ratio (EPR) for the period 1970-71 to 2017-18.

The calculations of Nominal Protection Coefficient (NPC) and Export Performance Ratio (EPR) were shown in Table 4.19. It is revealed from the Table 4.19 that, the paddy had a comparative advantage because the values of NPC for overall study period have been found less than unity except some years such as 1973-74, 1977-78, 1978-79, 1997-98, 2001-02 and 2011-12, In this period the NPC values were recorded as greater than unity. On an average the Nominal Protection Coefficient (NPC) was 0.62, which was less than unity for paddy export and which indicates that the domestic prices received by the farmers in the country were lower than the international prices. The values of Export Performance Ratio for overall study period have been found more than unity except some years such as 1970-71 to 1973-74 and 1975-76 to 1977-78, in this period the EPR values were less than unity. On an average the Export Performance Ratio (EPR) was 11.74 means greater than unity for paddy export which indicates that the paddy has comparative advantage in export.

Table 4.19 Export Competitiveness of Indian Paddy

Sr. No.	Year	NPC	EPR
1	1970-71	0.39	0.73
2	1971-72	0.50	0.48
3	1972-73	0.80	0.47
4	1973-74	1.57	0.39
5	1974-75	0.09	1.62
6	1975-76	0.51	0.76
7	1976-77	0.16	0.97
8	1977-78	3.36	0.38
9	1978-79	1.01	2.85
10	1979-80	0.60	6.24
11	1980-81	0.91	8.31
12	1981-82	0.20	17.00
13	1982-83	0.11	12.98
14	1983-84	0.31	7.11
15	1984-85	0.31	5.53
16	1985-86	0.15	12.72
17	1986-87	0.38	10.06
18	1987-88	0.21	15.79

Table 4.19 Contd….

Sr. No.	Year	NPC	EPR
19	1988-89	0.31	11.15
20	1989-90	0.29	9.40
21	1990-91	0.38	8.70
22	1991-92	0.23	12.58
23	1992-93	0.24	12.70
24	1993-94	0.24	13.33
25	1994-95	0.41	10.12
26	1995-96	0.41	29.94
27	1996-97	0.54	18.64
28	1997-98	1.18	18.27
29	1998-99	0.42	25.67
30	1999-00	0.45	14.26
31	2000-01	0.60	14.51
32	2001-02	1.87	14.10
33	2002-03	0.66	22.44
34	2003-04	0.69	15.06
35	2004-05	0.68	18.38
36	2005-06	0.75	14.90
37	2006-07	0.99	14.09
38	2007-08	0.33	18.31
39	2008-09	0.29	10.66
40	2009-10	0.31	8.66
41	2010-11	0.80	6.98
42	2011-12	1.05	9.93
43	2012-13	0.71	15.66
44	2013-14	0.63	19.20
45	2014-15	0.55	18.97
46	2015-16	0.59	17.02
47	2016-17	0.85	14.93
48	2017-18	0.50	20.31
	Average	**0.62**	**11.74**

4.3.13 Export competitiveness of Indian paddy with major importing countries

Estimated values of Nominal Protection Coefficient (NPC) showing export competitiveness of Indian paddy with major importing countries during the period 1991-92 to 2017-18 is presented Table 4.20. It is observed from the Table 4.20 that, the paddy had a comparative advantage because the values of NPC for overall study period in major importing countries have been found less than unity. On an average the Nominal

Protection Coefficient (NPC) were 0.46, 0.16, 0.65, 0.55 and 0.51 for major importing countries such as Saudi Arabia, UAE, Kuwait, Yemen AR and USA respectively, means less than unity for paddy export which indicates that the domestic prices received by the farmers in the country were lower than the international prices.

Table 4.20 Competitiveness of Indian paddy with major importing countries

Sr. No.	Year	Nominal Protection Coefficient (NPC)				
		Saudi Arabia	UAE	Kuwait	Yemen AR	USA
1	1991-92	0.76	0.09	0.78	0.39	0.14
2	1992-93	0.42	0.07	0.16	0.40	0.14
3	1993-94	0.30	0.05	0.20	0.60	0.13
4	1994-95	0.35	0.09	0.12	0.20	0.13
5	1995-96	0.47	0.06	0.20	0.53	0.16
6	1996-97	0.41	0.09	0.28	0.34	0.23
7	1997-98	0.41	0.12	0.22	0.48	0.23
8	1998-99	0.35	0.10	0.30	1.07	0.23
9	1999-00	0.47	0.08	0.26	0.76	0.22
10	2000-01	0.43	0.09	0.30	0.61	0.20
11	2001-02	0.51	0.08	0.38	0.72	0.20
12	2002-03	0.65	0.07	0.47	0.67	0.18
13	2003-04	0.81	0.06	0.53	0.78	0.20
14	2004-05	0.54	0.16	0.38	0.66	0.21
15	2005-06	0.38	0.24	0.45	0.43	0.23
16	2006-07	0.44	0.16	0.40	0.70	0.24
17	2007-08	0.52	0.14	0.40	0.57	0.28
18	2008-09	0.25	0.09	0.24	0.47	0.35
19	2009-10	0.25	0.12	0.21	0.35	0.33
20	2010-11	0.32	0.14	0.40	0.54	0.39
21	2011-12	0.44	0.18	0.20	0.73	0.42
22	2012-13	0.51	0.28	0.37	0.52	0.42
23	2013-14	0.37	0.51	0.57	0.54	0.44
24	2014-15	0.42	0.28	0.31	0.46	0.40
25	2015-16	0.46	0.26	0.24	0.33	0.37
26	2016-17	0.54	0.32	0.36	0.52	0.36
27	2017-18	0.56	0.31	0.37	0.49	0.35
Grand Total		**12.34**	**4.27**	**9.11**	**14.83**	**7.19**
Average		**0.46**	**0.16**	**0.65**	**0.55**	**0.51**

From the forgoing discussion, it is noted that, the values of Nominal Protection Coefficient (NPC) in paddy were less than unity over a period of 27 years for all the important importing countries indicating highly competitiveness of Indian paddy for export in international market. The NPC was lowest *i.e.* below 0.50 for Saudi Arabia and UAE for overall period *i.e.* 1991-92 to 2017-18 indicating the highly export competitiveness of these two countries. The similar results were noted by Makama *et al.* (2016) and Yamini (2019). The hypothesis viz; Indian paddy are competitive in the international market has been proved.

4.4 Structural Changes in Paddy Export From India

4.4.1 Major export destinations of Indian paddy

Indian paddy mainly exported to Saudi Arabia, Kuwait, UK, UAE, Yemen Arab Republic, USA, Canada and Belgium. The major destinations of Indian paddy in terms of both quantity and value and their shares is illustrated in Tables 4.21 and 4.22, respectively. It is revealed from the Table 4.21 that the Saudi Arabia accounted for the highest share (37.05 %) in paddy export from India in terms of quantity followed by UAE (34.67 %), Kuwait (7.70 %), Yamen Arab Republic (6.67 %), UK (6.44 %), USA (5.72 %), Canada (1.27 %) and Belgium (0.48 %) in the year 2016-17. Whereas Table 4.22 depicted in terms of export value. Saudi Arabia accounted the highest share (37.74%) followed by UAE (30.96 %), Kuwait (8.67 %), USA (7.19 %), Yamen AR (6.29 %), UK (5.62 %), Canada (1.78 %) and Belgium (1.75 %) in the year 2016-17. Paddy is not produced in Saudi Arabia and the country imports substantial quantity of paddy from India to meet its more consumer demand and the UAE imports paddy due to extreme heat and limited fresh water supplies that limit crop output. There has been a major destinations of export of Indian paddy over a period of ten years (2007-08 to 2016-17).

4.4.2 Trade directions of paddy exports from India

The changing pattern of Indian paddy export were estimated by computing the transitional probability matrices for the annual export data in terms of quantity and value presented in Tables 4.23 and 4.24, respectively. The row elements in the transitional probability matrix provide the information on the extent of loss in quantity and value of imports to competing countries. The columns element indicates the probability of gains in quantity and value of trade from other competing countries and the diagonal element indicates probability of retention of the previous year's trade quantity and value by the respective country.

The major importers countries from India *viz.*, Saudi Arabia, Kuwait, UK, UAE, Yemen Arab Republic, USA, Canada and Belgium were considered for analysis. It is evident from the Table 4.23 that, UAE was the most stable market among the major importers of Indian paddy as reflected by the probability of retention at 0.6793, which means that UAE had retained its original export quantity share of 67.93 per cent during the period 2007-08 to 2016-17. Saudi Arabia had probability of retention 0.5734, and it retained its original export quantity share of 57.34 per cent. Similarly, Yamen Arab Republic retained its original export quantity share of 39.39 per cent. This implies that Saudi Arabia and Yamen AR were also the stable importer of Indian paddy. Kuwait and UK have shown lower probability of retention *viz.*, 0.1355 and 0.0865 respectively, on the contrary, USA, Canada and Belgium have shown 'zero' probability of retention which means that they were unstable importers of Indian paddy.

The major gainer among the importers of Indian total paddy in quantity over the study period was Saudi Arabia which had a transfer probability of 1.0000 from Canada, 0.2779 from Kuwait, 0.4745 from UK, 0.1672 from UAE, 0.9897 from USA and 0.2699 from Belgium.

The Transitional Probability Matrix presented in Table 4.24 provides a broad indication of changes in the direction of export value of paddy from India .The major Indian paddy importing countries were Saudi Arabia, Kuwait, UK, Yamen Arab Republic, U.S.A, Canada and Belgium in terms of value.

Table 4.24 indicated that U.S.A. was the most stable market in terms of value among the major importers of Indian paddy, as exhibited by highest probability of retention at 0.7634, which means that U.S.A. had retained its original export value share of 76.34 per cent during the period 2007-08 to 2016-17. UAE had the probability of retention 0.5647, and it retained its original export value share of 56 .47 per cent. Similarly, Saudi Arabia retained its original export value share of 43.88 per cent. This implies that UAE and Saudi Arabia was the stable importer of Indian paddy in value term.

Table 4.21 India's total paddy export to major importing countries

(Qty: MT)

Year	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	U.S.A.	Canada	Belgium	Total
2007-08	382642.50 (44.29)	74026.9 (8.57)	44459.87 (5.15)	252641.99 (29.24)	51997.24 (6.01)	41965.16 (4.86)	8899.45 (1.03)	7344.335 (0.85)	863977.43 (100.00)
2008-09	262562.61 (41.18)	55867.05 (8.76)	31928.45 (5.00)	238729.17 (37.44)	15923.84 (2.50)	20022.05 (3.14)	8899.45 (1.40)	7344.34 (1.15)	637649.3 (100.00)
2009-10	327640.85 (41.74)	70025.92 (8.92)	18963.55 (2.42)	313970.28 (39.10)	32000.81 (4.08)	15439.69 (1.97)	5402.63 (0.69)	1495.05 (0.19)	784938.8 (100.00)
2010-11	311962.36 (36.94)	98876.17 (11.78)	38809.34 (4.60)	318196.95 (37.68)	35146.76 (4.16)	24019.21 (2.84)	8321.04 (0.99)	9207.06 (1.09)	844538.9 (100.00)
2011-12	411962.83 (33.20)	109385.2 (8.81)	80573.44 (6.51)	468147.03 (37.73)	82219.44 (6.63)	55891.63 (4.50)	16056.48 (1.30)	16430.22 (1.32)	1240666.28 (100.00)
2012-13	412204.69 (37.40)	101732.05 (9.23)	107939.20 (9.80)	248375.66 (22.54)	113903.70 (10.34)	56371.15 (5.12)	15052.42 (1.37)	46303.31 (4.20)	1101882.18 (100.00)
2013-14	482852.43 (45.51)	101354.37 (9.55)	71377.88 (6.73)	186979.14 (17.62)	105752.98 (9.97)	64404.42 (6.07)	15955.99 (1.50)	32198.23 (3.03)	1060875.43 (100.00)
2014-15	574498.42 (46.73)	99875.99 (8.12)	75941.77 (6.18)	259876.56 (21.14)	126585.49 (10.30)	58464.10 (4.76)	14779.48 (1.20)	19479.96 (1.58)	1229502.66 (100.00)
2015-16	550356.92 (38.73)	106611.91 (7.50)	101907.46 (7.17)	423212.95 (29.78)	113420.71 (7.98)	81081.95 (5.71)	20406.1 (1.44)	23895.66 (1.68)	1420893.66 (100.00)
2016-17	467503.11 (37.05)	97224.45 (7.70)	81208.435 (6.44)	437437.87 (34.67)	84119.91 (6.67)	72125.53 (5.72)	16060.44 (1.27)	6021.105 (0.48)	1261700.84 (100.00)

(Figures within the parentheses indicate per cent share of each importing country)

Source : www.APEDA.com

Table 4.22 India's paddy export to major countries during 2007-08 to 2016-17

(Value ₹. Lakh)

Year	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	U.S.A.	Canada	Belgium	Total
2007-08	122567.89 (45.99)	23646.92 (8.87)	16191.23 (6.07)	75897.35 (28.48)	11607.63 (4.35)	10744.88 (4.03)	3226.70 (1.21)	2600.94 (0.97)	266483.52 (100.00)
2008-09	155277.97 (39.86)	36737.47 (9.43)	21782.69 (5.59)	145144.98 (37.26)	8795.24 (2.25)	13728.42 (3.52)	6048.67 (1.55)	1991.01 (0.51)	389506.43 (100.00)
2009-10	167329.08 (40.46)	51607.38 (12.47)	10050.92 (2.43)	156833.07 (37.92)	15115.72 (3.65)	8593.58 (2.07)	3222.29 (0.77)	783.63 (0.17)	413535.66 (100.00)
2010-11	156906.23 (38.42)	54593.07 (13.36)	17626.70 (4.31)	142243.24 (34.83)	14860.00 (3.63)	12628.38 (3.09)	5044.42 (1.23)	4,489.55 (1.09)	408391.57 (100.00)
2011-12	183037.19 (32.74)	71136.71 (12.72)	34693.54 (6.21)	196591.37 (35.16)	28927.38 (5.17)	28805.09 (5.15)	9332.66 (1.67)	6593.74 (1.18)	559117.67 (100.00)
2012-13	204701.51 (39.22)	59174.47 (11.34)	45360.50 (8.69)	103567.20 (19.84)	51505.94 (9.87)	32352.29 (6.20)	8858.75 (1.70)	16429.85 (3.15)	521950.49 (100.00)
2013-14	362077.60 (49.84)	81037.38 (11.16)	43588.52 (6.00)	94751.59 (13.04)	67281.15 (9.26)	50287.71 (6.92)	12304.69 (1.69)	15107.59 (2.08)	726436.21 (100.00)
2014-15	395508.67 (48.99)	82850.62 (10.26)	48129.46 (5.96)	134849.68 (16.70)	74600.67 (9.24)	47072.79 (5.83)	12401.72 (1.54)	11914.19 (1.48)	807327.80 (100.00)
2015-16	300026.68 (40.41)	74768.86 (10.09)	50108.45 (6.70)	192924.28 (25.79)	50741.22 (6.78)	53969.45 (7.21)	13568.08 (1.81)	12095.81 (1.62)	748202.82 (100.00)
2016-17	246134.94 (37.78)	56522.05 (8.67)	36683.62 (5.69)	201935.95 (30.45)	40993.55 (6.29)	46889.82 (7.29)	11617.87 (1.79)	11436.46 (1.94)	652214.23 (100.00)

(Figures within the parentheses indicate per cent share of each importing country)

Source : www.APEDA.com

Kuwait, UK, Yamen Republic, and other countries have shown lower probability of retention, *viz.* 0.2010, 0.1586 and 0.2899, respectively on the contrary, Canada and Belgium have shown 'zero' probability of retention, indicating that Canada and Belgium were unstable importers of Indian paddy.

The major gainer among the importers of Indian paddy over the study period was Yamen Republic which had a transfer probability of 1.0000 from Belgium, 0.0051 from U.S.A. 0.1463 from Kuwait and 0.7077 from Canada.

Thus, the trade direction of Indian paddy export in terms of quantity and value were changing over a period of time. These results are in line with findings of Anup Adhikari *et al.* (2016) and Yamini (2019). The hypothesis viz; the dynamics in the direction of paddy export is changing has been proved.

Table 4.23 Transitional probability matrix for total paddy export in quantity from India during 2007-08 to 2016-17

	Saudi Arabia	**Kuwait**	**UK**	**UAE**	**Yamen AR**	**USA**	**Canada**	**Belgium**
Saudi Arabia	**0.5734**	0.1220	0.0000	0.3046	0.0000	0.0000	0.0000	0.0000
Kuwait	0.2779	**0.1355**	0.1482	0.0000	0.3067	0.0000	0.0463	0.0855
UK	0.4745	0.0000	**0.0865**	0.0000	0.0000	0.3552	0.0837	0.0000
UAE	0.1672	0.0724	0.0414	**0.6793**	0.0000	0.0308	0.0089	0.0000
Yamen AR	0.0000	0.0000	0.3464	0.0000	**0.3939**	0.1832	0.0000	0.0766
USA	0.9897	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0103	0.0000
Canada	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000
Belgium	0.2699	0.0000	0.0000	0.0000	0.7301	0.0000	0.0000	**0.0000**

Table 4.24 Transitional probability matrix for paddy export in value from India during 2007-08 to 2016-17

	Saudi Arabia	**Kuwait**	**UK**	**UAE**	**Yamen AR**	**USA**	**Canada**	**Belgium**
Saudi Arabia	**0.4389**	0.1202	0.0864	0.3340	0.0000	0.0000	0.0206	0.0000
Kuwait	0.5021	**0.2010**	0.0000	0.0000	0.1463	0.0835	0.0117	0.0553
UK	0.8309	0.0000	**0.1587**	0.0000	0.0000	0.0000	0.0105	0.0000
UAE	0.2794	0.1555	0.0000	**0.5647**	0.0000	0.0000	0.0005	0.0000
Yamen AR	0.4183	0.0000	0.0726	0.0000	**0.2899**	0.1256	0.0000	0.0935
USA	0.0113	0.0000	0.0833	0.0000	0.0051	**0.7634**	0.1047	0.0323
Canada	0.2923	0.0000	0.0000	0.0000	0.7077	0.000	**0.0000**	0.0000
Belgium	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	**0.0000**

4.4.3 Major export destinations of Indian basmati paddy

In earlier part of this section, the structural changes in export and import of Indian total paddy has been discussed. However, for more detailed analysis the structural changes in export and import of Indian rice of Basmati and non-basmati rice is explained as below.

Indian basmati paddy mainly exported to Saudi Arabia, Kuwait, UK, UAE, Yemen Arab Republic, USA, Canada and Belgium. The major destinations of Indian basmati paddy in terms of both quantity and value and their shares illustrated in Table 4.25 and 4.26 respectively. It is revealed from the Table 4.25 that the Saudi Arabia accounted for the highest share (40.75 %) in basmati paddy export quantity from India followed by UAE (22.07 %), UK (9.28 %), Yamen Arab Republic (8.62 %), Kuwait (8.58 %), USA (6.52 %), Canada (2.12 %) and Belgium (2.06 %). Whereas, Table 4.26 depicted that, Saudi Arabia also accounted the highest share (41.39 %) in basmati paddy export in terms of value from India followed by UAE (21.85 %), Kuwait (8.88 %), Yamen AR (8.04 %), UK (7.97 %), USA (7.44 %), Canada (2.39 %) and Belgium (2.05 %) in the year 2017-18. There has been major destinations of export of Indian paddy over a period of ten years (2008-09 to 2017-18).

Table 4.25 India's Basmati paddy export to major importing countries from 2008-09 to 2017-18

Qty : MT

Year	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	USA	Canada	Belgium	Total
2008-09	524401.67 (41.94)	111547.25 (8.92)	62563.10 (5.00)	456146.51 (36.48)	31475.68 (2.52)	39625.13 (3.17)	17835.20 (1.43)	6898.73 (0.55)	1250493.27 (100.00)
2009-10	640404.41 (41.79)	139473.57 (9.10)	36966.43 (2.41)	616125.13 (40.21)	61809.92 (4.03)	25922.13 (1.69)	9244.81 (0.60)	2511.00 (0.16)	1532457.40 (100.00)
2010-11	622704.96 (37.16)	197590.40 (11.79)	77384.45 (4.62)	634769.33 (37.88)	70042.10 (4.18)	47489.73 (2.83)	16531.47 (0.99)	9207.06 (0.55)	1675719.50 (100.00)
2011-12	721245.48 (35.58)	199869.77 (9.86)	141666.21 (6.99)	728823.29 (35.95)	92112.14 (4.54)	91816.94 (4.53)	28458.45 (1.40)	23279.84 (1.15)	2027272.12 (100.00)
2012-13	681238.69 (42.09)	163317.07 (10.09)	192433.35 (11.89)	234679.47 (14.50)	172348.74 (10.65)	91546.37 (5.66)	28145.15 (1.74)	54959.36 (3.40)	1618668.20 (100.00)
2013-14	826289.81 (52.19)	175444.79 (11.08)	118888.17 (7.51)	149041.96 (9.41)	146839.58 (9.27)	103377.64 (6.53)	28826.11 (1.82)	34498.88 (2.18)	1583206.94 (100.00)
2014-15	966931.17 (51.78)	166468.29 (8.91)	136347.31 (7.30)	278596.43 (14.92)	174368.66 (9.34)	89223.17 (4.78)	25666.84 (1.37)	29900.00 (1.60)	1867501.87 (100.00)
2015-16	948847.51 (41.87)	180731.80 (7.98)	187701.72 (8.28)	612154.81 (27.01)	142161.42 (6.27)	120687.24 (5.33)	36216.07 (1.60)	37516.00 (1.66)	2266016.57 (100.00)
2016-17	809342.72 (39.59)	162675.52 (7.96)	150537.21 (7.36)	614656.98 (30.07)	130652.82 (6.39)	108990.92 (5.33)	31651.40 (1.55)	35694.91 (1.75)	2044202.48 (100.00)
2017-18	792480.09 (40.75)	166873.90 (8.58)	180507.92 (9.28)	429325.73 (22.07)	167687.62 (8.62)	126791.19 (6.52)	41232.62 (2.12)	40061.40 (2.06)	1944960.47 (100.00)

(Figures within the parentheses indicate per cent share of each importing country)
Source: www.ricestat.com

Table 4.26 Export of Basmati paddy from India to major importing countries in Value

₹ Lakh

Year	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	USA	Canada	Belgium	Total
2008-09	310280.84 (40.51)	73393.68 (9.58)	43103.89 (5.63)	278620.50 (36.37)	17515.88 (2.29)	27259.70 (3.56)	12007.75 (1.57)	3836.29 (0.50)	766018.53 (100.00)
2009-10	329547.41 (40.49)	103014.17 (12.66)	19589.45 (2.41)	309465.31 (38.02)	29548.25 (3.63)	15349.93 (1.89)	6136.60 (0.75)	1294.17 (0.16)	813945.29 (100.00)
2010-11	313294.44 (38.64)	109164.06 (13.46)	35176.84 (4.34)	283975.54 (35.02)	29678.49 (3.66)	25032.49 (3.09)	10054.08 (1.24)	4489.55 (0.55)	810865.49 (100.00)
2011-12	338088.10 (33.80)	136292.08 (13.63)	62945.73 (6.29)	343279.33 (34.32)	40291.21 (4.03)	50388.20 (5.04)	17402.42 (1.74)	11612.14 (1.16)	1000299.21 (100.00)
2012-13	365908.13 (41.79)	105967.74 (12.10)	84998.43 (9.71)	131119.84 (14.98)	87819.40 (10.03)	56169.10 (6.42)	17080.52 (1.95)	26473.00 (3.02)	875536.16 (100.00)
2013-14	671706.04 (53.07)	151305.57 (11.95)	78584.89 (6.21)	118922.48 (9.40)	110779.47 (8.75)	87044.95 (6.88)	23154.93 (1.83)	24177.24 (1.91)	1265675.57 (100.00)
2014-15	726078.26 (51.56)	153322.63 (10.89)	89981.41 (6.39)	192996.56 (13.71)	120100.30 (8.53)	80540.10 (5.72)	22966.48 (1.63)	22214.35 (1.58)	1408200.09 (100.00)
2015-16	549385.15 (42.33)	137670.34 (10.61)	93283.66 (7.19)	311070.29 (23.97)	73128.18 (5.64)	86167.51 (6.64)	25104.43 (1.93)	21911.18 (1.69)	1297720.74 (100.00)
2016-17	449452.95 (40.17)	100241.95 (8.96)	68080.94 (6.08)	314171.59 (28.08)	69244.80 (6.19)	75285.27 (6.73)	21156.50 (1.89)	21214.35 (1.90)	1118848.35 (100.00)
2017-18	534317.17 (41.39)	114627.09 (8.88)	102835.66 (7.97)	282053.47 (21.85)	103843.45 (8.04)	96013.19 (7.44)	30854.75 (2.39)	26404.73 (2.05)	1290949.51 (100.00)

(Figures within the parentheses indicate per cent share of each importing country)
Source : www.ricestat.com

4.4.4 Trade directions of basmati paddy exports from India

The changing pattern of Indian basmati paddy in export were estimated by computing the transitional probability matrices for the annual export data in terms of quantity and value, presented in Table 4.27 and 4.28 respectively.

The major importer countries from India *viz.*, Saudi Arabia, Kuwait, UK, UAE, Yemen Arab Republic, USA, Canada and Belgium were considered for analysis. It is evident from the Table 4.27 that, UAE was the most stable market among the major importers of Indian basmati paddy as reflected by the probability of retention at 0.7937, which means that UAE had retained its original export quantity share of 79.37 per cent during the period 2008-09 to 2017-18. Saudi Arabia had probability of retention 0.7401, and it retained its original export quantity share of 74.01 per cent. Similarly, Kuwait retained its original export quantity share of 53.66 per cent and Yamen Arab Republic retained its original export quantity share of 51.50 per cent. This implies that Saudi Arabia, Kuwait and Yamen AR were also the stable import countries of Indian basmati paddy. UK has shown lower probability of retention *viz.*, 0.1205, on the contrary, USA, Canada and Belgium have shown 'zero' probability of retention which means that they were unstable importer of Indian basmati paddy.

Table 4.27 Transitional probability matrix for basmati paddy export in quantity from India during 2008-09 to 2017-18

	Saudi Arabia	**Kuwait**	**UK**	**UAE**	**Yamen AR**	**USA**	**Canada**	**Belgium**
Saudi Arabia	**0.7401**	0.0448	0.0382	0.1428	0.0333	0.0000	0.0000	0.0008
Kuwait	0.4634	**0.5366**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
UK	0.4600	0.0000	**0.1205**	0.0000	0.0000	0.2249	0.0556	0.1390
UAE	0.0000	0.0668	0.0493	**0.7937**	0.0000	0.0614	0.0212	0.0075
Yamen AR	0.0000	0.0000	0.1307	0.0000	**0.5150**	0.2784	0.0759	0.0000
USA	0.0867	0.0000	0.4173	0.0000	0.4208	**0.0000**	0.0075	0.0677
Canada	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000
Belgium	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**

Table 4.28 Transitional probability matrix for basmati paddy export in value from India during 2008-09 to 2017-18

	Saudi Arabia	**Kuwait**	**UK**	**UAE**	**Yamen AR**	**USA**	**Canada**	**Belgium**
Saudi Arabia	**0.7298**	0.0838	0.0203	0.1173	0.0488	0.0000	0.0000	0.0000
Kuwait	0.1658	**0.4753**	0.2732	0.0000	0.0062	0.0070	0.0688	0.0038
UK	0.6487	0.0000	**0.0370**	0.0000	0.0000	0.2824	0.0295	0.0025
UAE	0.0798	0.0813	0.0000	**0.7962**	0.0000	0.0335	0.0092	0.0000
Yamen AR	0.6503	0.0000	0.0000	0.0000	**0.3497**	0.0000	0.0000	0.0000
USA	0.0000	0.0000	0.2644	0.0000	0.1102	**0.5530**	0.0000	0.0724
Canada	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.2945**	0.7055
Belgium	0.1983	0.0000	0.0000	0.0000	0.8017	0.0000	0.0000	**0.0000**

The major gainer among the importers of Indian basmati paddy over the study period was Saudi Arabia which had a transfer probability of 1.0000 from Canada, 1.0000 from Belgium 0.4634 from Kuwait, 0.4600 from UK and 0.0867 from USA.

The Transitional Probability Matrix presented in Table 4.28 provides broad indications of changes in the direction of export value of basmati paddy from India. The major Indian paddy importing countries were Saudi Arabia, Kuwait, UK, Yamen Arab Republic, U.S.A, Canada and Belgium. Table 4.28 indicated that UAE, was the most stable market in terms of value among the major importers of Indian basmati paddy, as exhibited by highest probability of retention at 0.7962, which means that UAE had retained its original export value share of 79.62 per cent during the period 2008-09 to 2017-18. Saudi Arabia had the probability of retention 0.7298, and it retained its original export value share of 72.98 per cent. Similarly, USA retained its original export value share of 55.30 per cent. This implies that Saudi Arabia and USA were also the stable import value of Indian basmati paddy.

Kuwait, UK, Yamen Republic and canada have shown lower probability of retention, *viz.* 0.4753, 0.0.0370, 0.3497 and 0.2945 respectively, on the contrary, Belgium had shown 'zero' probability of retention, indicating that Belgium was an unstable importer of Indian basmati paddy.

The major gainer among the importers of Indian basmati paddy over the study period was Yamen Republic which had a transfer probability of 0.8017 from Belgium , 0.1102 from USA, 0.0488 Saudi Arabia and 0.0062 from Kuwait.

4.4.5 Major export destinations of Indian non-basmati paddy

Indian non-basmati paddy mainly was exported to Saudi Arabia, Kuwait, UK, UAE, Yemen Arab Republic, USA, Canada and Belgium. The major destinations of Indian non-basmati paddy in terms of both quantity and value and their shares are illustrated in Tables 4.29 and 4.30 respectively. It is revealed from the Table 4.29 that the UAE accounted for the highest share (47.03 %) in non-basmati paddy export quantity from India followed by Saudi Arabia (22.22 %), Yaman Arab Republic (14.57 %), USA (6.95 %), Kuwait (6.34 %), UK (1.57 %), Canada (0.77 %) and Belgium (0.54 %). Whereas, Table 4.30 depicted that, UAE also accounted the highest share (43.52 %) in non-basmati paddy export value from India followed by Saudi Arabia (21.40 %), Yamen

AR (15.17 %), Kuwait (6.50 %), UK (2.22 %), Canada (0.94 %), Belgium (0.53 %) and USA (0.10 %) in the year 2017-18. There has been a major destinations of export of Indian paddy over a period of ten years (2008-09 to 2017-18).

4.4.6 Trade directions of non-basmati paddy exports from India

The changing pattern of Indian non-basmati paddy in export were estimated by computing the transitional probability matrices for the annual export data in terms of quantity and value presented in Tables 4.31 and 4.32 respectively.

The major importer countries from India *viz.*, Saudi Arabia, Kuwait, UK, UAE, Yemen Arab Republic, USA, Canada and Belgium were considered for analysis. It is evident from the Table 4.31 that, Belgium was the most stable market among the major importers of Indian non-basmati paddy as reflected by the probability of retention at 0.4409, which means that Belgium had retained its original export quantity share of 44.09 per cent during the period 2008-09 to 2017-18. UAE had probability of retention 0.3371, and it retained its original export quantity share of 33.71 per cent. Similarly, Saudi Arabia retained its original export quantity share 22.08 per cent and UK retained its original export quantity share of 19.26 per cent. This implies that Saudi Arabia and UK were also the stable import quantity of Indian non-basmati paddy. Canada has shown lower probability of retention *viz.*, 0.0854, on the contrary, Kuwait, USA and Yaman Arab Republic have shown 'zero' probability of retention which means that they were unstable importer of Indian non-basmati paddy.

The major gainer among the importers of Indian non-basmati paddy over the study period was UAE which had a transfer probability of 1.0000 from Kuwait, 1.0000 from USA, 0.7607 from Yaman Arab Republic and 0.3665 from Saudi Arab.

The Transitional Probability Matrix presented in Table 4.32 provides a broad indication of changes in the direction of export value of non-basmati paddy from India .The major Indian paddy importing countries were Saudi Arabia, Kuwait, UK, Yamen Arab Republic, U.S.A, Canada and Belgium. Table 4.32 indicated that Kuwait was the most stable market among the major importers of Indian non-basmati paddy, as exhibited by highest probability of retention at 0.4290, which means that Kuwait had retained its original export value share of 42.90 per cent during the period 2008-09 to 2017-18. UAE had the probability of retention 0.2933, and it retained its original export value share of 29.33per cent. Similarly, Saudi Arabia retained its original export value share of 23.79 per cent. This implies that Saudi Arabia had also the stable import value of Indian non-basmati paddy.

Canada has shown lower probability of retention, *viz.* 0.0620 while UK, Yaman Arab Republic, USA and Belgium have shown 'zero' probability of retention, indicating that they were unstable importer of Indian non-basmati paddy.

The major gainer among the importers of Indian non- basmati paddy over the study period was Saudi Arabia which had a transfer probability of 1.0000 from Belgium, 0.4150from UAE and 0.0863 from Yaman Arab Republic.

Table 4.29 Export of Non-Basmati paddy from India to major importing countries during 2008-09 to2017-18

Qty : MT

Year	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	USA	Canada	Belgium	Total
2008-09	723.55 (2.92)	186.84 (0.75)	1293.79 (5.22)	21311.83 (85.92)	372 (1.50)	418.97 (1.69)	206.93 (0.83)	291.4 (1.17)	24805.31 (100.00)
2009-10	14877.29 (39.76)	578.26 (1.55)	960.67 (2.57)	11815.43 (31.58)	2191.70 (5.86)	4957.24 (13.25)	1560.45 (4.17)	479.1 (1.28)	37420.14 (100.00)
2010-11	1219.76 (29.38)	161.93 (3.90)	234.22 (5.64)	1624.56 (39.13)	251.42 (6.06)	548.68 (13.22)	110.61 (2.66)	0 (0.00)	4151.18 (100.00)
2011-12	102680.18 (22.61)	18900.68 (4.16)	19480.66 (4.29)	207470.76 (45.69)	72326.74 (15.93)	19966.31 (4.40)	3654.51 (0.80)	9580.59 (2.11)	454060.43 (100.00)
2012-13	143170.69 (24.47)	40147.03 (6.86)	23445.04 (4.01)	262071.85 (44.79)	55458.66 (9.48)	21195.93 (3.62)	1959.69 (0.33)	37647.26 (6.43)	585096.15 (100.00)
2013-14	139415.05 (25.89)	27263.95 (5.06)	23867.59 (4.43)	224916.32 (41.76)	64666.38 (12.01)	25431.19 (4.72)	3085.86 (0.57)	29897.57 (5.55)	538543.91 (100.00)
2014-15	182065.66 (30.78)	33283.69 (5.63)	15536.23 (2.63)	241156.68 (40.77)	78802.32 (13.32)	27706.82 (4.68)	3892.12 (0.66)	9059.92 (1.53)	591503.44 (100.00)
2015-16	151866.33 (26.38)	32492.02 (5.64)	16113.20 (2.80)	234271.09 (40.69)	84680.00 (14.71)	41476.65 (7.20)	4596.13 (0.80)	10275.32 (1.78)	575770.74 (100.00)
2016-17	125663.49 (24.37)	31773.38 (6.16)	11879.66 (2.30)	260218.76 (50.47)	37587.00 (7.29)	35260.14 (6.84)	4694.47 (0.91)	8472.30 (1.64)	515549.20 (100.00)
2017-18	129329.04 (22.22)	36928.35 (6.34)	9123.32 (1.57)	273769.97 (47.03)	84783.00 (14.57)	40476.33 (6.95)	4497.38 (0.78)	3163.00 (0.54)	582070.39 (100.00)

(Figures within the parentheses indicate per cent share of each importing country)

Source : www.ricestat.com

Table 4.30 Export of non-basmati paddy from India to major importing countries

Value: ₹. lack

Year	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	USA	Canada	Belgium	Total
2008-09	275.09 (2.12)	81.26 (0.63)	461.48 (3.55)	11669.45 (89.80)	74.6 (0.57)	197.13 (0.02)	89.59 (0.69)	145.72 (1.12)	12994.32 (100.00)
2009-10	5110.74 (38.94)	200.59 (1.53)	512.39 (3.90)	4200.82 (32.00)	683.18 (5.20)	1837.23 (0.14)	307.98 (2.35)	273.09 (2.08)	13126.02 (100.00)
2010-11	518.02 (36.27)	22.07 (1.55)	76.55 (5.36)	510.93 (35.78)	41.51 (2.91)	224.26 (0.16)	34.76 (2.43)	0 (0.00)	1428.1 (100.00)
2011-12	27986.28 (23.73)	5981.34 (5.07)	6441.35 (5.46)	49903.41 (42.31)	17563.54 (14.89)	7221.97 (0.06)	1262.89 (1.07)	1575.34 (1.34)	117936.12 (100.00)
2012-13	43494.89 (25.83)	12381.19 (7.35)	5722.56 (3.40)	76014.56 (45.15)	15192.48 (9.02)	8535.48 (0.05)	636.97 (0.38)	6386.69 (3.79)	168364.82 (100.00)
2013-14	52449.15 (28.02)	10769.18 (5.75)	8592.15 (4.59)	70580.70 (37.70)	23782.83 (12.70)	13530.46 (0.07)	1454.45 (0.78)	6037.93 (3.23)	187196.85 (100.00)
2014-15	64939.11 (31.35)	12378.61 (5.98)	6277.50 (3.03)	76702.80 (37.02)	29101.03 (14.05)	14318.93 (0.07)	1836.95 (0.89)	1614.03 (0.78)	207168.96 (100.00)
2015-16	50668.20 (25.50)	11867.38 (5.97)	6933.24 (3.49)	74778.26 (37.64)	28354.29 (14.27)	21771.38 (0.11)	2031.72 (1.02)	2280.43 (1.15)	198684.90 (100.00)
2016-17	42816.92 (23.07)	12802.15 (6.90)	5286.29 (2.85)	89700.30 (48.34)	12742.30 (6.87)	18494.36 (0.10)	2079.23 (1.12)	1658.56 (0.89)	185580.11 (100.00)
2017-18	47270.46 (21.40)	14357.55 (6.50)	4903.07 (2.22)	96152.22 (43.52)	33514.23 (15.17)	21456.43 (0.10)	2087.24 (0.94)	1173.85 (0.53)	220915.05 (100.00)

(Figures within the parentheses indicate per cent share of each importing country)
Source : www.ricestat.com

Table 4.31 Transitional probability matrix for non-basmati paddy export in Quantity from India during 2008-09 to 2017-18

	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	USA	Canada	Belgium
Saudi Arabia	**0.2208**	0.0536	0.0336	0.3665	0.3255	0.0000	0.0000	0.0000
Kuwait	0.0000	**0.0000**	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000
UK	0.0000	0.0020	**0.1926**	0.0000	0.4999	0.0000	0.0000	0.3054
UAE	0.4550	0.0287	0.0046	**0.3371**	0.0248	0.1350	0.0146	0.0000
Yamen AR	0.0000	0.2393	0.0000	0.7607	**0.0000**	0.0000	0.0000	0.0000
USA	0.0000	0.0000	0.0000	1.0000	0.0000	**0.0000**	0.0000	0.0000
Canada	0.0000	0.0000	0.7649	0.0000	0.0000	0.1496	**0.0854**	0.0000
Belgium	0.0164	0.0288	0.3694	0.0000	0.1446	0.0000	0.0000	**0.4409**

Table 4.32 Transitional probability matrix for non-basmati paddy export in value from India during 2008-09 to 2017-18

	Saudi Arabia	Kuwait	UK	UAE	Yamen AR	USA	Canada	Belgium
Saudi Arabia	**0.2379**	0.0000	0.0431	0.2806	0.3551	0.0825	0.0000	0.0007
Kuwait	0.0000	**0.4290**	0.0000	0.3873	0.1837	0.0000	0.0000	0.0000
UK	0.0000	0.1104	**0.0000**	0.8896	0.0000	0.0000	0.0000	0.0000
UAE	0.4150	0.0054	0.0352	**0.2933**	0.0482	0.1540	0.0257	0.0231
Yamen AR	0.0863	0.0999	0.0000	0.8138	**0.0000**	0.0000	0.0000	0.0000
USA	0.0000	0.2120	0.0000	0.7880	0.0000	**0.0000**	0.0000	0.0000
Canada	0.0000	0.0000	0.9380	0.0000	0.0000	0.0000	**0.0620**	0.0000
Belgium	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**

4.5. Determinants of export of paddy from India

The factors influencing the export of Indian paddy were analysed. The data pertaining to different aspects that influence the export of paddy were collected for 48 years from 1970-71 to 2017-18. The multiple regression model was employed for the analysis. The model is fitted and R^2 value was used to fit the model to analyze the parameters under study.

Table 4.33. Determinant of Paddy Export From India

Sr. No.	Variables	Coefficients	S.E.
1	Intercept	-175251.0000	1441427
2	Domestic Production of Paddy (Tonnes)(X_1)	-0.0254**	0.012161
3	Wholesale Price of Paddy (₹/qtl)(X_2)	-1206.5300***	176.66
4	International Price of Paddy (₹/qtl)(X_3)	4818.9000***	719.78
5	World Production Paddy (Tonnes) (X_4)	0.0029	0.0075
6	Exchange Rate(X_5)	-41660.5600*	22791.33
7	NPC(X_6)	-2906.1700	285467
8	EPR(X_7)	59635.2000*	29864.24
9	R^2	0.95	-

Note: ***, ** and * indicates 1, 5 and 10 per cent level of significance

It is revealed from the Table 4.33 that, the factors determining paddy export from India were studied by using multiple regression model where quantity exported (Y) was regressed against domestic production (X_1), wholesale price (X_2), international price (X_3), world production (X_4), exchange rate (X_5), Nominal Protection Coefficient (NPC) (X_6) and Export Performance Ratio (EPR) (X_7). The data used for regression analysis were for 48 years. (1970-71 to 2017-18).

Table 4.33 shows that the Domestic Production (X_1), Wholesale price (X_2), Exchange rate (X_5) and NPC (X_6) were negatively significant. Whereas, the international price (X_3), world Production of paddy (X_4) and EPR (X_7) were positively significant. The regression coefficient of domestic production of paddy (X_1) is 0.03 wereas negatively significant at 5 per cent level of significant. It indicates that if the domestic production of paddy increased by one tonne then export of paddy was declined by 0.03 tonne. If wholesale price (X_2) increased at 1₹/qtl then export of paddy decline at 1206.53 tonnes with 1 per cent level of significant. Demand for paddy export from India was found to be increased with increase in international prices of paddy (X_3), with 1₹/qtl increase in international prices of paddy the export of paddy would be increased by 4818.90 tonne. World production of paddy (X_4) was positive but non-significant which indicates that the increase in the world production of the paddy export would be 0.003 tonne. If exchange rate (X_5) increased at 1₹/qtl then export of paddy decline at 41660.56 with 10 per cent level of significant. Nominal Protection Coefficient (X_6) was negative but non-significant. This indicates that if the domestic price of paddy was less than international price, then it increased export of paddy from India. Export Performance Ratio (X_7) was positively significant with 10 per cent level of significance This indicates that, the share of paddy in India's total export was more than share of paddy in the World total export. Similar observations were reported by Adhikar (2016) and Yamini (2019).

5. SUMMARY AND CONCLUSIONS

International trade plays an important role in economic development and growth of a country. Exports are vital to Indian economy as it is the major source of foreign exchange earnings and provides employment to millions of people in the country. Paddy is one of the major cereal crop in the World and most important food crop of India. It plays an important role in providing food security to the country. Paddy is grown and consumed extensively in India. The present study was undertaken in order to know the Indian scenario of paddy trade along with its area, production and productivity, pattern of export performance of paddy in India and policies to enhance the export of paddy from India in order to gain valuable foreign exchange with the following objectives.

5.1 Objectives

1. To estimate the growth rates of area, production and productivity of paddy in India.
2. To estimate the trends in domestic and international prices of paddy.
3. To examine the competitiveness of Indian paddy.
4. To analyze the direction of trade of paddy export from India.
5. To study the determinants of export of paddy in India.
6. To suggest the policy measures for export of paddy

5.2 Methodology

The study was conducted at all India level using secondary data collected from different sources for the period of 48 years beginning with 1970-71 to 2017-18. The data were divided into three sub periods *i.e.* pre-WTO period (1970-71 to 1994-95), post-WTO period (1995-96 to 2017-18) and overall period (1970-71 to 2017-18). For the meaningful interpretation of data, appropriate percentages and averages were worked out. The annual compound growth rates and variability of area, production and productivity and export of paddy in India were estimated during different time period. The trends in domestic and international prices of paddy were analysed by polynomial (cubic) function. Nominal protection coefficient and Export Performance Ratio were employed to measure export of competitiveness of Indian paddy during the study period 1970-71 to 2017-18. The direction trade of exports of Indian paddy were analysed using the first order Markov chain analysis and the factors determining paddy export from India were studied by using multiple regression model.

5.3 Summary

The results of study are summarized as follows,

The growth rates of area, production and productivity of paddy at National level were increased at the rate of 0.33, 2.22 and 1.88 per cent per annum, respectively, with positive and highly significant at one per cent level it means that production increased due to area expansion and productivity improvement for the overall period. The same trend was observed in Pre-WTO period at National level where the growth rate of area, production and productivity was positive and highly significant which increased at the rate of 0.54, 3.05 and 2.50 per cent per annum, respectively. However, in Post-WTO period the production and productivity of paddy was highly significant and increased at the rate of 1.53 and 1.55 per cent per annum, respectively. Whereas, the area under paddy was declined by 0.02 per cent per annum. It indicates that, the production of paddy in Post-WTO period was mainly increased by productivity improvement.

In major states of India, the growth rates of area, production and productivity were positive and significant in Uttar Pradesh, West Bengal, Karnataka, Maharashtra, Punjab and Assam at overall period indicating that, the production of paddy was influenced by both area expansion and productivity improvement in these states. The growth rate in area were negatively significant while, the production and productivity was positively significant in Andhra Pradesh and Tamil Nadu for overall period, indicating that the production of paddy was increased only due to productivity improvement in these two states. However, in Madhya Pradesh and Kerala, the growth rates of area and production of paddy was negatively significant and the growth rate of productivity was positively significant at overall period. The rate of growth decline in area was higher than the positive growth rate of productivity of paddy in Madhya Pradesh and Kerala, that's why the production of paddy was declined in these states, even though, there was a improvement in productivity.

In Post-WTO period the production of paddy was increased only due to productivity improvement in West Bengal, Uttar Pradesh, Maharashtra and Assam. Whereas, the production of paddy increased by both area expansion and productivity improvement in Punjab states. However, the production of paddy was declined only due to decreased in area in Andhra Pradesh, Karnataka, Madhya Pradesh, Tamil Nadu and Kerala. It is due to the diversification in cropping pattern and different competing crops for paddy in above mentioned states.

In Pre-WTO period, the production of paddy was significantly increased at the rate of 5.28, 3.31, 3.18, 2.22, 10.34 and 2.75 per cent per annum due to both productivity improvement and area expansion in Uttar Pradesh, West Bengal, Andhra Pradesh, Maharashtra, Punjab and Madhya Pradesh, respectively. Whereas, production of paddy was significantly increased due to only yield improvement in Tamil Nadu and Assam.

As regards the World wide paddy production it increased to729.10 m.tons in 2017-18 from 316.40 m.tons in 1970-71. The per cent change recorded over the base period was 130.47 per cent. The paddy production at national and state level were increased to 111.01m.tons in 2017-18 from 42.22 m.tons in 1970-71 and 2.66 m.tons in 2017-18 from 1.66 m.tons in 1970-71 then per cent change recorded over base period were 130.12 and 60.24 per cent respectively.

The area under paddy was most consistent and stable with 5.47 per cent C.V. followed by productivity (25.61 % C.V.) and production (29.61 % C.V.) in India at overall period. In post-WTO period the area, production and productivity of paddy with 2.52, 11.68 and 11.2 per cent C.V. was more stable and consistent than in pre-WTO period with 4.62, 23.72 and 19.51 per cent C.V. of area, production and productivity of paddy in India.

During the pre-WTO period the area under paddy was observed more stable in states *viz.*, Uttar Pradesh, West Bengal, Andhra Pradesh, Madhya Pradesh, Assam, Kerala and Maharashtra whereas area under paddy in Karnataka, Tamil Nadu and Punjab was fluctuated. In post-WTO period the area under paddy was observed more consistent in states *viz.*, West Bengal, Karnataka, Tamil Nadu, Assam, Maharashtra and Punjab but in case of Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Kerala, there were inconsistency in area of paddy, At overall period the area under paddy was observed more consistency in states *viz.*, Uttar Pradesh, West Bengal, Andhra Pradesh, Karnataka, Assam, and Maharashtra whereas Madhya Pradesh, Tamil Nadu, Kerala and Punjab have shown fluctuated area under paddy cultivation respectively.

In first stage, the trends in domestic prices were declined @ 6.60 ₹/qtl but in international prices it increased @ 31.40₹/qtl. In second stage, trends in domestic prices increased @ 0.42₹/qtl but in international prices it declined @ 0.82₹/qtl. and in terminal stage domestic prices of paddy significantly increased @ 0.02₹/qtl and international prices also increased @ 0.04₹/qtl. The trend equation was significant in domestic and international prices, as revealed by F value (483.58) and (34.66) respectively, and fluctuation in domestic prices and international prices of paddy due to time factor to extent of 97 per cent and 70 per cent respectively, as indicated by R^2.

The growth rates of domestic and international prices of paddy were estimated significant growth at 5.92 and 8.71 per cent per annum during pre-WTO period respectively. However during post-WTO period, the growth rate domestic and international prices were estimated at 6.71 and 6.84 per cent per annum respectively. As such growth rate for domestic price *i.e.* 8.21 is higher than international price *i.e.* 7.02 during overall period.

The instability index of domestic (45.95) and international (61.77) prices of paddy was higher in pre-WTO period and in both post-WTO (33.77 and 42.03 %) and overall (37.99 and 53.23 %) period respectively. It means that, domestic prices of paddy were more consistent than international prices of paddy in both pre-WTO and post- WTO period.

India’s export share in World total export was increased from 1.03 in 1960-61 to 1.30 per cent in 2017-18. India’s Agricultural export share in World Agricultural export was 1.66 in 1960-61 which has increased to 3.74 per cent in 2017-18. India’s paddy export share in the World agricultural export was very negligible. It ranged from 0.02 to 0.47 per cent during the study period.

India’s Agricultural export share in India’s total export was decreasing continuously. In 1960-61 it was 43.69 per cent and it has drastically decreased to 18.82 per cent in 2017-18.

India’s paddy export shares in the India’s agricultural export trade 1.43 per cent in 1960-61 and increased up to12.60 per cent in 2017-18. The same case was registered with India's paddy export share in India's paddy production**.** The share of paddy export in total paddy production during 1960-61 was 0.62 per cent while it increased to 11.93 per cent in 2017-18. Whereas, the India's paddy export share in paddy production has continuously increased during post-WTO period *i.e.* after 1990-91.

Direction of trade for World total export and World total import has a continuously negative balance of trade up to 2010-11 then it was changed as positive trade balance in the year 2017-18 but direction trade of India's total export and India's total import the negative balance of trade in India did not change over the last 57 years, in spite of all government policies regarding export promotions.

Direction trade of India's agricultural export denotes negative trade balance. It means that India was deficit during 1960-61. India's agriculture export trade balance were positive from 1970-71 to 2017-18. It means that India with a surplus from 1970-71 to 2017-18, in agricultural export.

Direction trade of World paddy export-import indicates continuously negative trade balance up to year 2017-18. It indicates that there was a continuous demand for paddy in the World but in case of India's paddy export-import direction trade show negative balance of trade was in the year 1960-61 and 1970-71. Then it was positive trade balance for remaining period. It means that India was deficit in paddy export during the period 1960-61 to 1970-71 but from the period 1980-81 to 2017-18 India with a surplus in trade balance of paddy export-import.

On an average during entire study period the Nominal Protection Coefficient (NPC) was 0.62 means less than unity for paddy export which indicates that the domestic prices received by the farmers in the country were lower than the international prices. On an average the Export Performance Ratio (EPR) was 11.74 means greater than unity for paddy export which indicates that the product has comparative advantage in export. On an average the Nominal Protection Coefficient (NPC) were 0.46, 0.16, 0.65, 0.55 and 0.51 for major importing countries such as Saudi Arabia, UAE, Kuwait, Yemen AR and USA respectively, means less than unity for paddy export which indicates that the domestic prices received by the farmers in the country were lower than the international prices.

The trade direction has been explored by Markov chain analysis using export quantity and value data for paddy export from 2007-08 to 2016-17. It is observed that UAE was the most stable market among the major importers of Indian paddy in terms of quantity as reflected by the high probability of retention at 67.93 per cent. Similarly, Saudi Arabia, Yamen Arab Republic, Kuwait, and Uk have retained their original export quantity share of 57.34, 39.39, 13.55 and 8.65 per cent respectively, on the contrary, USA, Canada and Belgium they were unstable importer of Indian paddy.

In terms of value of paddy export U.S.A. was the most stable market among the major importers of Indian paddy, it retained its original export value share of 76.34 per cent. Similarly, UAE and Saudi Arabia, have retained its original export value share of 56.47 and 43.88 per cent respectively, means stable importer Indian paddy in value term.

The trade direction has been explored by Markov chain analysis using export quantity and value data for basmati paddy and non-basmati paddy export from 2008-09 to 2017-18. It was observed that UAE was the most stable market among the major importers of Indian basmati paddy, it retained its original export quantity share of 79.37 per cent. Similarly, Saudi Arabia, Kuwait and Yamen Arab Republic have retained its original export quantity share of 74.01, 53.66 and 51.50 per cent respectively, means stable import quantity of Indian basmati paddy. UK has shown lower probability of retention *viz.*, 12.05, on the contrary, USA, Canada and Belgium were unstable importers of Indian basmati paddy.

In terms of value of basmati paddy export, it is observed that the UAE was the most stable market among the major importers of Indian basmati paddy, it retained its original export value share of 79.62 per cent. Similarly, Saudi Arabia, USA have retained its original export value share of 72.98 and 55.30 per cent respectively, means they have stable import value of Indian basmati paddy. Kuwait, UK, Yamen Republic and Canada have shown lower probability of retention, *viz.* 0.4753, 0.0.0370, 0.3497 and 0.2945, respectively, on the contrary, Belgium was an unstable importer of Indian basmati paddy.

Belgium was the most stable market among the major importers of Indian non-basmati paddy, it retained its original export quantity share of 44.09 per cent. UAE, Saudi Arabia and UK have probability of retention 33.71, 22.08 and 19.26 per cent respectively, means they have stable import quantity of Indian non-basmati paddy. Canada has shown lower probability of retention *viz.*, 0.0854, on the contrary, Kuwait, USA and Yaman Arab Republic they were unstable importer of Indian non-basmati paddy.

In terms of value of non-basmati paddy export, Kuwait was the most stable market among the major importers of Indian non-basmati paddy, it retained its original export value share of 42.90 per cent. UAE and Saudi Arabia were retained its original export value share of 29.33 and 23.79 per cent respectively, means UAE and Saudi Arabia was also the stable import value of Indian non-basmati paddy. Canada had shown lower probability of retention, *viz.* 0.0620 on the contrary, UK, Yaman Arab Republic, USA and Belgium they were unstable importer of Indian non-basmati paddy.

The factors determining paddy export from India were studied by using multiple regression model during (1970-71 to 2017-18), where quantity export regressed against domestic production of paddy (X_1) is 0.03 with negatively significant at 5 per cent level of significant. It indicates that if the domestic production of paddy increased by one tonne then export was decline at 0.03 tonne, wholesale price (X_2) increased at 1 ₹/qtl then export of paddy decline at 1206.53 tonnes with 1 per cent level of significant, international prices of paddy (X_3), with 1 ₹/qtl increase in international prices of paddy the export of paddy would be increased by 4818.90 tonne, World production of paddy (X_4) was positive but non-significant it indicates that the increase in the World production of paddy the paddy export will increased at 0.003 tonne, exchange rate (X_5) increased at 1 ₹/qtl then export of paddy decline at 41660.56 with 10 per cent level of significant, Nominal Protection Coefficient (X_6) was negative but non-significant. This indicates that if the domestic price of paddy was less than international price, then it increased export of paddy from India and Export Performance Ratio (X_7) was positively significant with 10 per cent level of significant. This indicates that, the share of paddy in India's total export was more than share of paddy in the World total export.

India had a great advantage to specialize in production of paddy and to export the surplus production to earn valuable foreign exchange. India needs to capitalize this advantageous position by ensuring its position in the international market as a stable and dependable source of paddy quality. There was also need to increase the export of paddy in our country, by reducing cost of production considerably through enhancing productivity per unit of resources used, which would enhance the comparative advantage in paddy export from India.

5.4 Conclusions

The following conclusions emerged from the present study-

1. India stands 1st in area, but 2nd in production and 5th in Productivity of paddy in the World.
2. In India the area of paddy declined during the study period except in 1990-91 whereas, production and productivity continuously increased.
3. In Maharastra the area, production and productivity of paddy were fluctuating during the entire study period.
4. The growth rates of area, production and productivity of paddy at National level were observed to be positive and highly significant at one per cent level for the overall period. It indicates that the production of paddy at national level was increased by both area expansion and productivity improvement.
5. Across the entire study period, in major states of India, the growth rates of area, production and productivity were positive and significant in Uttar Pradesh, West Bengal, Karnataka, Maharashtra, Punjab and Assam. It indicated that, the production of paddy was influenced by both area expansion and productivity improvement in these states.
6. The area of paddy was most consistent and stable with 5.47 per cent C.V. in India, followed by productivity (25.61 % C.V.) and production (29.61 % C.V.) whereas, the production of paddy was not consistent in all selected states as shown by coefficient of variation and yield of paddy was not stable in all selected states except two states, *viz.*, Maharashtra and Punjab, with 18.73 and 18.49 per cent respectively, measured by coefficient of variation.
7. The trends in domestic prices of paddy were fluctuated due to time factor. The polynomial curve of domestic prices of paddy behaved almost constant in the initial study years. But, after 1990-91 it started increasing at increasing rate till the end of the year 2017-18.

8. The trends in international prices of paddy indicated wide fluctuatings due to time factor. The analysis of trend in international prices of paddy movement indicated more fluctuations during the entire period (1970-71 to 2017-18).
9. The growth rate estimated for domestic prices (*i.e.* 8.21 per cent per annum) was higher than international prices (*i.e.* 7.02 per cent per annum) at overall period.
10. The growth of domestic and international prices of paddy in post-WTO period did not fluctuate more due to less restrictions and growing demand of Indian paddy. In general, domestic prices of paddy were more consistent than international prices of paddy in both pre and post- WTO period.
11. India's total export share in World's total export has increased from 1960-61 to 2017-18. But, still the share could not be retained to a considerable level.
12. India's agricultural export share in World agricultural export did not show a promising picture which is less than 3 per cent.
13. India's paddy export share in World agricultural export has marginally increased. It lies between 0.02 to 0.47 per cent.
14. India's agricultural export share in India's total export has declined.
15. India's paddy export share in India's agricultural export trade (1.43 per cent in the year 1960-61) increased to 12.60 per cent in the year 2017-18.
16. India's paddy export share in total paddy production during 1960-61 was 0.62 per cent while it increased to 11.93 per cent in the year 2017-18.
17. The balance of trade of World total export –import shows negative trade balance during study period except in the year 2017-18, where in it shows positive balance trade.
18. The balance trade of India's total export-import shows negative balance trade during overall study period.
19. Direction of trade in India's agricultural export-import shows positive balance trade during study period except in the year 1960-61, where in shown negative balance trade.
20. Trade balance of World paddy export-import was negative during overall study period.

21. Trade balance of India's paddy export-import was negative balance trade during the initial period, *i.e.* 1960-61 to 1970-71, while it was positive from the year 1990-91 to 2017-18.
22. The NPC is less than one in almost all the years. This indicates that paddy enjoys competitive advantage in the international market.
23. The EPR is greater than one in almost all the years. This indicates that paddy enjoys comparative advantage in the international market.
24. The UAE was the most stable market among the major importers of Indian paddy as it retained its original export quantity share of 67.93 per cent during the period 2007-08 to 2016-17. Similarly, Saudi Arabia and Yamen Arab Republic have retained their original export quantity share of 57.34 and 39.39 per cent, respectively. This implies that Saudi Arabia and Yamen AR were also the stable importers of Indian paddy.
25. The USA was the most stable market among the major importers of Indian paddy, it retained its original export value share of 76.34 per cent during the period 2007-08 to 2016-17. Similarly, UAE and Saudi Arabia have retained their original export value shares of 56 .47 and 43.88 per cent, respectively.
26. The UAE was the most stable market among the major importers of Indian basmati paddy, it retained its original export quantity share of 79.37 per cent during the period 2008-09 to 2017-18. Similarly, Saudi Arabia, Kuwait and Yamen Arab Republic retained their original export quantity share of 74.01, 53.66 and 51.50 per cent, respectively.
27. The UAE was the most stable market among the major importers of Indian basmati paddy, as it retained its original export value share of 79.62 per cent during the period 2008-09 to 2017-18. Similarly, Saudi Arabia and USA have retained their original export value shares of 72.98 and 55.30 per cent, respectively.
28. The Belgium was the most stable market among the major importers of Indian non-basmati paddy, as it retained its original export quantity share of 44.09 per cent during the period 2008-09 to 2017-18. Similarly, UAE, Saudi Arabia and UK have retained their original export quantity shares of 33.71, 22.08 and 19.26 per

cent, respectively. This implies that Saudi Arabia and UK were also the stable importers of Indian non-basmati paddy.

29. The Kuwait was the most stable market among the major importers of Indian non-basmati paddy, it retained its original export value share of 42.90 per cent during the period 2008-09 to 2017-18. Similarly, UAE and Saudi Arabia have retained their original export value shares of 29.33 and 23.79 per cent, respectively. This implies that Saudi Arabia was also the stable import value of Indian non-basmati paddy.

30. Seven independent variables *viz.*, Domestic production of paddy (X_1), Wholesale Price of Paddy (X_2), International Price of Paddy (X_3), World Production of Paddy (X_4), Exchange rate (X_5), NPC ratio (X_6) and EPR (X_7) jointly explained the 95 per cent of total variation in export of paddy from India. The coefficient of international prices of paddy and the World production of paddy were statistically significant and have positive impact on export of paddy.

5.3 Policy implications

1. Export is a result of production over domestic consumption and stock. Higher the production, higher would be the surplus and ultimately export. Therefore, the policy focus to increase production through breeding program, infrastructure investment, cost of reduction technology, identifying contiguous zone for cultivation of export quality rice should be adopted. The production of scented fine quality rice varieties, like basmati, should be encouraged in the country, because these varieties of rice have more demand in international markets.

2. There is a need of separate long term export policies for basmati and non-basmati rice. The export of basmati rice is due to higher demand in international market, where as export of non-basmati rice is due to higher domestic production.

3. The analysis of instability in export earnings revealed that changes in price variance is contributing to the tune of 20 per cent to the variability in export earnings whereas the effect of changes in quantity variance is nil. Therefore measures should be taken to minimize the price variance by entering in to bilateral/multilateral trade agreements with the importing countries so as to minimize the instability in the export earnings.

4. The productivity stagnated at 2584.63 kg per hectare as compared to world average yield of 4535.33 kg per hectare. The stagnation was not because of any lack of technological inputs, but because of slow technological transformation and progress. Dissemination of information on latest technology holds key to increasing productivity and production. Rigorous extension mechanism should deliver this input. Efforts should be stepped up to seek the aid of frontier sciences like biotechnology and genetic engineering to increase productivity.
5. The paddy prices in the domestic and international market are integrated. This implies that domestic market is responsive to changes in the international market prices and producers would benefit from increases in the international market prices. However, this benefit has not been fully exploited by the farmers because the Indian paddy exports are regulated by the government by export quota system. This requires the initiation of new paddy policy to remove the present export quota system, therefore, that farmer can be benefited from price increase in the international market. This will encourage paddy production especially quality paddy, which will also meet the requirement of rice mills.

6. LITERATURE CITED

Abolagba, E.O., Onyekwere, N.C., Abonkpolor, B.N. and H.Y. Umar. 2010. Determinants of agricultural exports. *J. Humane Ecology*, 29 : 181-84.

Acharya, S.P., Basavaraja, H., Kunnal, L.B., Mahajanasetti, S.B. and A.R.S. Bhat. 2012. Growth in area, production and productivity of major crops in Karnataka. *Karnataka J. Agric. Sci.,* 25 (4): 431-436.

Ananthi, S. 2000. An econometric analysis of Indian rice exports. M.Sc.(Agri) Thesis, (Unpublished), University of .Agricultural Science, Dharwad, Karnataka.

Ankur Jain. 2018. Analysis of growth and instability in area, production, yield and price of rice in India. Social Change and Development, 15(2): 47-66

Anup Adhikari, Sekhon, M.K. and Manjeet Kaur. 2016. Export of rice from India: Performance and determinants. *Agricultural Economics Research Review,* 29(1):135-150.

Anup Adhikari. 2014. Export of rice from India: performance and determinants. M.Sc. (Agri) Thesis (Unpublished), Punjab Agricultural University, Punjab. Bangalore, Karnataka, India.

Barah, B.C. 2005. Dynamic of rice economy in India, emerging scenario and policy options. Occasional paper-47. Published by the National Bank for Agriculture and Rural development, Department of Economic Analysis and Research, pp.1-82.

Bilal, M. and S.B.H. Rizvi. 2013. Determinants of rice exports: An empirical analysis of Pakistan. *J. Global Scientific Issues* (1**) :** 5-16

Clarkson Kishore, Kulkarni, G., and Korbel, T. 2007. Policy on rice production and exports. *Indian Journal of Agricultural Economics,* 16(3) : 133-140.

Golappanavar, S. and B.L. Patil 2017. Changing direction in area of major fruit crops in Dharwad district of Northern Karnataka. *International Journal of Agriculture Sciences*, 10(9) 4008-4011.

Guledgudda, S.S., Patil, B.L. and B.C. Rajur. 2014. Export performance of Indian cashewnut – An analysis. Economic Affairs, 59(4): 669-674.

Guledgudda, S.S., Patil, B.L., Hosamani, S.B., Hiremath, G.K. and J.N. Olekar. 2002. Production and export performance of tea industry in India. *Journal of Plantation Crops.* 30(3): 27-32.

Haleem, U., Mushtaq, K., Abbas, A., and A.D. Shiekh. 2005. Estimation of export supply function for citrus fruit in Pakistan. *The Pakistan Develop Review*, 44 : 659-72.

Jayesh, T. 2001. Production and export performance of selected spices in South India: An Economic Analysis. M.Sc. thesis, University of Agricultural Sciences, Dharwad, Karnataka, India.

Kanaka, S. and Chinnadurai, M. 2015. A study of export competitiveness of groundnut in India. *Global Journal of Advanced Research*, 2 (2) : 512-520.

Kannan, M., 2013. The determinants of production and export of natural rubber in India. *IOSR Journal of Economics and Finance*, 5(1) : 41-45.

Kasula Sekhara. 2019. Trends in area, production and productivity of paddy crop: An overview. *Ijhssi*, 8(1) : 50-58.

Kerutagi, M.G., Ramchandra, V.A., Kunnal, L.B., Mahajanshetti, S.B. and A.M. Shirol. 2009. Marketing of sapota in Northern Karnataka. Indian *Journal of Agricultural Marketing*, 23(2) : 57-63

Kumar Rai, A.B. and Mathura Rai. 2008. Export of cucumber and gherkin from India : Performance, destinations, competitiveness and determinants. *Agricultural Economics Research Review,* 21 :130-138.

Kumar, A., Ali, J. and Singh, H. 2001. Trade in livestock products in India: Trends, performance and competitiveness. *Indian Journal of Agricultural Economics*., 56 (4): 653-67.

Kumar, N.R., Rai, A.B. and M. Rai. 2008. Export of cucumber and gherkin from India: Performance, destinations, competitiveness and determinants. *Agric. Econ. Res. Rev.,* 21:130-38.

Kusuma, D.K. and Basavaraja, H. 2014. Stability analysis of mango export markets of India : Markov Chain Approach. *Karnataka J. Agric. Sci*., 27(1) : 36-39.

Lekshmi, S., Mohanakumar, S. and George, K.T. 1996. The trend pattern of natural rubber price in India: An exploratory analysis. *Indian Journal of Natural Rubber Research.* 9(2): 82-92.

Mahadevaiah, G.S. 2001. Export trade performance of Indian cotton-An econometric analysis. Ph.D. Thesis (Unpublished) University of Agricultural Science, Bangalore, Karnataka, India.

Mahadevaiah, G.S., Ravi, P.C. and Chengappa, P.G. 2005. Stability analysis of raw cotton export markets of India- Markov Chain Approach. Agricultural Research Review, 18 : 235-259.

Makama, S.A., Amrutha, T.J., Patil, S.S. and V.B. Wali. 2016. Export competitiveness of Indian rice: A policy analysis matrix approach. *International Journal of Innovative Research and Development,* 5(1): 339-344.

Manitra, A. and T. Rakotoarisoa. 2006. Policy distortions in the segmented rice market. *International Food Policy Research Institute,* 94: 17-19.

Mohalkar, S.S. 2005. Export performance and competitiveness of rice in India. M.Sc. (Agri.) thesis PDKV, Akola, Maharashtra.

Myneni Yamini. 2019. Export performance and competitiveness of cotton of India. M.Sc. thesis (Unpublished) MPKV, Rahuri, Maharashtra.

Naik Vinod R. and S.B. Hosamani. 2013. Growth and export dimensions of Indian turmeric, International Research Journal of Agricultural Economics and Statistics, 4(1):91-97.

Nancy Clarkson, Kishore, G. and T. Kulkarni 2013. Effects of India's trade policy on rice production and exports. *Indian Journal of Agricultural, Economics*, 33(2) : 155-163.

Neha, G. 2013. Government intervention in grain markets in India: Rethinking the procurement policy. Centre of Development Department Economics, Delhi.

Nethrayini, K.R., Vinod, R., Naik, H.B., Mallikarjun, V.K. and S. Siddayya. 2012. Export performance of rice in India. *Research Journal of Agricultural Sciences,.* 3(2) : 513-516.

Pal, R.K., Babu, K.D., Singh, N.V., Maity, A. and N. Gaikwad. 2015. Pomegranate research in India-Status and future challenges. Progressive Horticulture, 46(2):33-41.

Patil, N.A. and R.A. Yeledhalli. 2016. Growth and instability in area, production and productivity of different crops in Bengaluru division. IJAEB, 9(4):599-611.

Pavithra, H.K., Gajanana, T.M. and M. Satishkumar. 2016. Production, changing pattern and trade directions of Indian exports in floriculture products. *Eco. Env.*, **22** : S47- S53.

Prabakaran, K. and C. Sivapragasam. 2013. Analysis of growth rates of rice and sorghum in Andhra Pradesh. *International Journal of Farm Sciences.* 3(1):1-9.

Rajesh, S.R., Raveendran, N. and N. Ajjan. 2002. An analysis: Trends in area, production, productivity and export of major spices in India. *Journal Spice India,* 15(2): 19-20.

Reddy Sreenivasa, B., Venkata Naidu, G. and M. Narayana Reddy. 2015. Trends in food crops and non-food crops in India. *International Journal of Current Innovation Research.* 1(9) : 207-212.

Sadavati, T. 2006. Exports of basmati rice and its stability - Markov chain analysis. *India J. Agric. Mktg,* 20(1): 11-15.

Samal, P., Rout, C., Repalli, S.K. and Jambhulkar, N.N. 2018. State-wise analysis of growth in production and profitability of rice in India. *Indian Journal of Economics and Development*, 14(3): 399-409.

Satishkumar, M., Harishkumar, H.V., Ramesh, V. and R. Rangegowda. 2016. Growth, export performance and competitiveness of basmati and non-basmati rice of India- an Markov Chain Approach. *IJAEB*, 9(2): 305-311.

Savitha, M.G. and Kunnal, L.B. 2016. Pace and pattern of market arrivals and prices of paddy in Sindhanur and Sirguppa markets of Karnataka. *IRJAES*, 7(2): 143-148.

Sengupta, U. and S.S. Roy. 2011. Behaviour of India's horticultural exports: Does price competitiveness play a determining role. *Ind. J. Agri. Econ.,* 66 : 230-40.

Shende, N.V., Bhole, B.D. and P.V. Shende. 1999. Export performance of India in tea, coffee and tobacco. *Ind. J. Agril. Mktg.* 13:78-81.

Shivaraya, B. and L.B. Hugar. 2005. Export growth and competitiveness of vegetables in the context of WTO-A case study of tomato. *Karnataka J. Agri. Sci.,* 18(2):407-410.

Surabhi Mittala, Hariharan, V.K. and S.P. Subash. 2018. Price volatility trends and price transmission for major staples in India. Agricultural Economics Research Review, 31(1): 65-74.

Thumar, V.M., Khunt, K.A., Thanki, P.M. and K. Kumar. 2012. Growth and export performance of major seed spices of India. *Ind. J. Agri. Mktg.* 26:21-35.

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I hereby declare that this thesis or part
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This is to certify that the thesis entitled, "**ECONOMICS OF PRODUCTION AND MARKETING OF BANANA IN SOLAPUR DISTRICT OF MAHARASHTRA",** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar (M.S.) in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS,** embodies the results of a piece of bonafide research work carried out by **MISS. REDE BHARATI HARISHCHANDRA,** under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

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CERTIFICATE

This is to certify that the thesis entitled, "**ECONOMICS OF PRODUCTION AND MARKETING OF BANANA IN SOLAPUR DISTRICT OF MAHARASHTRA",** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar (M.S.) in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS,** embodies the results of a piece of bonafide research work carried out by **MISS. REDE BHARATI HARISHCHANDRA,** under the guidance and supervision of **Prof. A. N. RATNAPARKHE,** Assistant Professor, Department of Agricultural Economics, RCSM College of Agriculture, Kolhapur and that no part of the thesis has been submitted for any other degree or diploma.

Place: Kolhapur (J. P. Yadav)

Date: / /2020

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Date: / /2020

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Before giving way to my feelings, I cordially salute that supreme cosmic consciousness from which everything originates in the beginning and to which everything goes at the end. Though formal and dead words cannot carry the fragrance of emotions with them still they are the only available ways to express emotions in such formal acknowledgement.

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Place: Kolhapur

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ABBREVIATIONS

@	-	at the rate
Agri.	-	Agriculture
Asso.	-	Association
Co-op.	-	Co-operative
e.g.	-	Exampli gratia (For example)
econ.	-	Economics
et. al.	-	*ET ALIA* (and others)
etc.	-	Etcetera
Fig.	-	Figure
FC	-	Factor Cost
FYM	-	Farm Yard Manure
Gm	-	Gram
GM	-	Geometric Mean
ha.	-	Hectare
/	-	Per
i.e.	-	That is
Ind.	-	Indian
J.	-	Journal
Cal	-	Calorie
Kg.	-	Kilogram
Mg	-	Milligram
Mcg	-	Microgram
resp.	-	Respectively
MP	-	Marginal Product
T	-	Tonne
MVP	-	Marginal Value Product
NI	-	Net Income
q.	-	Quintals
Qtls. /ha.	-	Quintals /hectare
Qty.	-	Quantity
Res.	-	Research
Rs.	-	Rupees
%	-	Per cent
Univ.	-	University
Viz.,	-	Videlicet (namely)
Vol.	-	Volume

ABSTRACT

ECONOMICS OF PRODUCTION AND MARKETING OF BANANA IN SOLAPUR DISTRICT OF MAHARASHTRA

by

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of
MASTER OF SCIENCE (AGRICULTURE)

In
AGRICULTURAL ECONOMICS
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2020

Research Guide	:	Prof. A. N. Ratnaparkhe
Department	:	Agricultural Economics

The present study entitled, 'Economics of production and marketing of Banana in Solapur district of Maharashtra' is based on a sample of 90 Banana growers drawn from Malshiras and Madha tahsils of Solapur district. The present study was undertaken with per hectare costs and returns of banana, resource use efficiency, marketing cost, marketing margin, price spread and constraints in banana cultivation and marketing. The factors affecting yield of banana were estimated by using the Cobb-Douglas type production function. The data pertained to the agricultural year 2018-19.

Banana occupied 22.73 per cent of the gross cropped area. The cropping intensity was 126.27 per cent at overall level. Regarding the production, it was found that, at overall level, average per hectare production was 563.11 quintals. Regarding disposal of produce, it was observed that 98.98 per cent of the quantity was sold and same trend found among all size groups. The estimated per hectare cost, at overall level was Rs.324671.04. The per hectare inputs utilized for banana at overall level were 118.58 human days, 22.67 tonnes manures, 399.60 kg N, 126.11 kg P, 720.29 kg K. Average per hectare gross income was Rs.627708.57. The gross income received in size group small, medium and large was Rs. 609142.70, Rs. 614926.70 and Rs.659056.30, respectively. The benefit-cost ratio was 1.93 at the overall level and it was found higher in large size group (2.06).

The results of Cobb-Douglas type production function analysis revealed that the factors *viz*., seed, manures, K and irrigation were found positive and significant thereby influencing the yield of banana. The magnitude of coefficient of multiple determination (R^2) was 0.92. In between size groups, quantity of per hectare produce marketed was maximum (99.09 per cent) in large size group and minimum in (98.88 per cent) small size group i.e. there is no significant difference. At the overall level, 557.35 q. quantity was sold in different markets, of which, 7.23 per cent quantity was sold through Channel I (Producer -Consumer), 73.55 per cent quantity was sold through Channel II (Producer-Pre-harvest contractor-Wholesaler-Retailer-Consumer) and 19.22 per cent quantity sold through Channel III (Producer-Wholesaler-Retailer-Consumer).The cost of marketing of banana in Channel II was higher due to involvement of large number of intermediaries. It was Rs.827.50 followed by Channel III Rs. 611.00 and Channel I Rs.81.41. The producer's share in consumer rupees was the highest in Channel I (95.35 per cent) followed by, Channel III (67.69 per cent) and Channel II (60.17 per cent). The marketing efficiency was found highest in Channel I (21.49) than that of Channel II (2.51) and Channel III (3.09).

The major constraint faced by sample banana growers with response priority index score was losses due to high wind velocity. The other constraints faced by the banana growers in production were high price of seedlings, lack of quality seedlings, lack of credit facility, disease occurrence and problem faced by growers in marketing was price fluctuation, lack of storage facilities and delay in payment.

1. INTRODUCTION

The production of fruits and vegetables is of vital importance as it provides three to four times more cash income than cereals per unit of land. Fruits and vegetables are prime source of vitamins and minerals, which is helpful to maintain proper health to resist the diseases.

The process of commercialization of agriculture in any locality has been, in the first instance, initiated by first introduction of crops of commercial importance and gradual expansion in area under such crop. The commercialization of farm business in a locality, depends upon suitability of soil and climatic condition of the locality for production of certain commercial crops and their relative profitability over other crops. When commercial crop are introduced in the production programme, cultivators come in direct contact with the market and market activities and prices. Such contact of cultivator with market gradually prepares him for introduction of those commercial crops, which will be best suited to his farm resource structure and finally contributing to maximize his farm earnings.

Banana is a developing world's fourth most important fruit crop (after rice, wheat and maize) in terms of gross value of production. It is grown mostly under tropical condition of high humidity in countries viz., India, China, Philippines, Brazil, Indonesia etc. It is used as a raw material in industries for preparation of banana powder being used for direct consumption. Being available in all seasons of the year, this nutritious fruit is a staple food within the reach of buying capacity of all. This fruit finds a place for consumption in poor huts as well as in the royal palaces. It is because of this reasons that the fruit has a universal demand for consumption.

1.1 Origin and Botany:

Banana (*Musa paradisiaca* L.) belong to the family Musaceae. It is one of the oldest fruit known to mankind. Its antiquity can be traced back to the garden of paradise where 'Eve' was said to have used its leaves to cover her modesty, may be one of the reason why banana is called the "Apple of paradise". It is also known as "Adam Fig". Though originated in South East Asia, it is widely grown in India, China, Philippines, Brazil, Indonesia etc. Banana is an elongated, edible fruit – botanically a berry. The fruit is variable in size, colour and firmness, but it is elongated and curved, with soft flesh rich in starch covered with a rind, which may be green, yellow, red, purple, or brown when ripe.

Banana plant is the largest herbaceous flowering plant. All the above-ground part of a banana plant grow from a structure usually called a "corm". Plants are normally tall and fairy sturdy, and are often mistaken for trees, but what appear to be a trunk is actually a "false stem or pseudostem". The leaves of banana are composed of a "stalk" (petiole) and a blade (lamina). When a banana plant mature, the corm stops producing new leaves and begins to form a flower spike or inflorescence. Each pseudostem normally produce a single inflorescence, also known as "banana heart". The banana fruit develop from the banana heart, in large hanging cluster, made up of tiers (called "hands"), with up to 20 fruit to a tier. The hanging cluster known as bunch, comprising 3-20 tiers or commercially as a "banana stem", and can weigh 30-50 kilograms. Individual banana fruits (commonly known as banana or "finger") average 125 grams, of which approximately 75% is water and 25% dry matter.

1.2 Importance of Banana

a) Medicinal Importance of Banana

Banana is one of the best source of potassium which is necessary for maintain normal blood pressure and heart function. Banana powder is used as first baby food. Consumption of banana helps in lowering cholesterol. Also it has antacid effect that protect against stomach ulcer. Banana contains 25% of recommended daily allowance for vitamin B_6, necessary for producing antibodies and red blood cells. As it is high in iron, it stimulates the production of hemoglobin in the blood and so helps in cases of anemia.

b) Nutritional Importance of Banana

Banana has great nutritional importance is due to its low price and high nutritive value. It is consumed both fresh or cooked form both as ripe and raw fruit. Banana is a rich source of carbohydrates and vitamins particularly vitamin B. It also good source of potassium, phosphorous, calcium and magnesium. Banana fruit is easy to digest, free from fat and cholesterol. Banana powder is used as first baby food. It helps in reducing risk of heart diseases when used regularly and recommended for patients suffering from high blood pressure, arthritis, ulcer, gastroenteritis and kidney disorders.

Table 1.1 Nutritional importance of Banana

(In 100g fruit)

Nutrients	Quantity
Carbohydrates (g)	23
Proteins (g)	1.1
Dietary fiber (g)	2.6
Energy (Calories)	89
Magnesium (mg)	27
Potassium (mg)	358
Vitamin-C (mg)	8.7
Vitamin-B (mg)	0.4

(**Source:** U. S. Department of Agriculture, Agricultural Research Service. Food Data Cental, 2019)

c) Economic Importance of Banana

Processed products such as chips, banana puree, jam, jelly, juice, wine and halva can be made from this fruit. The fruits, male florets and pseudo-stem are also used for consumption after cooking. Banana fibers is used to make attractive handicraft items like bags, pots, mats, wall hangers and rope. Good quality paper can also be made from banana waste. Banana leaves are used as healthy and hygienic eating plates.

1.3 Scenario of Banana Cultivation in world

The global production of banana is around 115.74 million tonnes of which India contributes 29.19 %. Besides India other major banana producing countries are China, Philippines, Ecuador, Brazil and Indonesia.(Source: Horticultural Statistics at a Glance 2018).

1.4 Scenario of Banana Cultivation in India and Maharashtra

Total area under banana in India was 8.84 lakh hectare. India was the largest producer with an annual production of banana was 308.08 lakh MT with productivity of 34.86 T/ha, in the year 2017-2018. The major production of banana crop was confined to Andhra Pradesh (50.03 lakh MT), Gujarat (44.72 lakh MT), Maharashtra (42.09 lakh MT) which account about 44.50 per cent of total production in India. Total estimated export of banana 1.01 lakh MT in quantity with value of Rs.34877.39 lakh in 2017-18 year.

In Maharashtra during 2017-2018, total production of Banana was 42.09 lakh MT having 0.80 lakh hectares area with the productivity of 52.05 T/ha. Basrai, Robusta, Shreemanti, Grand naine, Dwarf Cavendish are the varieties cultivated in Maharashtra. (Source: Horticultural Statistics at a Glance 2018).

1.5 Objectives

1. To study the resource use, costs and returns of banana production.
2. To estimate resource use efficiency of inputs.
3. To estimate the marketing costs, price spread and marketing efficiency of banana production.
4. To study the problems in production and marketing of banana.

1.6 Hypotheses

1. Banana is a profitable crop.
2. There is scope for increasing the resource use efficiency in banana cultivation.

1.7 Scope of the Study

The results of the study provide information on costs and returns from banana cultivation which would be useful to the producers, researchers and policy makers to take suitable measures to improve the production of banana. Reorganization of resource use would contribute to the economic efficiency resulting in higher production, lesser costs and more profits. The study of price spread and role of middleman would be of greater relevance to policy makers in fixing remunerative price and to remove the bottlenecks in marketing of banana.

1.8 Limitations of the study

The study was conducted over a limited period of time, in a limited area of particular agro-climatic and socio economic situation and hence suffers from draw backs. The conclusions drawn are applicable to that area and areas with similar conditions. The necessary primary data regarding the cultivation of banana were collected from farmers based on their recall memory by using survey method and hence has inherent limitations.

2. REVIEW OF LITERATURE

In this chapter an attempt is made to critically review the literature of past research work done in relevance to the present study. A brief account of the previous research work done on the study is presented under the following heads.

2.1 Costs and returns in Banana production

2.2 Resource use efficiency of Banana

2.3 Marketing channels and price spread

2.4 Problems faced by growers in production and marketing

2.1 Cost and returns in Banana production

Senthilathan *et al.* (1994) studied the cost and returns of Poovan cultivar banana production in Tiruchirapalli district of Tamil Nadu, over a period of three year. Total cost of cultivation per hectare was Rs. 1,24,668.11, with gross income of Rs. 1,62,235.69 per hectare. The study showed the high profitability of variety Poovan banana with a benefit cost ratio 2.3:1 in the study area.

Maurya *et al.* (1996) studied the profitability of banana production in Hajipur district of Bihar state, during 1993-94 based on sample of sixty banana growers selected from five villages in the district. The study revealed that, banana was the most profitable crop production activity in the study area, as it provided a net income of Rs. 29,748.05 per hectare with a total expenditure of Rs. 20,160.70 and gross income of Rs. 49,958.75.

More (1999) studied the economics of production and marketing of banana in Marathawada region of Maharashtra state, it was observed that the cost of cultivation of banana per hectare was higher on small farms (Rs. 32,294.72) compared to large farms (Rs. 76,610.06) due to inefficiency in utilization of bullock labour, machine labour, human labour and manure and fertilizer in case of large farmer. The gross income per hectare was higher in large farmers (Rs. 1,42,885.30) compared to small farmers (Rs. 1,40,696.80) due to higher yield in large farmer.

Mishra *et al.* (2000) conducted a study on production and marketing of banana in Gorakhpur district of Uttar Pradesh. The researchers estimated the total per hectare cost of production of banana on small, medium and large farmers at Rs. 36,281.50, Rs. 37,820.50 and Rs. 38,447.50 respectively, with average cost of Rs. 37,516.50 per hectare. The per hectare average gross returns were Rs. 71,133.33, which was higher on large farms (Rs. 73,400) followed by medium farms (Rs. 72,250) and small farms (Rs. 67,750). The average input output ratio was 1:1.89.

Guledgudda *et al.* (2002) conducted study on economics of banana cultivation and its marketing in Haveri district of Karnataka. The study revealed that the variable cost incurred by producer was Rs. 54,502.81 per hectare which was accounted to 65 per cent of total cost. Among variable costs, the human labour was found to be the major item of cost, which accounted for 18 per cent. On an average farmers got 175 quintals of banana yield as main product valued at Rs. 1,54,375 and farmer have realized Rs. 30,000 by selling suckers, the gross returns from banana cultivation were Rs. 1,00,545.96 with B:C ratio of 2.19.

Mali *et al.* (2003) studied the economics of production and marketing of banana in Jalgaon district of western Maharashtra. The 112.39 q of output i.e. the wet rhizomes gave the returns of Rs.1,08,692.91 with the per quintal cost found that the per hectare cost of cultivation of banana worked out to Rs.1,33,477.36 the gross return per hectare of banana come to Rs.214867.24 and net return of Rs.66,761.87 were obtained.

Suresh and Keshaveredy (2004) made an attempt to study on economic analysis of banana cultivation in Pecchi command area of Thrissur district of Kerala state. The study revealed that average per hectare cost of cultivation of banana was Rs.1,08,669 with average per hectare return of Rs.1,85,792. This gives to profit of Rs.77,123 indicating a B:C ratio of 1.71. This mean that one rupee spent on cultivation of banana would yield Rs.0.71 over and above the cost incurred. The cost amount spend on human labour was Rs.48,178 (44.33%) of cost of cultivation. The other important expenditure came under the heading of other expenditure Rs.23,425 (22%) for propping to prevent the plant from breaking heavy wind of December. The inputs like suckers, fertilizers, organic manures and plant protection chemicals accounted for 5.2, 14.2, 13.38 and 13.9 per cent of total expenditure respectively.

Patil (2005) worked out cost of production of banana in Jalgaon district. The per hectare total cost was Rs.85,498.74 in which cost ‘A’, cost ‘B’ and cost ‘C’ was Rs.47,409.90, Rs.74,713.2 and Rs.77,739.86 respectively. In cost ‘A’ major items are manures and fertilizers (15.84%), hired human labour (9.75%) accounts major portion of total cost.

Naduvrnamani and Mamle Desai (2007) studied economics of red banana production under the contract farming in Karnataka. The primary data was collected to study the resource use efficiency, detail information on input used and output soled and problem faced by 35 contract farmer in the period of 2004-05. It was estimated in present study that total cost of red banana production per hectare was Rs.97,976.40. The average variable cost incurred in red banana cultivation under contract farming was Rs.86,760.40. The B:C ratio was 3.28.

Dave *et al.* (2016) studied the comparative economics of banana cultivation in Anand district of Gujarat. The study revealed that the banana farming under drio irrigation system was found more profitable as compared to conventional method of irrigation. The net profit was higher under drip banana cultivation (Rs. 165184) as compared to non-drip banana cultivation (Rs. 108135). The average yield per hectare was 13.94 per cent higher under drip irrigation system than that under conventional irrigation system. Banana growers also receives higher prices for the banana when adopted drip irrigation system as quality was better in drip farms. The input-output ratio over total cost (C_2) was also higher under drip banana cultivation (2.10) as compared to non-drip banana cultivation (1.71).

Mungalpara (2017) conducted study on economics of production and marketing of banana in Bharuch district of South Gujarat. The study revealed that the average cost of cultivation per hectare of banana was Rs. 2,24,671. It was highest on large farms (Rs. 2,30824), followed by medium farms (Rs. 2,23,184) and small farms (Rs. 2,20,022). The gross income per hectare was Rs. 5,66,809.00 on sample farms while the average net income per hectare was Rs. 3,42,132.00. the input output ratio was 1:2.52.

2.2 Resource use efficiency :

Thomas *et al.* (1987) studied economics of banana cultivation in Kottayam district of Kerala. The Cobb-Douglas production function was used and result showed increasing returns to scale. The response of gross income to an increase in expenditure on suckers, plant protection chemicals, propping materials, baskets, transportation and marketing was highly significant and positive, and marginal value product of human labour and manure and fertilizers were lesser than marginal input prices. The study revealed that increase in suckers, plant protection chemicals, propping materials would generate a substantial level of additional income with negative amount of additional expenditure.

More (1999) studied economics of production and marketing of banana in Maharashtra state. Cobb-Douglas type of production function was used to determine the level of resource use efficiency for banana crop of small, large and pooled farm. The independent variable included in the function were land, human labour, machine labour, farm yard manure, nitrogen, potash, irrigation, capital and bullock labour. The dependent variable was yield of banana. The coefficient of multiple determination were 73, 67 and 85 per cent respectively for all the three categories if farmer land and capital were significantly influenced on yield in all three categories of farmers and human labour machine labour in large farmers category were more than unity, indicating that under-utilization of these resources.

Kameswararao (2000) studied resource productivity of banana crop in Tungabhadra command area of Karnataka. Researcher employed Cobb-Douglas type of production function in which banana yield (tonnes) as dependent variable and land (hectares), human labour (man days), bullock labour (pair days), suckers (tonnes), irrigation (numbers) and value of manures and fertilizers (Rs.) as independent variables. The result revealed that land was underutilized to the extent of 23.35 per cent. The regression coefficient of human labour for small farmer was significant at 1 per cent level and the same was non-significant for large and pooled farmers. The regression coefficient for irrigation for small and large farmers was significant at 5 per cent level. The regression coefficient for land, bullock labour, sucker and manures and fertilizers were non-significant in all categories of farmer. The variation in banana production was explained by selected independent variables in small and large farmers group.

Yadav (2000) made comparative study of resource use efficiencies and resource productivities of traditional and tissue culture banana production in Maharashtra state. The regression coefficient of area, FYM and potash were positive and significant at 10 per cent level, indicating, scope to increase level of those inputs to step up the productivity. The sum of elasticities of production was equal to unity; reveal that constant returns to scale in traditional method of banana production. In tissue culture banana, the functional analysis revealed that, regression coefficient of plantlet was highly significant, there by indicating scope to increase the level of plantlet. The sum of elasticities of production was equal to unity showing constant returns to scale. MVP/ MFC ratio for inputs namely sucker, nitrogen and bullock labour was greater than unity referring that efficient use of these resources.

Alagumani (2005) found that, in tissue-culture banana, the co-efficient of plantlets, manures and fertilizers were positive and significant at 1 per cent level. Labour cost had negative and non-significant influence on gross income. Sum of elasticities of resources shown that the constant returns to scale. Whereas in sucker propagated banana the co-efficient of sucker and fertilizer costs were positive and significant at 1 per cent level. The sum of elasticities of resources shown that decreasing returns to scale.

More *et al.* (2006) studied on labour utilization and input use pattern in banana cultivation in Maharashtra. Data were collected from 120 banana growers in Nanded and Parbhani districts determine the labour utilization and input use pattern (fertilizer and irrigation use) in banana cultivation. The study revealed that major proportion of human labour was used for irrigating the banana crop. Hence, there is a need to encourage farmers to adopt the drip irrigation method, which is somewhat costly but labour-saving.

Hanumantharaya (2009) studied a comparative economic analysis of tissue culture banana and sucker propagated banana production in Karnataka. The study revealed that the regression coefficient of sucker (0.13) was not significant and the MVP (Marginal Value Product) to MFC (Marginal Factor Cost) ratio was 0.51. The regression coefficient of FYM (Farm Yard Manure) and fertilizers (0.35) was significant at 5 per cent and MVP to MFC ratio was 1.61 and -0.025 respectively. The regression coefficient of human labour (0.078) was significant at 1 per cent and the ratio was 0.019. The R^2 value was 0.86. The return to scale was 0.625. The result of tissue culture banana was noticed that regression co-efficient of plantlets was (0.091) significant at 5 per cent level and the MVP to MFC ratio was 1.74. The regression coefficient of FYM and fertilizers was (-0.042) and non-significant and the MVP to MFC ratio was -3.4703. The regression coefficient of plant protection chemicals, human labour and bullock labour were significant at 1 per cent level and their respective MVP to MFC ratios were 2.19, 0.96 and 0.92 respectively. The R^2 value was 0.46 with 0.37 returns to scale

Patil and Leua (2011) made a comparative study on economics and marketing of tissue culture and suckers banana in South Gujarat. A multi stage random sampling design was used for selecting the sample. The study covered 4 talukas, 12 villages and 180 banana growers (90 tissue culture banana and 90 sucker banana) from Surat and Bharuch districts. The major findings of study revealed that there exist difference in cost of cultivation. The average total cost (cost C2) per quintal of tissue culture production was to around 283.34 and 257.27 for sucker banana. The expenditure of planting material was more in case of tissue culture banana as compared to sucker banana. The modified Cobb-Douglas production function analysis techniques where used, it revealed that output elasticises of chemical fertilizer on production of tissue culture banana and sucker banana was positive and significant. Whereas manure was negatively significant and negative effect on yield. The area under tissue culture banana and sucker banana was significant and positive effect on productivity of sucker banana. The Chows "F" ratio was found to be significant at 1% level indicating the existence of significant difference in parameters between tissue culture banana and sucker banana production function. MVP-MFC ratio was more than one for the inputs like seed, human labour, chemical fertilizer, but less than one for inputs like bullock labour, plant protection chemical, FYM in tissue culture banana cultivation. While in sucker banana cultivation the ratio was found to be more than one for inputs like chemical fertilizer and plant protection chemical.

Nandi *et al*. (2011) conducted study to determine technical, allocative and economic efficiencies of Ginger farmers in Kaduna State, Nigeria. A multi-stage sampling technique was employed to select 240 Ginger farmers. Data were analysed using the stochastic parametric technique and these findings showed that technical efficiency indices range from 25.47 to 94.33 per cent, with a mean of 64.98%; allocative efficiency varied from 10.28 to 98.72%, with a mean of 40.68% and economic efficiency varied from 2.62 to 93.12%, with a mean of 26.43%. The indices of efficiency indicate great potential to achieve productivity growth through improved efficiency, using existing technologies and the available resource base in the study area. Analysis of estimated coefficients indicated that age and education positively relate to technical efficiency while education and extension contact correlate with allocative efficiency positively.

Gurikar (2014) conducted study on production and marketing management of Onion in Gadag District-a management appraisal. Multi-stage random sampling technique was employed to select the 120 sample farmers from Gadag District. The results indicated that there was positive and significant growth in area and production of Onion (4.06 and 4.18% per annum respectively). The total variable cost incurred per hectare by large farmers was highest (Rs.29,535.82/ha) as compared to small (Rs.26,580.72/ha) and medium category farmers

(Rs.27,,720.34/ha). Among the three categories of farmers the total cost incurred by the large farmers was the highest (Rs.34648.53/ha) as compared to small and medium farmers (Rs.31460.80/ha and 32703.53/ha respectively). The highest yield obtained by medium farmers (58.56Q) followed by large farmer (57.56Q) and small farmers (52.72Q). The study revealed that most of the resources were under utilized as revealed by MVP: MFC ratios and only plant protection chemicals was over used in case of large farmers.

Kumar *et al*. (2015) studied resource use efficiency and constraints in production and marketing of tissue culture and sucker propagated banana. The results indicated that the regression coefficient of sucker (0.13) was not significant and the MVP (Marginal Value Product) to MFC (Marginal Factor Cost) ratio was 0.51. the regression coefficient of FYM (Farm Yard Manure) and fertilizers was (0.35) was significant at 5 per cent and MVP to MFC ratio was 1.72. The regression coefficient of plant protection chemical and machine labour were non-significant and their MVP to MFC ratio was 1.61 and -0.025 respectively. The regression coefficient of human labour (0.078) was significant at 1 per cent and the ratio was 0.019. The R^2 value was 0.86. The return to scale were 0.625. The regression coefficient of plantlet was (0.091) significant at 5 per cent level and the MVP to MFC ratio was 1.74. The regression coefficient of FYM and fertilizers was (-0.042) and non-significant and the MVP to MFC ratio was -3.4703. The regression coefficient of plant protection chemicals, human labour and machine labour were significant at 1 per cent level and their respective MVP to MFC ratios were 2.19, 0.96 and 0.92 respectively. The R^2 value was 0.46 with 0.37 return to scale.

2.3 Marketing channels and price spread:

Garde *et al.* (1992) in their study on marketing of banana in Jalgaon district identified the following channels. Channel-I Producer → Co-operative fruit sale society → Commission agent → Wholesaler – Retailer – Consumer. Channel-II Producer → Group sale agency → Commission agent → Wholesaler → Retailer → Consumer. Channel-III Producer → Private agency → Commission agent → Wholesaler → Retailer → Consumer. The maximum marketing cost of Rs. 90.99 per quintal was incurred in channel-III followed by Rs. 84.46 in channel-II and Rs. 82.26 in channel-I. The marketing margin under channel-III was found higher than those under channel-II and channel-I. The producer’s share in consumer’s rupee was estimated 32.57, 32.43 and 31.31 per cent for channel-I, II and III respectively.

Chavan *et al.* (2001) studied marketing of banana in Parbhani market of Maharashtra state. Two marketing channels were observed in study area viz. channel I: Producer → Wholesaler → Retailer → Consumer and channel II: Producer → Wholesaler → Processor → Retailer → Consumer. From the study it was concluded that, the per quintal marketing cost in channel I was Rs. 112.25 while it was Rs. 95.20 in channel II. Marketing margin was Rs. 312.75

and Rs. 329.80 per quintal of banana sold in Parbhani market through channel I and channel II, respectively.

Gajanana (2002) studied marketing practices and post-harvest loss assessment of banana var Poovan in Tamil Nadu. The study revealed the marketing practices were collected during March-April 2001 from the growers of Trichy and Lalgudi talukas of the study district. It can be inferred from the whole analysis that the farmers use value judgement by resorting to field sale to the agents of the distant market (Bangalore regulated market) wholesaler for getting higher prices. A need is suggested to convert all unregulated markets like Trichy into regulated markets for the benefit of farmers throughout the country.

Sudha *et al.* (2005) in the study on post-harvest handling and marketing of banana in Rajahmundry region of Andhra Pradesh. Two distinct marketing channels were identified they were channel-I, which is mainly a wholesale market sale, the producer themselves or through pre-harvest contractors market the produce to the wholesaler. The produce is then sold to the traders then to retailer. The trader in turn transports a part of the produce to Hyderabad to merchants who specialized catering to the specific demand for specific variety. The marketing costs for the sellers, who includes producers and field level buyers worked out to be 8.16 per bunch when sold to wholesale markets and farmers have spent Rs. 45.3 per bunch while self-marketing.

Rane and Bagade (2006) studied economics of production and marketing of banana in Sindhudurg district of Maharashtra. The study identified following two channels of marketing. Channel-I: Producer → Wholesaler → Retailer → Consumer was the prominent channel of banana marketing and about 71% of the produce is routed through this channel, Channel-II: Producer → Village retailer → Consumer, was the other channel of banana marketing and about 29% of total produce is routed through this channel. They also found that, the per bunch marketing cost incurred was Rs.59.79 in Dodamarg tehsil and Rs.40.33 in Sawantwadi tehsil with overall average cost per bunch of banana marketing incurred by the producer in Sindhudurg district was Rs.50.06. They observed that the channel I i.e. Producer → Wholesaler → Retailer → Consumer was major channel of banana marketing and about 70 per cent of produce was routed through this channel whereas, Producer → Village retailer → Consumer referred channel-II and about 29% banana marketing is routed through this channel. On an average per bunch marketing cost was worked out Rs.50.06 in channel II.

Gajanana *et al.* (2009) made study on marketing and post-harvest losses in fruits: its implications on availability and economy. He identified fallowing marketing channels, Channel-I Farmers → Wholesaler → Retailer → Consumer, Channel-II Farmers → Farmers co-operative society → Consumers, Channel-III Farmers → Pre-harvest contractors → Wholesalers → Retailers → Consumers, Channel-IV Farmers → Wholesalers → Consumers. More than 70 per cent banana was marketed through channel-I and channel-II. In channel-I the farmers from different part of Karnataka, Tamil Nadu and Andhra Pradesh brought their produce mostly by trucks to an exclusive banana wholesale market at Binny Mills area, Bangalore. Banana was disposed through an open auction and the major varieties traded were Dwarf Cavendish and Ney Poovan. In cahnnrl-II, the Horticultural Producers Co-operative Marketing and Processing Society Ltd. (HOPCOMS) played a role of single window agency of procurement and distribution. The society procure banana from farmers through its collection centres located at production areas, viz., Channapatna, Ramanagaram and Kanakapura and distributes the same to the consumers through 256 retail outlets in major cities like Banglore, Mysore and Mangalore. In channel-III, the PHCs play an important role. They enter into a contract with the farmers and sell banana in the nearby wholesale markets. The marketing system for banana is reasonably well networked in Karnataka.

Sarode (2009) studied economics of banana marketed in Jalgaon district. The auther observed the three marketing channel viz, channel I – Producer → Co-operative fruit sale society → Commission agent → wholesaler → Retailer → Consumer. Channel II – Producer → Group sale agency →Commission agent → Wholesaler → Retailer → Consumer. Channel III – Producer → Private agency → Commission agent → Wholesaler → Retailer → Consumer. The maximum marketing cost of Rs. 90.99 per quintal was incurred in channel III followed by Rs. 84.46 in channel I. The marketing margin under the channel III was found higher than those channel II and channel I. It worked out to Rs. 287.58 and Rs. 282.26 per quintal for channel I, II and III respectively.

Kurkute *et al.* (2010) studied marketing of banana in Pune district of Maharashtra. They observed that, the average production of banana on sample farm was 349.98 quintals, of the total production, more than 99 per cent was sold and about 1 per cent quantity was used for home consumption. They identified following two marketing channels in banana marketing. Channel I: Producer → Group sale agency → Commission agent → Wholesaler → Retailer → Consumer and channel II: Producer → Co-operative marketing society → Commission agent → Wholesaler → Retailer → Consumer. They also observed that per quintal cost of marketing was highest in Mumbai market (Rs. 135.80) followed by Pune (Rs. 122.04) Otur (Rs. 94.98) and Junnar (Rs. 83.27). The marketing cost was highest in channel I (Rs. 117.61), than channel II (Rs. 109.83). The producer’s share in consumer’s rupee was highest in Junnar market (51.13%) followed by Otur (49.33%), Pune (46.72%) and Mumbai market (42.33%). Channel II had provided relatively higher share (46.50%) in consumer’s rupee than channel I (45.37%).

Barkade *et al.* (2011) worked on economics of Onion cultivation and its marketing pattern in Satara district of Maharashtra and observed that producers share in consumers rupee was 78.68% by selling fresh onion. The wholesalers and retailers were taking away the major share of 5.37% and 8.76% of consumer's price without investing any penny in the marketing process. For the marketing of Onion the important channel were identified channel I – Producer → Consumer, channel II – Producer → Wholesaler → Consumer and channel III – Producer → Wholesaler → Retailer → Consumer.

Kumar (2011) studied the channels, costs, margins and price spread included in the marketing of Ginger. He selected a random sample of five intermediaries of each category. He identified three channels for marketing of Ginger *viz*., Channel I: Farmer → Consumer; Channel II: Farmer → Wholesaler cum commission agent → Retailer → Consumer; and Channel III: Farmer → Wholesaler cum commission agent → Wholesaler → Retailer → Consumer. It was observed that the producer's share in the consumer's rupee was the highest in channel I (90.12%) followed by channel II (62.66%) and channel III (58.91%) with reflected its inverse relationship with number of middlemen in the channel. In same manner, the net price realized by producer was the highest in channel III because of absence of any middlemen.

Anap (2013) made study on economics of production and marketing of banana in Wardha district. The marketing channels identified in study area were, channel I – Producer → Retailer → Consumer, channel II – Producer → Village trader → Retailer → Consumer and channel III – Producer →Village trader → Wholesaler → Retailer → Consumer. The maximum marketing cost of Rs. 186.42 per quintal followed by Rs. 124.66 per quintal in channel II and Rs. 43.09 per quintal in channel I. The net price received by producer in channel I, channel II and channel III were Rs. 524.84, Rs. 533.43 and Rs. 521.64 per quintal respectively. The producer share in consumer's rupee was highest in channel - I i.e. 86.71 per cent followed by channel - II 74.12 per cent and channel - III 57.74 per cent.

Khedkar (2015) conducted study on economics of production and marketing of banana in Kolhapur district of Maharashtra. There was three marketing channels were identified as Channel-I Producer → Hundekari → Wholesaler → Retailer → Consumer. Channel-II Producer → Wholesaler → Retailer → Consumer, Channel-III Producer → Retailer → Consumer. Price spread in channel-I was 66.84 per cent, channel-II was 71.44 per cent and channel-III was 76.87 per cent. It is indicated that the channel-III is profitable but the sale of quantity is very small.

Singh *et al.* (2017) conducted study of banana growers in Fatehpur district of U.P. In the study area the following channels of banana were found under operation. Channel-I Producer → Consumer, Channel-II Producer → Wholesaler → Retailer → Consumer and Channel-III Producer → Contractor → Wholesaler → Retailer → Consumer. Producer's share in consumer's rupee was lowest being 34.48 per cent in Channel-III, it was 43.39 per cent in Channel-II and 90.83 per cent in Channel-I in banana marketing on sample farms. The lower [roducer's share in consumer's rupee was due to higher marketing cost and marketing margins of profit charged by middleman. Marketing cost incurred by retailer per quintal came to Rs. 120 (9.92%) in Channel-

II and Rs. 110 (7.50%) in Channel-III, respectively. Retailer’s net margin came to 225 (18.59%) and Rs. 290 (19.79%) Channel-II and Channel-III, respectively. Total marketing cost incurred by wholesaler per quintal came to Rs. 180 (15.28%) and Rs. 200 (13.65%) in Channel-II and III, respectively. Marketing cost incurred by contractor per quintal came to Rs. 80 (5.46%) in Channel-III. Contractors net margin cames to Rs. 120 (8.19%) in Channel-III. Price spread came to Rs. 55 (9.17%), Rs. 685 (56.61%), Rs. 960 (65.52%) in Channel-I, II and III, respectively.

Jondhale and Nagargoje (2018) studied an economics of production and marketing of banana in Marathwada region. The study revealed that there exists three marketing channels in study area. Channel – I: Producer → Consumer, channel: – II Producer → Retailer → Consumer and channel – III: Producer → Pre-harvest contractor → Retailer → Consumer. The small farm marketed 5.00 per cent, 15.00 per cent and 80.00 per cent produce through channel-I, channel-II and channel-III respectively. Similarly medium banana farm marketed 3.60 per cent, 11.40 per cent and 85.00 per cent banana through channel-I, channel-II and channel-III. Large farm marketed 2.02 per cent, 12.60 per cent and 85.40 per cent banana through channel-I, channel-II and channel-III respectively. It is observed that all size group marketed maximum produce through channel-III and per quintal marketing cost observed in channel-I, channel-II and channel-III was Rs. 60.50, Rs. 148.32 and Rs. 189.72. Producer share in consumer rupee was 92.02 per cent in channel-I, 69.62 per cent in channel-II and 58.07 in channel-III respectively.

Kumari *et al.* (2018) conducted study on the marketing channels, price spread and marketing efficiency in different marketing channels of banana in Vaishali district of Bihar. It revealed that, price spread in channel I (Producer → Consumer), channel II (Producer → Commission agent/Wholesaler → Retailer → Consumer) and channel III (Producer → Pre-harvest contractor → Wholesaler → Retailer → Consumer) were (Rs. 150/quintal, Rs. 920/quintal and 1230/quintal) respectively. Total marketing cost was highest for channel III (Rs. 555/quintal) compared to channel I and channel II (Rs. 150/quintal and Rs. 430/quintal) respectively. Producer’s share in consumer’s rupee for channel I was 95.00 per cent, channel II was 79.36 per cent and channel III was 73.34 per cent. Marketing efficiency for channel I was 20 per cent, channel II was 4.10 and channel III was 3.25 per cent respectively.

2.4 Problems faced by growers in production and marketing

More (1999) studied the economics of production and marketing of banana in Marathwada region of Maharashtra. The study identified the problem faced by farmers that, all the farmers in the study area were facing the problem of *Musa cercospora* disease. The other major problem were high labour wages, non-availability of quality planting material at right time and non-availability of technical assistance from experts on behalf of government. The problem in marketing were spatial variation in the prices creating uncertainty among cultivators in choosing the market for the sale of produce. The higher transportation cost was also one of the major marketing problem. Inadequate availability of the loan at right time by financial institution was the main problem in production of banana in the study area.

Mishra *et al.* (2000) conducted a study on production and marketing of banana in Gorakpur district of Uttar Pradesh. The researcher identified the problems faced by the farmers in the production and marketing of banana they were unavailability of quality suckers and high cost of seed suckers, high cost of transportation, lower ruling price for produce due to unavailability of sufficient storage facilities.

Begum and Raha (2002) studied on marketing of banana in selected areas of Bangladesh. The existing marketing system for banana in selected areas of Bogra district of Bangladesh was examined based on data from 40 market intermediaries. Also examined were the marketing costs and margins at different levels of banana marketing and the existing marketing constraints. Results revealed that banana marketing is a profitable venture and major marketing problems are price instability, lack of capital, inadequate facilities and lack of adequate market information.

Guledgudda *et al.* (2002) conducted study on economics of banana cultivation and its marketing in Haveri district of Karnataka. The study identified production problems like lack of technical knowledge, scarcity of labour, pest and disease, lack of adequate credit facilities and scarcity of water. The farmers in the study area expressed also marketing problems like involvement of intermediaries, lack of storage facilities and inadequate transportation.

Mali *et al.* (2003) studied economics of production and marketing of banana in Jalgaon district of Maharashtra. The study identified that the high cost of transportation, non-availability of sufficient credit by the institution in time, high price fluctuations, the problem of cheating in weighing of produce and lack of suitable grading of the produce according to the quality as main problems in production and marketing.

Alagumani (2005) made an economic analysis of tissue cultured banana and sucker propagated banana in Theni district of Tamil Nadu. It is observed from study that the risk in cultivation of banana using tissue culture plantlet was lower than that of sucker propagated banana production. The constraints in tissue culture banana production were high cost of tissue culture plantlets.

Yadnik (2005) conducted study on marketing management of banana in Jalgaon district. Study revealed that major problem faced by banana growers in production and marketing were inadequate and non-availability of loan in time, non-availability of good quality suckers, fluctuation in electricity supply, transportation problem, malpractices in weighing and high charges of commission agent.

Patil and Leua (2011) studied a comparative study on economics and marketing of tissue culture and suckers banana in South Gujarat. The major production problems faced by banana growers were non availability of labour in sufficient quantity, destruction of plants due to high wind, pest and diseases. The problems faced in marketing and financial problems were fluctuation in market prices of the produce, lack of market for banana nearer (local market) to farm or village, non-availability of proper storage facilities, lack of grading and packaging, delayed payment, high cost of planting material, high cost of pesticides, high cost of borrowing, inadequate credit facilities and non-availability of credit in time were found to be problems in banana production.

Bhardwaj *et al.* (2011) studied challenges and constraints in marketing of Indian spices in India. The major problems faced by farmers were poor product quality, low productivity, poor post-harvest handling, insufficient mechanization of spice production and processing; and non-market orientation of agricultural extension. The Problems of growers of Uttaranchal are inadequate price for producers, pest and disease problems and poor availability of inputs, dependence on nature, crop insurance is absent.

Telang (2016) studied economics of production and marketing of banana in Washim district. The study revealed that the major problems faced by banana growers were high cost of planting suckers (76.52 per cent) followed by high wind during monsoon causing damage to the plant (75.37 per cent), lack of technological knowledge about disease and pest control measures (67.13 per cent) and non-harvest of small size bunches (65.82 per cent). In case of marketing of banana, inadequate storage facilities (68.86 per cent) is the major problem faced by grower. Combining of two small bunches as one bunch during counting for price fixing is the second most important problem (58.40 per cent).

Nayak *et al.* (2018) studied an economic analysis of production and marketing of banana in Drug district of Chhattisgarh. It was found that the problems faced by the sample farmers in the production and marketing of banana were problems in obtaining quality rhizomes at reasonable price and higher prices for human labour and fertilizer inputs. Higher human labour input cost due to lack of management and high rate of human labour per day and high fertilizer cost due to lack of market yard and reasonable price and also lack of credit facilities for securing crucial inputs at reasonable prices was not found timely to banana growers through institutional financing agency. Some important constraints found in banana marketing were lack of market information, storage facilities, processing industries based on fruit, government facilities in marketing of banana.

3. METHODOLOGY AND PROFILE OF STUDY AREA

A. Methodology

The object of any specific investigation is to draw the useful conclusions in the light of the objectives of the study. In order to arrive at the conclusions, it is essential for investigators to adopt appropriate methods and procedures. Keeping this in view, this chapter has been devoted to explain the methodology adopted to fulfill the objectives under study. It deals with the procedure used for selection of sample, method of data collection, type of data collected, and sources of data need analytical procedures used to get results as per the objectives of the study.

3.1 Data Requirement

To study the production and marketing aspects of banana in Solapur district the data on various aspects were required. The major aspects of data requirements were as under

1. General information of the sample banana growers
2. Detail information regarding resource use, the cost of cultivation and returns from banana
3. Information on market channels, market costs and market margins
4. Information on problems faced by growers in production and marketing of banana.

3.2 Selection of the Study Area

Solapur district is one of the major district growing banana in Maharashtra. The total area under banana during 2018-2019 was 700 ha. Solapur district was selected purposively for the present study. Secondly, two tahsil *viz.* Malshiras (65 ha) and Madha (50 ha) were selected purposively. The three villages from each tahsil were selected on basis of highest area under banana.

3.3 Sampling Technique

The list of banana growers were prepared from each of these villages as shown in table no. 3.1. Then growers from list were categorized into three size groups on the basis of area under banana for *viz.* Small (below 0.40 ha), Medium (0.41 to 0.80 ha) and Large (0.81ha and above). Fifteen banana growers were selected randomly from each village. Thus, total sample of 90 banana growers comprising of 30 small, 30 medium and 30 large growers were selected for present study.

3.4 Sampling Design

The sampling design adopted for the investigation were two stage purposive sampling with sample Tahsil as a primary unit of sampling and village as a secondary unit of sampling.

Table 3.1 Size Group wise Distribution of Selected Banana Grower

(Numbers)

Tahsil	Name of Village	Size Groups			Total
		Small (below 0.40 ha)	**Medium (0.41 to 0.80ha)**	**Large (above 0.81ha)**	
Malshiras	Mahalung	5	5	5	15
	Nevare	5	5	5	15
	Umbare	5	5	5	15
Madha	Takali	5	5	5	15
	Alegaon (khurd)	5	5	5	15
	Alegaon (budruk)	5	5	5	15
	Total	**30**	**30**	**30**	**90**

3.5 Data Collection

The data were collected by survey method by conducting personal interviews using specially designed questionnaire for the study purpose. The information was collected regarding the aspects like land use pattern, cropping pattern, input utilization and yield for banana crop during the year 2018-19. The information pertaining to marketing of banana *viz.* marketing cost, price realized and marketing channel followed, was also collected from banana growers and market functionaries.

3.6 Analysis of Data

Analysis of the data on physical resources use in banana cultivation *viz*: seedlings, male labour, female labour, manures, fertilizers, irrigations and plant protection etc., was carried out by tabular analysis.

3.6.1 Estimation of Costs and Returns

The costs and returns of banana crop were estimated with the help of standard cost concept. The details of standard cost concept used in present study are as below,

3.6.1.1 Evaluation of Costs

1) Crops: Yield of crop was evaluated at the prevailing prices in the respective village at the time of harvest.

2) Human labour: Human labour includes both family and hired labour. The hired labours were evaluated at the actual wages paid to the labour. Family labour was evaluated at the wage rates prevailing in the village for hired labour.

3) Bullock labour: The evaluation of hired bullock labour was done according to actual amount paid. The evaluation of own bullock labour was done at wage rate prevailing in the respective villages for hired bullock labour. Bullock labour was considered as a separate independent variable and it is measured in pair days.

4) Seedling: The cost of seedling was evaluated at the rate of suckers/seedling in the market.

5) Fertilizer: The cost on account of fertilizers was worked out at the actual prices paid by the growers.

6) Manures: The cost of farm yard manure produced on the farm was evaluated at the rates prevailing in village. In case of purchased manure the costs was accounted based on actual price paid for the purpose.

7) Irrigation charges: Expenditure on protective irrigation was accounted based on actual amount spend on the maintenance and working of oil engine or electric-pump.

8) Rent of land: For the own land the rental value was evaluated at one sixth of value of gross produce minus land revenue.

9) Land Revenue: This item of cost includes land revenue and other relevant cesses which were actually paid by the cultivators.

10) Interest on working capital: This was charged at the rate of 6 per cent per annum.

11) Interest on fixed capital: This was charged at the rate of 10 per cent on the value of agricultural capital assets such as farm buildings, implements and machinery, irrigation structure and equipments, live-stock (only draft animals).

Cost 'A'

Includes the costs on account of hired human labour, bullock labour, machinery charges, value of manures, value of fertilizers, value of seedling, irrigation charges, plant protection charges, land revenue, depreciation and repairs, interest on working capital etc.

Cost 'B'

Rental value of land and interest on fixed capital represent imputed cost which is added to the Cost 'A'.

Cost 'B' = Cost 'A' + rental value of land + interest on fixed capital.

Cost ‘C’

It is the total cost of production, which included all the costs items, actual as well as imputed. The value of owned labours is imputed and added to cost ‘B’ to work out cost ‘C’.

Cost ‘C’ = Cost ‘B’ + imputed value of family labour.

3.6.2 Functional Analysis

The empirical evidence from previous studies suggest that amongst the many mathematical functions, Cobb-Douglas production function is the appropriate one for the studies of resources productivities because it gives specific diminishing, increasing or constant returns. The data were therefore, subjected to functional analysis by using the following Cobb-Douglas type of production function,

$$Y = a\, X_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6}\, X_7^{b7}\, X_8^{b8} X_9^{b9}.\ e^{u}$$

When expressed in logarithmic terms this function transfer into linear function of the following types,

$$\text{Log } Y = \text{Log } a + b_1 \text{ Log } X_1 + b_2 \text{ Log } X_2 + \dots\dots\dots + bn \text{ Log } Xn + u \text{ Log } e$$

Where,

Y= Dependent variable (Output) in Quintals

a = Intercept

X_1 = Seed (Seedlings) (plants per hectare)

X_2= Male Labour (man days)

X_3= Female Labour (man days)

X_4= Manures (quintals)

X_5= Nitrogen (kg)

X_6= Phosphorus (kg)

X_7= Potash (kg)

X_8= Irrigation charges (Rs.)

X_9= Plant protection charges (Rs.)

bi’s = Elasticity of production of respective factors

e = Error term

3.6.3 Specification of Variables

A brief description of the inputs used as explanatory variables for the individual crop enterprise in present study has been explained in succeeding paragraphs.

i) Seed (Suckers/Seedlings) (X_1)

Banana is propagated by Suckers/Seedlings. Input has been expressed in terms of plants per hectare.

ii) Male labour (X_2)

Input has been expressed in terms of man days of eight hours. It includes all human labour utilized for performing different farm operations right from preparation of land to harvesting

iii) Female labour (X_3)

Like male labour, female labour has been expressed in terms of man days of eight hours. Mostly female labour required for weeding operation.

iv) Manures (X_4)

This input variable used on the farm to use organic FYM for plant nutrients supply. This input is considered in quintals.

v) Nitrogen (X_5)

This input variable included the use of plant nutrients in form of nutrients which includes inorganic fertilizers. The nitrogen contained in straight and mixed fertilizer is calculated by applying proper formula. It is taken in kilogram.

vi) Phosphorus (X_6)

Same way the P_20_5 contained in fertilizers is calculated and taken in kilogram.

vii) Potash (X_7)

Same way the potash contained in fertilizers is calculated and taken in kilogram.

viii) Plant protection (X_8)

The actual charges incurred for plant protection by the cultivators for Banana crop were considered.

ix) Irrigation (X_9)

The actual charges incurred for irrigation by the cultivators for Banana crop were considered.

x) Output (Y)

The output has been used as a dependent variable for Banana crop. Therefore, fruits are taken on total physical quantities which in quintals.

3.6.4 Estimation of Resource Use Efficiency

The resource use efficiency was judged on the basis of the ratio of marginal value products of the resources to its factor price ratio as under:

MVP/MFC =1 (Optimum use of resources)

MVP/MFC <1 (Excess use of resources)

MVP/MFC >1 (Underutilization of resources)

3.6.4.1 Marginal Value Product

The marginal value of products (MVPs) of the individual resources was estimated and compared with the marginal cost (MC). The MVP of individual resources was estimated by using the following formula,

$$\text{MVP} = b_i \frac{\overline{Y}}{\overline{X}} p_y$$

Where,

bi= Elasticity of production corresponding to the i^{th} input

$\overline{X}$ = Geometric mean of particular independent variable.

$\overline{Y}$ = Geometric mean of dependent variable.

P_y= Price of output.

3.6.5 Marketing Cost, Market Margin, and Price Spread

3.6.5.1 Total Marketing Cost

$$\mathbf{C = C_f + Cm_1 + Cm_2 + \ldots\ldots\ldots + Cm_n}$$

Where,

C = Total Marketing cost

C_f = Cost paid by the producer from the time the produce leaves the farm till he sells it.

Cm_i = Cost incurred by its middleman in the process of buying and selling the product.

(Agriculture marketing in India by S. S. Acharya and N. S. Agrwal)

3.6.5.2 Price Spread

Price spread = Consumer's price - price received by farmer

$$\mathbf{Ps = Cp - Pf}$$

Where,

Ps = Price Spread

Cp = consumer's price

Pf = price received by farmer

3.6.5.3 Market Margin

$$\mathbf{MT = \sum_{i=1}^{n} (Si - Pi)/Qi}$$

Where,

MT = Total market margin

Si == Sale value of a product paid by i^{th} firm.

Pi = Purchase value of a product paid by i^{th} firm.

Qi = Quantity of product handled by ith firm.

3.6.6 Marketing Efficiency (ME)

The marketing efficiency has been calculated by using the modified method as suggested by Shepherd's.

Shepherd's formula: E = (O/I)

Where,

E = Marketing efficiency

O = Price paid by consumer (Rs.)

I = 'Cost + margin' of market intermediaries (Rs.)

3.6.7 Problems in Production and Marketing

In the quantification of constraints expressed by the farmers, there was a problem, whether emphasis should be given for the number of responses to a particular priority or to the highest number of responses to a constraint in the first priority. But, both lead to different conclusions. To resolve this, a Responses-Priority Index (RPI) was constructed as a product of Proportion of Responses (PR) and Priority Estimate (PE), where PR for the ith constraint gave the ratio of number of responses for a particular constraint to the total responses as per equation given below,

$$(\mathrm{RPI})_I = \frac{\sum_{j=1}^{k} f_{ij} \cdot X_{[(k+1)-j]}}{\sum_{i=1}^{1} \sum_{j=1}^{k} f_{ij}} \quad (0 \leq \mathrm{RPI} \leq 5)$$

where,

$(\mathrm{RPI})_I$ = Response Priority Index for ith constraint,

f_{ij} = Number of responses for the jth priority of the ith constraints.
(i=1, 2……, l; j= 1, 2, 3,…..k),

$\sum_{j=1}^{k} fij$ = Total number of responses for the ith constraint.

$X_{[(k+1)-j]}$ = Scores for the jth priority,

k = Number of priorities, i.e. 5,

$\sum_{i=1}^{1} \sum_{j=1}^{k} fij$ = Total number of responses to all constraints, and

$\sum_{i=1}^{1} (\mathrm{RPI})_I$ = Summation of RPI indices for all constraints

B. Profile study of Area

Solapur district is one of the four districts that form the region of Western Maharashtra. It is the fourth largest district in Maharashtra in terms of land area and seventh largest in terms of population. It is important junction of Central railway line. Solapur is a city with an array of small and medium scale industries. The district is well known for its textile industries and Solapur chadars and towels are famous around the globe. The district has largest industry in Maharashtra for Beedi production. Solapur is known for its oilseed-market. It is located on the South East edge of the state and lies entirely on the Bhima and Seena basins. The entire district is drained by the Bhima river. The Solapur municipal council was the first municipal council of India. Solapur has a rich history and cultural heritage. This chapter deals with profile of the district mainly the location, physical setting, rainfall, climate condition, transport facilities, district administration and demographic features etc.

3.7 Location

Solapur district lies between 17°10’ to 18°32’ N latitude and 74°42’ to 76°15’ E longitude. On the Northern side of Solapur district are bounded by Ahmednagar and Osmanabad district, on the east by Sangli and Karnataka, on the south by Sangli and Karnataka and west by the Satara and Pune district.

3.8 Area and Population

The total geographical area of the district is 14,895 sq.km. with a population of 43,17,756. The Male number is 22,27,852 & Female 20,89,904 constituting a male / female ratio of 1000:938. The Urban population is 1,399,091 and Rural population is 2,918,665. The SC population is 6,49,745 constituting 15.05 per cent of the total population whereas ST population is 77,592 constituting a 1.8 per cent of the total population. The Literacy percentage of the district is 77.02 per cent. The population density is 290/Sq.km. (Data is as per 2011 Census)

3.9 Soil

The soil of Solapur district is mainly black cotton soil ranging in thickness from 0.3 m to 2.5 m. This black cotton soil is the ultimate product of weathering of Deccan trap. The fertility of soil increases near the Bhima river. The thickness of the soil cap along the river section increases to as much as 3m to 4m. Most of the area of district has covered with sandy loam slightly blackish coloured soil. The Balaghat mountains ranks flank the district on North-East side, whereas to the South-West part of the district stands the Mahadev hills. The rest of the district is flatland and plateau. The soil of Solapur district are favourable for arid fruit crops like ber, pomegranate, custard apple and grape.

3.10 Rivers

Rivers are one of the important sources of irrigation in Solapur district. Bhima river and Sina river, which flow south-east, are two famous rivers in Solapur and tributaries of which are

Nira river, Mann river and Bhogavati river. Among them the Nira and Mann run nearly east. Bhima river has 289 kms length in Solapur district. Madha and Karmala talukas acts as a watershed between the Bhima and Sina rivers. Around 2,96,107 hectares of area in Solapur is under irrigation from various sources.

3.11 Land Utilization Pattern in Solapur District

Land is a crucial input in process of agricultural production. Its availability and proper use is an essential condition for development of agriculture. The detail information of land use pattern in the district is as shown in the following Table 3.2.

Table 3.2 shows that out of the total geographical area of 14,87,843 ha of the land under forest, 32,000 ha, 63,700 ha of the land is Barren or uncultivable, 5200 ha non agricultural land and 1,11,500 and 1,11,200 ha area is covered by not-cultivated waste land and follow land, respectively. In Solapur district net cultivated area was 9,19,700 ha and gross cropped area 10,22,500 ha.

Table 3.2 Land utilization pattern of Solapur district 2018-19

(Hectares)

Sr. No.	Particulars	Area	Percentage (%)
1.	Total geographical area	14,87,843	100
2.	Area under forest	32000	2.15
3.	Barren/uncultivated land	63,700	4.28
4.	Non-agricultural land	5200	0.35
5.	Not cultivated land(excluding fallow land)	1,11,500	7.49
6.	Current fallow	1,11,200	7.47
7.	Other fallow	1,21,000	8.13
8.	Net cultivated area	9,19,700	61.81
9.	Other	1,23,788.54	8.32
9.	Intensity of cropping	111%	-
10.	Gross cropped area	10,22,500	68.72

Source: Socio-economic review and district statistical abstract of Solapur District(2018-19)

3.12 Irrigation Facilities

The information on area irrigated by different sources in Solapur district is presented in Table 3.3.

Irrigation is the important input playing a crucial role in pushing up the crop yields. In Solapur district, as per 2017-18 statistics, total area under irrigation was 3,50,731 ha. In Solapur district area irrigated by wells was 59.12 per cent, canal 21.15 per cent, lift irrigation 8.15 per cent, bore well 1.57 per cent, tank 0.16 per cent and other sources 9.85 per cent. River Bhima from Solapur streaming through the district, act as main source of irrigation.

Table 3.3 Area under Irrigation in Solapur district

(Hectares)

Sr. No.	Source of water for irrigation	Area irrigated (ha)	Percentage (%)
1.	Tanks	550	0.16
2.	Open wells	207350	59.12
3.	Tube/Bore wells	5500	1.57
4.	Lift irrigation	28600	8.15
5	Canal	74191	21.15
6	Other Sources	34540	9.85
	Total	350731	100.00

3.13 Cropping Pattern

The detail cropping pattern of Solapur district is presented in Table 3.4.

Table 3.4 Cropping Pattern of Solapur District

(Hectares)

Sr. No.	Crop	Area (ha)	Production (Qtl)	Productivity (Qtl/ha)
A)	**Cereals**			
1.	K. Jawar	500	8,500	17.00
2.	R. Jawar	6,01,700	44,31,000	6.50
3.	Bajra	63,400	7,61,000	12.00

4.	Wheat	60,900	5,54,000	9.10
5.	Sugarcane	35,400	1,69,92,000	480.00
B)	**Oilseeds**			
1.	K. Sunflower	19,900	1,25,000	6.28
2.	R. Sunflower	19,900	1,25,000	6.28
3.	Safflower	14,000	23,000	1.65
4.	Summer groundnut	3,200	83,000	26.00
5.	Soybean	4,900	58,000	11.60
C)	**Pulses**			
1.	Redgram	39,100	2,57,000	6.28
2.	Green gram	6,000	50,000	8.25
3.	Black gram	9,100	37,000	4.08
4.	Chickpea	33,000	1,49,000	4.50
D)	**Fruits**			
1.	Pomegranate	21,433	10,65,600	50.00
2.	Ber	7,461	37,10,000	50.00
3.	Grape	5,231	35,980	272.00
4.	K. lime	3,718	18,56,000	50.00
5.	Mango	2,180	21,700	10.00
6.	Sapota	1,902	95,100	50.00
7.	Tamarind	1,139	11,390	10.00
8.	Custard apple	791	7,910	10.00
9.	Banana	700	5,417	773.00
E)	**Vegetables**			

1.	Onion	7,938	9,59,200	120
2.	Chilli	2,753	2,20,240	80
3.	Brinjal	877	1,75,000	200
4.	Tomato	877	1,75,400	200
5.	Okra	69	10,350	150
6.	Garlic	245	2,455	10

Source: Socio-economic review and district statistical abstract of Solapur District (2018-2019)

3.14 Socio economic Indicators

3.14.1 Educational Facilities

The true education is to bring out, physical, mental and spiritual power of a person. In Solapur district, there have been considerable progress in education. There were 3679 educational institutions in the Solapur district as a whole. The villages have 2837 primary schools. There are 630 secondary schools (2001), 114 Higher Secondary Schools and 49 colleges are there. Some professional colleges like D.Ed., B.Ed. colleges, ITI, Polytechnic, Law colleges, Medical colleges and Engineering Colleges are in Solapur district.

3.14.2 Electricity

Electricity consumption from Maharashtra state electricity board (M.S.E.B.) in the year 2016-17 was 2280790 thousand KW hr. Out of it 389396 was consumed for residential purpose and 440395 KW hr for industrial purpose, 1173727 KW hr went for agricultural sector. New connection figure during the above said year was 8.13 lakh.

3.14.3 Transportation

In Solapur district buses and railway are the significant means of transportation. The state transport buses, trucks, tempos, private jeeps, autos are the major means of transportation.Total road length 13,390 km (2013). Pune-Machilipatnam (NH-65) highway passes through this district. Post offices (533) and telephone facilities are available in almost all the villages. The radio, television and internet means of communication are also spreading in the district.

3.14.4 Other Facilities

The institutes i.e. primary schools, secondary schools, hospitals, nationalized banks, credit co-operatives, cold storage facilities, co-operative dairy societies, lift irrigation societies, mahila mandals, bachat gut, fair price shops, medical stores and other such mandals are operating in the district.

4. RESULT AND DISCUSSION

The data collected from 90 banana growers were processed and analyzed with reference to specific objectives of the study. In this chapter, the results of the study along with the discussion are presented in the following order.

4.1 Socio-economic characteristics of the respondents

4.2 Input use pattern in banana cultivation

4.3 Economic aspects of banana production

4.4 Resource use efficiency

4.5 Marketing aspects of banana and

4.6 Constraints in production and marketing of banana.

4.1 Socio-economic Characteristics of the Respondents

4.1.1 Family Size and Age of Banana Growers

The socio economic information about banana growers pertaining to age, size of family, education of farmers and occupation is presented in Table 4.1 and Table 4.2.

Table 4.1 Family Size and its Composition

(Numbers)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Family size				
A	Male	2.50 (35.76)	2.50 (36.60)	2.43 (34.92)	2.48 (35.76)
B	Female	2.43 (34.77)	2.46 (36.03)	2.60 (37.36)	2.49 (36.05)
C	Children	2.06 (29.47)	1.87 (27.37)	1.93 (27.72)	1.95 (28.19)
	Total	6.99 (100.00)	6.83 (100.00)	6.96 (100.00)	6.92 (100.00)
2	Members working on Farm	2.67 (38.19)	2.70 (39.53)	3 (43.10)	2.79 (40.27)
3	Age (years)	44.2	48.46	47.73	46.79

(Figures in parentheses indicates percentage to the total)

Size of family is an important factor influencing supply of farm labour. It is observed from Table 4.1 that, the average size of family at the overall level was 6.92 family members, consisting of 35.76 per cent male, 36.05 per cent female and 28.19 per cent children. At overall level around 40.27 per cent family members were actually working on farm.

It is noticed from Table 4.1 that, the average age of sample growers in small, medium and large group was 44.2, 48.46 and 47.73 years, respectively with overall average age of 46.79 years.

4.1.2 Occupational Pattern

Table 4.2 Occupational Pattern of Banana Growers

(Numbers)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Farming	20.00 (66.67)	22.00 (73.33)	24.00 (80.00)	22.00 (73.33)
2	Farming +Business	4 (13.33)	4 (13.33)	4 (13.33)	4 (13.34)
3	Service +Farming	3 (10.00)	3 (10.00)	2 (6.67)	2.67 (8.89)
4	Business +Farming	3.00 (10.00)	1.00 (3.34)	0.00 (0.00)	1.33 (4.44)
	Total	30.00 (100.00)	30.00 (100.00)	30.00 (100.00)	90.00 (100.00)

(Figures in parentheses indicates percentage to the total)

It is seen from the Table 4.2, at overall level majority 73.33 per cent banana growers had farming as a main occupation without any subsidiary occupation, 13.34 per cent had farming as main occupation along with business as subsidiary occupation and 8.89 per cent had service as a main occupation along with farming as subsidiary occupation and 4.44 per cent had business as their main occupation along with farming as subsidiary occupation.

4.1.3 Educational Status

From Table 4.3, it is noticed that in small size group, 13.33 per cent selected banana growers were having education up to primary level, 20.00 per cent up to secondary level, 53.33 per cent up to higher secondary level, 6.67 per cent up to degree level and 6.67 per cent banana growers were illiterate.

In medium size group, 6.67 per cent selected banana growers having education up to primary level, 13.33 per cent up to secondary level, 63.34 per cent up to higher secondary level, 13.33 per cent up to degree level and 3.33 per cent banana growers were illiterate.

In large size group, 6.67 per cent selected banana growers having education up to primary level, 20.00 per cent up to secondary level, 60.00 per cent up to higher secondary level, 10.00 per cent up to degree level and 3.33 per cent banana growers were illiterate.

Table 4.3 Educational Status of Banana Growers

(Numbers)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Up to Primary	4.00 (13.33)	2.00 (6.67)	2.00 (6.67)	2.67 (8.89)
2	Up to Secondary	6.00 (20.00)	4.00 (13.33)	6.00 (20.00)	5.33 (17.78)
3	Up to Higher secondary	16.00 (53.33)	19.00 (63.34)	18.00 (60.00)	17.67 (58.89)
4	Up to Degree	2.00 (6.67)	4.00 (13.33)	3.00 (10.00)	3.00 (10.00)
5	Illiterate	2.00 (6.67)	1.00 (3.33)	1.00 (3.33)	1.33 (4.44)
	Total	30.00 (100.00)	30.00 (100.00)	30.00 (100.00)	30.00 (100.00)

(Figures in parentheses indicates percentage to the total)

4.1.4 Land Utilization Pattern of Banana Growers

Land use pattern includes utilization of area according to different land use categories. It includes cultivated land, fallow land etc. The land use pattern of banana growers is presented in Table 4.4. The data revealed that, total area of land at overall level was 2.34 ha. Out of the size groups, total area under land was higher in large size group i.e. 2.99 ha, medium and

Table 4.4 Per Farm Land Utilization Pattern of Banana Growers

(Hectares)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Total land holding	1.89 (100.00)	2.13 (100.00)	2.99 (100.00)	2.34 (100.00)
2	Permanent fallow	0.09 (4.55)	0.08 (3.80)	0.18 (6.35)	0.12 (4.79)
3	Net cropped area	1.80 (95.25)	2.05 (96.20)	2.80 (93.65)	2.22 (95.21)
4	Gross cropped area	2.30	2.62	3.45	2.79
5	Cropping intensity (%)	127.78	127.80	123.21	126.27

(Figures in parentheses indicates percentage to the total land holding)

small group having 2.13 and 1.89 ha respectively. Per farm net cultivated area was 2.22 ha (95.21 per cent) at overall level while in small, medium and large group having 1.80 ha (95.25 per cent), 2.05 ha (96.20 per cent) and 2.80 ha (93.65 per cent) respectively. At overall level, the fallow area was 0.12 ha (4.79 per cent). Out of three groups, large size group having higher area under fallow which was 0.18 ha (6.35 per cent) and for small 0.09 ha (4.55 per cent) whereas for medium it was 0.08 ha (3.80 per cent) fallow area.

4.1.5 Farm Investment of Banana Growers

Table 4.5 Farm Investment in Capital Assets

(Rupees)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Total land	1785733.30 (81.82)	2074616.70 (78.63)	2883286.70 (74.93)	2247878.89 (78.46)
2	House	213733.30 (9.79)	237200.00 (8.99)	364666.70 (9.48)	271866.67 (9.42)
3	Cattle shade	12426.67 (0.57)	14340.00 (0.54)	23216.67 (0.60)	16661.11 (0.57)
4	Electric motor	34446.67 (1.58)	40380.00 (1.53)	67900.00 (1.76)	47575.56 (1.62)
5	Implement and machinery	103040.50 (4.72)	172242.83 (6.53)	308594.44 (8.02)	194625.92 (6.42)
6	Pipelines	0.00 (0.00)	42000.00 (1.59)	96833.33 (2.52)	46277.78 (1.37)
7	Drip	33243.33 (1.52)	57800.00 (2.19)	103333.33 (2.69)	64792.22 (2.14)
	Value of Total Assets				
a	With land value	2182623.80 (100.00)	2638579.50 (100.00)	3847831.14 (100.00)	2889678.15 (100.00)
b	Without land value	396890.47 (18.18)	563962.83 (21.37)	964544.47 (25.07)	641799.26 (21.54)

(Figures in parentheses indicates percentage to the total asset value with land)

The study of the farm assets reveals the economic background of the farmers. The risk bearing ability of the farmers largely depends on the value of the assets owned. Since banana cultivation requires a large initial investment, the economic stability is crucial for the cultivators. The particulars of farm assets per hectare are presented in Table 4.5.

The per farm value of farm assets ranged from Rs.2182623.80 on small farms to Rs.3847831.14 on large farms, with an average value of Rs.2889678.15 at overall level. It was noticed that, the land, the basic resource that supports the production of farm commodities was the single most valuable asset on sample farms. The share of land value is very high with contribution of 81.82, 78.63, 74.93 per cent, respectively on small, medium and large size farms. An assessment of value of farm inventory excluding land revealed that the value of assets other than land varied from Rs. 396890.47 on small farms to Rs. 964544.47 on large farms, while the same was Rs. 641799.26 at overall farm level. It is observed that value of assets without land value exhibited direct relationship with the size of the holding. Coming to the machinery and implements, its value was Rs. 103040.50, Rs. 172242.83 and Rs. 308594.44 on small, medium and large farms respectively. The value of the fixed resources gets distributed over the size of the holding and hence the trend. When we take the value of buildings into consideration, for small farmers it was Rs. 213733.30 and for medium and large it was Rs. 237200.00, Rs. 364666.70 respectively. The higher value of buildings on large farms revealed the fact that large farmers were more inclined to possess well constructed farm buildings which last for more years.

4.1.6 Cropping pattern of Banana Growers

Cropping pattern refers to proportion of the area under different crops. In Table 4.6, areas under different crops of sample growers are presented. The average total net cropped area for banana grower was observed about 1.80 ha, 2.05 ha and 2.80 ha for small, medium and large size group respectively.

At the overall level, banana occupied 22.88 per cent of total gross cropped area. In kharif season, at the overall level major crops were soybean and jowar, which accounted 4.73 and 2.50 per cent of total gross cropped area, respectively. In rabi season, wheat, jowar and gram were major crops which accounted about 6.59, 2.85 and 1.12 per cent, respectively.

In Summer season, groundnut and fodder purpose jowar had been cultivated by banana growers. At overall level groundnut shared about 5.78 per cent while fodder jowar accounted 4.79 per cent of total gross cropped area. Sugarcane and banana were the perennial crops taken by banana growers which shared 45.41 and 22.88 per cent, respectively of total gross cropped area.The total gross cropped area at the overall level was 2.79 ha. It was 2.30, 2.62 and 3.45 ha in small, medium and large size groups, respectively. At the overall level, cropping intensity was worked out to 126.27 per cent.

4.1.7 Investment in Livestock by Banana Growers

The per farm livestock investment of sample growers were presented in Table 4.7. It can be observed from table that, at overall level, value of bullock, cow, exotic cow, buffalo and goat were Rs. 6166.67, Rs. 16966.64, Rs. 64933.33, Rs.81944.44 and Rs.5255.55, respectively.

In small size group, value of bullock was Rs. 7833.30 which was 4.77 per cent of total livestock value. In same manner, cow had value of Rs. 13933.30 which was 8.49 per cent, exotic cow had value of Rs. 63633.33 which was 38.77 per cent, buffalo valued for Rs. 63833.33 which was 38.90 per cent of total livestock value.

Table 4.6 Cropping Pattern of Banana Growers

(Hectares)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
A	**Kharif season**				
1	Groundnut	0.01 (0.43)	0.005 (0.19)	0.007 (0.20)	0.007 (0.27)
2	Soyabean	0.09 (3.91)	0.14 (5.34)	0.17 (4.93)	0.13 (4.73)
3	Red gram	0.03 (1.30)	0.03 (1.15)	0.04 (1.16)	0.03 (1.20)
4	Maize	0.06 (2.61)	0.05 (1.91)	0.04 (1.16)	0.05 (1.89)
5	Jowar	0.06 (2.61)	0.06 (2.29)	0.09 (2.61)	0.07 (2.50)
	Sub total	0.25 (10.87)	0.28 (10.69)	0.35 (10.14)	0.29 (10.57)
B	**Rabi season**				
1	Wheat	0.15 (6.52)	0.18 (6.87)	0.22 (6.38)	0.18 (6.59)
2	Gram	0.04 (1.74)	0.02 (0.76)	0.03 (0.87)	0.03 (1.12)
3	Jowar	0.06 (2.61)	0.08 (3.05)	0.10 (2.89)	0.08 (2.85)
	Sub total	0.25 (10.87)	0.28 (10.69)	0.35 (10.14)	0.29 (10.57)
C	**Summer season**				
1	Groundnut	0.14 (6.09)	0.15 (5.73)	0.19 (5.51)	0.16 (5.78)
2	Fodder Jowar	0.11 (4.78)	0.13 (4.96)	0.16 (4.63)	0.13 (4.79)
	Sub total	0.25 (10.87)	0.28 (10.69)	0.35 (10.14)	0.29 (10.57)
E	**Perennial crops**				
1	Sugarcane	1.22 (53.04)	1.17 (44.65)	1.33 (38.55)	1.24 (45.41)
2	Banana	0.33 (14.35)	0.61 (23.28)	1.07 (31.01)	0.67 (22.88)
	Sub total	1.55 (67.39)	1.78 (67.93)	2.40 (69.58)	1.91 (68.30)
	Gross cropped area	2.30 (100.00)	2.62 (100.00)	3.45 (100.00)	2.79 (100.00)
	Net cropped area	1.80 (78.26)	2.05 (78.24)	2.80 (81.16)	2.22 (79.45)
	Cropping intensity (%)	127.78	127.80	123.21	126.27

(Figures in parentheses indicates percentage to the total gross cropped area)

In medium size group, value of buffalo was Rs. 90666.67 which was 41.68 per cent of total livestock value while exotic cow, local cow, goat had share of 37.77, 7.69 and 2.50 per cent. In large size group, value of buffalo was Rs. 91333.33 which was 50.56 per cent of total livestock value. Exotic cow, cow, bullock, goat had share of 27.13, 11.20, 3.14, 2.31 per cent, respectively of total livestock value.

Table 4.7 Investment in Livestock by Banana Growers

(Rupees)

Sr. No.	Particulars	Size Groups			Overall
		Small	**Medium**	**Large**	
1	Bullock	7833.30 (4.77)	5000.00 (2.30)	5666.70 (3.14)	6166.67 (3.40)
2	Cow	13933.30 (8.49)	16733.33 (7.69)	20233.30 (11.20)	16966.64 (9.13)
3	Cow calf	1883.33 (1.15)	1633.33 (0.75)	2266.67 (1.25)	1927.77 (1.05)
4	Buffalo	63833.33 (38.90)	90666.67 (41.68)	91333.33 (50.56)	81944.44 (43.71)
5	Buffalo calf	4766.67 (2.90)	13266.67 (6.10)	5933.33 (3.28)	7988.89 (4.10)
6	Exotic Cow	63633.33 (38.77)	82166.67 (37.77)	49000.00 (27.13)	64933.33 (34.56)
7	Exotic Cow calf	2066.67 (1.26)	2633.33 (1.21)	2033.33 (1.13)	2244.44 (1.20)
8	Goat	6166.67 (3.76)	5433.33 (2.50)	4166.67 (2.31)	5255.55 (2.85)
	Total	164116.60 (100.00)	217533.33 (100.00)	180633.33 (100.00)	187427.75 (100.00)

(Figures in parentheses indicates percentage to the total)

The total investment on livestock at overall level was Rs.187427.75, medium size group invested Rs.217533.33 which was more than small (Rs.164116.60) and large (Rs.180633.33) group.

4.2 Input Use Pattern in Banana Cultivation

The information on per hectare utilization of different inputs for Banana is presented in Table 4.8.

i) Human labour

It can be observed from the table 4.8 that, at the overall level, the use of total human labour was 118.58 labour days per hectare, comprising 36.01 male labour and female 82.57 labour days. The use of human labour was found more in large size group of holding, it was 127.45 labour days followed by 122.55 labour days in small size and 105.74 labour days in medium size group.

ii) Machine labour

At the overall level, the per hectare use of machine labour was 13.61 hours. The per hectare machine labour utilization was observed slightly more in case of large size group of holding (14.31 hours) than medium and small size group of holdings. The machine power i.e. use of tractors was mostly for the operation of carrying of FYM, ploughing and harrowing etc.

Table 4.8 Per Hectare Utilization of Physical Input for Banana Crop

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Human labour	122.55	105.74	127.45	118.58
	(Days)				
	Male	38.39	33.86	35.79	36.01
	Female	84.16	71.88	91.66	82.57
2	Machine labour (hours)	13.06	13.45	14.31	13.61
3	Manures (Tonnes)	22.81	22.06	23.16	22.67
4	Fertilizers (kg)				
	N	409.67	397.08	392.04	399.60
	P	136.47	122.08	119.77	126.11
	K	725.82	720.53	714.53	720.29
5	Seedlings Nos./ha	4420.66	4427.26	4435.74	4427.88
6	Plant protection (Rs.)	8082.24	7240.40	6832.55	7385.06

iii) Manures and Fertilizer

The use of manure per hectare at overall level was 22.67 tonnes/ha. The use of manure was found more on large size of group (23.16 tonnes.) holding than small (22.81 tonnes.) and medium size (22.06 tonnes.) of group holdings. In manure, banana farmers applied farm yard manure, compost and banana press mud. At the overall level, the per hectare use of chemical fertilizers i.e. Nitrogen, Phosphorous, Potash were 399.60, 126.11 and 720.29 kg/ha. The per hectare use of fertilizer found more in small size group than medium and large size group of holding.

iv) Seedlings

At the overall level, on an average, utilization of seedlings was 4427.88 plants per hectare which was lesser than the recommendation (i.e. 4444 Plants per hectare). Farmers belonging to large size group use more seedlings than medium and small size group.

v) Plant protection charges

At the overall level, the per hectare utilization of plant protection charges were Rs. 7385.06. The per hectare use of plant protection charges were more in small size group of holding than medium and large size of group holding.

4.3 Economic Aspects of Banana Cultivation

4.3.1 Cost of Cultivation

The profitability of any enterprise depends upon costs and returns. The per hectare cost of cultivation of banana was worked out by using standard cost concepts. The information on various items of cost of cultivation of banana for different size of groups of holdings is presented in Table 4.9.

Table 4.9 Per Hectare Cost of Cultivation of Banana

(Rupees)

Sr. No.	Particulars	Small	Medium	Large	Overall
A.	**Cost of Cultivation**				
i)	Hired Labour				
	Male	11517.74 (3.46)	10158.48 (3.16)	10739.51 (3.37)	10805.23 (3.33)
	Female	16831.98 (5.05)	14376.87 (4.47)	18332.25 (5.74)	16513.70 (5.09)
	Total labour	28349.72 (8.51)	24535.35 (7.63)	29071.76 (9.11)	27318.94 (8.42)
ii)	Suckers or Rhizomes	57468.62 (17.25)	58439.80 (18.17)	57664.60 (18.06)	57857.67 (17.82)
iii)	Machinary	7836.67 (2.35)	8067.21 (2.51)	8588.95 (2.69)	8164.28 (2.52)
iv)	Manure	22816.98 (6.85)	22067.91 (6.86)	23165.19 (7.26)	22683.36 (6.99)
v)	Fertilizer	45415.09 (13.63)	41719.28 (12.97)	37380.74 (11.71)	41505.03 (12.78)
vi)	Irrigation	11284.33 (3.39)	12014.44 (3.74)	12066.95 (3.78)	11788.57 (3.63)
vii)	PPC	8082.24 (2.43)	7240.40 (2.25)	6832.56 (2.14)	7385.07 (2.27)
viii)	Repairs	1077.82 (0.32)	1191.14 (0.37)	1195.03 (0.37)	1154.66 (0.36)
ix)	Incidental charges	1564.12 (0.47)	1563.82 (0.49)	1590.95 (0.50)	1572.97 (0.48)
	Working Capital	183895.60 (55.19)	176839.36 (55.00)	177556.74 (55.62)	179430.57 (55.27)
x)	Interest on working	11033.74	10610.36	10653.40	10765.83
	capital @6%	(3.31)	(3.30)	(3.34)	(3.32)
xi)	Depreciation	3708.21	1883.82	1448.95	2346.99

		(1.11)	(0.59)	(0.45)	(0.72)
xii)	Land revenue	200 (0.06)	200 (0.06)	200 (0.06)	200 (0.06)
	Cost A	**198837.54** **(59.67)**	**189533.58** **(58.94)**	**189859.10** **(59.47)**	**192743.39** **(59.37)**
xiii)	Rental value of land	101323.78 (30.41)	102287.78 (31.81)	109642.72 (34.34)	104418.09 (32.16)
xiv)	Interest on F.C.	6543.27 (1.96)	4758.94 (1.48)	4107.91 (1.29)	5136.70 (1.58)
	Cost B	**306704.60** **(92.04)**	**296580.26** **(92.23)**	**303609.72** **(95.10)**	**302298.19** **(93.11)**
xv)	Family labour				
i)	Male	11576.19 (3.48)	10494.22 (3.27)	5945.66 (1.86)	9338.69 (2.88)
ii)	Female	14933.97 (4.48)	14480.01 (4.50)	9688.49 (3.04)	13034.16 (4.01)
	Total	26510.16 (7.96)	24974.23 (7.77)	15634.15 (4.90)	21716.26 (6.89)
	Cost C	**333214.76** **(100.00)**	**321554.50** **(100.00)**	**319243.87** **(100.00)**	**324671.04** **(100.00)**
B.	**Output** Main produce (q.) By produce (q.)	 574.36 0.00	 565.06 0.00	 549.91 0.00	 563.11 0.00
	Gross value	609142.70	614926.70	659056.30	627708.57
C.	**Per Qtl. Cost of Production**	580.15	569.06	580.54	576.58
D.	**B: C ratio**	1.83	1.91	2.06	1.93

(Figure in parenthesis indicates percentage to the total cost i. e. Cost C)

The data revealed that at overall level per hectare cost of cultivation for banana was worked out to Rs.324671.04. The contribution of Cost ‘A’ (Rs. 192743.39) accounted for 59.37 per cent to total cost. The contribution of Cost ‘B’ to total cost was 93.11 per cent. Out of total per hectare cost of cultivation of banana, the maximum 32.16 per cent cost was incurred on rental value of land followed by seedling (17.82 per cent) and fertilizer cost (12.78 per cent). Cost ‘B’ for small size group (Rs.306704.60) is significantly high than medium group (Rs.296580.26) and large group (Rs.303609.72). There was significant difference of Cost ‘A’ between small group (Rs.198837.50) and medium group (Rs.189533.58), also there was no significant difference of Cost ‘A’ between medium and large group. It was further noticed that among the different size groups per hectare cost of cultivation was maximum (Rs.333214.76) in small size group followed by medium (Rs.321554.50) and large (Rs.319243.87) size group. In small size group Cost ‘A’ was Rs.198837.54 which accounted for 59.67 per cent to the total cost and Cost ‘B’ Rs.306704.60 accounted for 92.04 per cent to the total cost. It can also be seen that in medium size group the contribution of Cost ‘A’ was 58.94 per cent to the total cost and contribution of Cost ‘B’ in the total cost of cultivation was 92.23 per cent to the total cost. In large size group Cost ‘A’ accounted for 59.47 per cent to total cost and Cost ‘B’ 95.10 per cent to the total cost. There was no significant difference between Cost ‘A’ and Cost ‘B’ of large size group, medium size group and small size group. Per quintal cost of banana was calculated on net Cost ‘C’ by dividing it value of main produce, at overall level per qtl. cost of banana was Rs.576.58. It was Rs.580.15, Rs.569.06, and Rs.580.54 for small, medium and large group, respectively.

4.3.2 Costs, Returns and Profitability of Banana Farm

At the overall level, the per hectare gross return was found to be Rs.627708.57. The per hectare gross returns of banana in small, medium and large size group was Rs.609142.70, Rs. 614926.70 and Rs.659056.30, respectively as depicted in Table 4.10. The net returns obtained at overall level were Rs.303037.52. Net returns obtained from small, medium and large size groups were Rs.275927.94, Rs.293372.40 and Rs.339812.43, respectively.

The benefit-cost ratio indicates the return from each rupee investment in banana cultivation. The results revealed that the B: C ratio is highest in large size group and it was 2.06. Similarly, B: C ratio was 1.83 and 1.91 for small and medium size groups, respectively.

At overall level, B: C ratio was 1.93. It clearly indicated that, banana is a profitable cash crop. Hence, hypothesis I was proved.

Table 4.10 Per hectare Profitability of Banana

(Rupees)

Sr. No.	Particulars	Size Group			
		Small	Medium	Large	Overall
1	Gross returns	609142.70	614926.70	659056.30	627708.57
2	Costs (Rs.)				
	i) Cost A	198837.54	189533.54	189859.09	192743.39
	ii) Cost B	306704.60	296580.26	303609.72	302298.19
	iii) Cost C	333214.76	321554.50	319243.87	324671.04
3	Profit (Rs.)				
	i) Cost A	410305.16	425393.16	469197.21	434965.18
	ii) Cost B	302438.10	318346.44	355446.58	325410.37
	iii) Cost C	275927.94	293372.40	339812.43	303037.52
4	Production	574.36	565.06	549.91	563.11
5	Per Qtl cost of production	580.15	569.06	580.54	576.58
6	Output-Input ratio				
	i) Cost A	3.06	3.24	3.47	3.26
	ii) Cost B	1.99	2.07	2.17	2.08
	iii) Cost C	1.83	1.90	2.06	1.93

Gross returns obtained at overall level were Rs.627708.57. Gross returns obtained in large size group were significantly higher than small and medium size group. At overall level, Cost ‘A’ was Rs.192743.39, Cost ‘B’ was Rs.302298.19 and Cost ‘C’ was Rs.324671.04 and total production was 563.11 quintals. In small group total production was 574.36 quintal followed by medium size group (565.06 quintal) and small large group (549.91 quintal). Per quintal cost of production were Rs.580.15, Rs.569.06 and Rs.580.54 in small, medium and large size group, respectively. At overall level, output-input ratio at Cost ‘A’ was 3.26 followed by 2.08 at Cost ‘B’ and 1.93 at Cost ‘C’.

4.4 Functional Analysis

4.4.1 Cobb-Douglas Production Function

The Cobb- Douglas type of production function was found to be “best fit” to present data. The regression coefficients for identified resources for Banana are presented in Table 4.11. It was observed that at overall level the magnitude of coefficient of multiple determination (R^2) was 0.92, indicated that 92 per cent variation in Banana production was explained by variables included in the function.

Table 4.11 Results of Estimated Cobb-Douglas Production Function

Sr. No.	Variables	Regression coefficients
1	Constant (Intercept)	0.1624 (1.2596)
2	Seed (X_1)	0.6898** (0.3091)
3	Male (X_2)	-0.0530^{NS} (0.0351)
4	Female (X_3)	-0.0633*** (0.0172)
5	Manure (X_4)	0.1816** (0.0700)
6	N (X_5)	-0.2350** (0.1131)
7	P (X_6)	-0.0496** (0.0237)
8	K (X_7)	0.0105** (0.0051)
9	Irrigation Cost (X_8)	0.3573** (0.0775)
10	Plant Protection Cost (X_9)	-0.2401*** (0.0633)
	R^2	**0.92**

(Figures in parentheses indicates standard error)

*** - Significance at 1 % level * - Significance at 10% level

** - Significance at 5 % level NS - Non significant

It is also revealed from the data presented in table 4.11 that the elasticity coefficients for seed (X_1), manure (X_4), K (X_7) and irrigation cost (X_8) were positive and statistically significant at 5 per cent level of significance, male labour (X_2) was negative and found statistically non significant, female labour (X_3) and plant protection cost (X_9) were negative and found statistically significant at 1 per cent level of significance. N (X_5) and P (X_6) were found negative and statistically significant at 5 per cent level of significance. This may be because of their excess use than recommended level. The R^2 was 0.92 indicating 92 per cent variation in the yield of Banana caused by the input factors.

4.4.2 Resource Use Efficiency in Banana Production

The resource use efficiency was studied and the marginal value of product (MVP) of each explanatory variables were computed with factor cost (FC) to know the resource use efficiency of farmer and the results are presented in Table 4.12. The data revealed that, the ratio of MVP/Px was found greater than unity in case of seed, manures and irrigation indicated the underutilization of these resources. The ratio of MVP/Px is less than unity in case of human labour, nitrogen, phosphorous, potassium and plant protection charges etc. which showed excess utilization of these resources. Use of these resources should be curtailed down for maximization of profit. Hence, hypothesis II was proved.

Table 4.12 Marginal Value Product in Banana Cultivation

Sr. No.	Resources	M.V.P.	F.C.(Px)	MVP/FC	Remarks
1	Seed (X1)	100.17	13	7.71	Underutilization
2	Male (X2)	-964.14	300	-3.21	Excess
3	Female (X3)	-524.50	200	-2.62	Excess
4	Manure (X4)	547.63	100	5.48	Underutilization
5	N (X5)	-376.93	5.34	-70.59	Excess
6	P (X6)	-253.03	126	-2.00	Excess
7	K (X7)	10.72	19	0.56	Excess
8	Irrigation Charges	19.43	1	19.43	Underutilization
9	Plant Protection Charges	-20.88	1	-20.88	Excess

4.5 Marketing Aspects of Banana

In marketing, the agricultural produce has to undergo a series of operations before it finally reaches to the consumers. The marketing process, therefore, has been regarded as a part and parcel of the production activity. The ultimate success of any commodity largely depends upon the ease and significance in the marketing of the produce; so it is important to study the various market functions involved in marketing of banana.

4.5.1 Harvesting

The banana is highly perishable fruit, which needs careful harvesting of bunches at proper stage of maturity so as to fetch better prices in market. The banana fruit generally attains maturity at 80 to 110 days from shooting. The maturity indices include duration as per the variety and rounding of ridges with pulp to skin ratio 70:30, dark green to yellowish color of fruit. The bunch should be removed by keeping the sufficient handling space above the banana hands.

4.5.2 Assembling

Assembling is the primary and the most important marketing practice. It implies gathering of farm produce prior to its distribution. Where the producing areas are at a longer distance from the consuming centers, assembling reduces the cost of marketing. It is observed in the study area that the pre-harvest contractor assembles the produce of banana and arranges for its transport to the market.

4.5.3 Grading and standardization

Grading and standardization of banana help in getting better prices. There are no specific standards and grades known to the cultivators. However, banana are graded as small, medium and large based on size.

4.5.4 Packaging

Better packing always helps in maintaining the quality and reducing losses during the transportation. The durability of packaging material, its cost, suitability of handling and ability to maintain keeping quality of banana are the important points to be considered in the light of distances of markets and mode of transport.

4.5.5 Transportation

Transportation by motor trucks and tempos today has become very common owing to need for unloading and delivery of goods to the traders. As bananas are sold in large quantities tempos and trucks are commonly used for transport of produce from the field to the market.

4.5.6 Storage

Banana being a perishable commodity needs most proper storage, not only for better prices but also for regular supply. At the time of survey, it is observed that, the farmers are not stored banana on his farm but the wholesalers and retailers store banana in different storage units for the regular supply of banana in the market.

4.5.7 Production and Disposal Pattern of Banana

The total produce of Banana was disposed off as home consumption, gratis, losses due to wind, losses due to pests and diseases and the rest was marketed. The information regarding the disposal pattern of Banana is given in Table 4.13.

It is revealed that, the per hectare total quantity of Banana produced were 574.36 quintals, 565.06 quintals and 549.91 quintals in small, medium and large size groups, respectively. Out of this total production, 0.14 per cent was used for home consumption by small groups, whereas 0.15 per cent and 0.15 per cent were used for home consumption for medium and large size groups, respectively. The per hectare losses due to wind were 0.49 per cent, 0.42 per cent and 0.38 per cent in small, medium and large groups. The per hectare quantity lost due to pests and diseases were

0.38 per cent, 0.33 per cent and 0.25 per cent of total produce for small, medium and large groups respectively. At overall level quantity used for gratis were worked out to 0.12 per cent of the total produce.

Table 4.13 Production and disposal pattern of Banana growers

(Qtl./ha)

Sr. No.	Particulars	Size Groups			Overall
		Small	Medium	Large	
1	Total Production	574.36	565.06	549.91	563.11
		(100.00)	(100.00)	(100.00)	(100.00)
2	Home consumption	0.80	0.87	0.89	0.85
		(0.14)	(0.15)	(0.15)	(0.15)
3	Gratis	0.65	0.67	0.68	0.67
		(0.11)	(0.12)	(0.13)	(0.12)
4	Losses due to wind	2.86	2.33	2.11	2.31
		(0.49)	(0.42)	(0.38)	(0.43)
5	Losses due to pest and diseases	2.96	1.91	1.33	1.81
		(0.38)	(0.33)	(0.25)	(0.32)
6	Marketable quantity	567.86	559.28	544.90	557.35
		(98.88)	(98.98)	(99.09)	(98.98)

(Figures in parentheses indicates percentage to the total production)

4.5.8 Marketing Channels in Banana Marketing

Marketing channels are the alternative routes of product-flows from producers to consumers. In the study area farmers used following three major channels for marketing of banana.

- Channel-I
  Producer ➤ Consumer
- Channel-II
  Producer ➤ Pre-harvest contractor ➤ Wholesaler ➤ Retailer ➤ Consumer
- Channel- III
  Producer ➤ Wholesaler ➤ Retailer ➤ Consumer

Among the three marketing channels, the most commonly used channel for marketing of Banana in the study area was Channel-II as 73.55 per cent of the produce marketed through this channel. The detailed information on the quantity of produce sold through different channels by the Banana growers in different markets is presented in Table 4.14

Table 4.14 Channel wise quantity of Banana marketed

(Qtl./ha)

Sr. No.	Channel	Size Groups			Overall
		Small	Medium	Large	
1	I	71.76 (12.64)	33.96 (6.08)	16.23 (2.98)	40.65 (7.23)
2	II	387.89 (68.31)	400.19 (71.55)	440.29 (80.80)	409.46 (73.55)
3	III	108.21 (19.05)	125.13 (22.37)	88.38 (16.22)	107.24 (19.22)
	Total	567.86 (100.00)	559.28 (100.00)	544.90 (100.00)	557.35 (100.00)

(Figure in parentheses indicates percentage to the total)

It can be seen that there are three different marketing channels for Banana. It was observed that at the overall level, marketing Channel-II (Producer – Pre-harvest contractor – Wholesaler - Retailer- Consumer) was the most preferred channel through which 73.55 per cent of the total produce was marketed followed by Channel-III (Producer – Wholesaler - Retailer- Consumer) and Channel I (Producer - Consumer) through which 19.22 and 7.23 per cent, respectively of the total produce was marketed.

In small size group total quantity sold through Channel I was 12.64 per cent while it was 68.31 per cent through Channel II and 19.05 per cent through Channel III. In medium size group, 6.08, 71.55 and 22.37 per cent produce were marketed through Channel I, II and III respectively. In large size group, 2.98, 80.80 and 16.22 per cent produce marketed through Channel I, II and III, respectively.

4.5.9 Marketing costs, Price spread in Marketing Channels of Banana

The marketing cost is the sum total of all costs incurred in the movement of produce and includes costs such as loading, unloading, packing, transportation, market fee, commission etc. The costs incurred by producer seller and the intermediaries in handling Banana were worked out and presented in following table.

In Channel I, there was negligible marketing cost incurred and there was no market margin. At overall level, total marketing cost incurred by producer is Rs.81.41. This cost was especially due to the ripening, transportation and losses faced by producer while selling their produce.

Table 4.15 Marketing Costs and Price spread in Marketing Channels of Banana

(Rs./Qtl.)

Sr. No.	Particulars	Channel I	Channel II	Channel III
1	Gross price received by the farmer	1749.88 (100.00)	1250 (60.17)	1280 (67.69)
	i) Marketing cost	81.41 (4.65)	0.00 (0.00)	0.00 (0.00)
	ii) Net price realized	1668.47 (95.35)	1250.00 (60.17)	1280 (67.69)
2	Pre-harvest contractor			
	i) Price paid	-	1250.00 (60.17)	-
	ii) Marketing cost	-	50.50	-
		-	(2.43)	-
	iii) Marketing margin	-	60.00 (2.88)	-
	iv) Price received	-	1360.50 (65.49)	-
3	Wholesaler	-		-
	i) Price paid	-	1360.50 (65.49)	1280.00 (67.69)
	ii) Marketing cost	-	325.00	310.00
		-	(15.64)	(16.39)
	iii) Marketing margin	-	200.00 (9.62)	150 (7.93)
	iv) Price received	-	1885.50	1740.00
		-	(90.76)	(92.01)
4	Retailer	-		
	i) Price paid	-	1885.50 (90.76)	1740.00 (92.01)
	ii) Marketing cost	-	92.00 (4.43)	91.00 (4.81)
	iii) Marketing margin	-	100.00 (4.81)	60.00 (3.18)
	iv) Price received	-	2077.50 (100.00)	1891.00 (100.00)
5	Consumer			
	Price paid	1749.88 (100.00)	2077.50 (100.00)	1891.00 (100.00)
	Price spread	81.41	827.50	611.00

(Figures in parentheses indicates percentage to the total price paid by consumer)

In Channel II, producer did not incur any expenditure towards marketing of Banana because pre-harvest contractor purchased the product from the producer from the production centers itself and thus saved marketing expenses, only the some amount of losses were faced by producer while selling their produce. Marketing of produce through Channel III happened same way as of Channel II.

Price spread is the difference between price paid by consumer and price received by producer. This consists of marketing costs and margins of the different intermediaries. The costs and margins of agency in different channels were worked out and details are presented in Table 4.15.

It is observed from the Table 4.15 that, the net per quintal cost incurred were Rs.81.41, Rs.827.50 and Rs.611.00 in Channel I, II, and III, respectively. Per quintal cost was high in Channel II because so many intermediaries included in that channel and produce was marketed to distant markets.

In Channel II, marketing cost incurred by Wholesaler (Rs. 325.00) was more than any other intermediate. Also, marketing margin was observed high for Wholesaler (Rs.200.00). Net price received by producer in Channel I was more than rest on Channels. It was happened because there were no intermediaries included in this channel. There is difference between net price received by producer in Channel II and Channel III was due to produce marketed through Channel III was received low price.

4.5.10 Marketing Efficiency of Banana

The Shepherd's method was followed for measuring the marketing efficiency of each channel. The results of marketing efficiency are given in Table. 4.16.

It is observed from Table 4.16 that, the marketing cost incurred in Channels I, II and III were Rs.81.41, Rs.467.50 and Rs.401.00, respectively. There was no margin incurred in Channel I, but it was up to Rs. 352.00 in Channel II and Rs.210.00 in Channel III. Price paid by consumer in Channel II was Rs.2077.50 followed by Channel II Rs.1891.00 and Channel I Rs.1749.88. The marketing efficiency was higher in Channel I (21.49) than that of Channel II (2.51) and Channel III (3.09).

Table 4.16 Marketing Efficiency of Identified Channels of Banana

(Rupees)

Sr. No.	Particulars	Channel I	Channel II	Channel III
1	Net price Received by the farmer	1668.47	1250.00	1280.00
2	Total marketing cost	81.41	467.5	401.00
3	Total marketing margin	0.00	352.00	210.00
	MM+MC	81.41	827.50	611.00
4	Price paid by consumer	1749.88	2077.50	1891.00
5	Marketing efficiency ratio	21.49	2.51	3.09

The higher marketing cost and margin in channel II and III resulted into poor efficiency of this channel. Thus the analysis indicated that marketing of Banana directly by farmer without intervention to consumer was most effective and beneficial but it was done rarely as, farmers are unable to sell large quantities of banana due to perishability of produce, bulkiness of produce and high transportation cost.

4.6 Problems Faced by Banana growers in Production and Marketing

The study of constraints or problems faced by the farmers is one of the important aspects of the research.

Table 4.17 Problems Faced by Banana Growers

Sr. No.	Constraints	Number in respective priorities					Total recorded responses	RPI	Rank
	Production Issues	**I**	**II**	**III**	**IV**	**V**			
1	Disease occurrence	2	19	7	13	2	43	0.30	**V**
2	High prices of seedlings	30	13	15	14	18	90	0.65	**II**
3	Lack of quality seedlings	11	8	11	10	10	50	0.33	**III**
4	Inadequate labour availability	7	9	12	8	10	46	0.29	**VI**
5	Losses due to high wind velocity	21	19	18	21	19	98	0.66	**I**
6	Lack of credit facility	8	10	10	8	13	49	0.31	**IV**
7	High labour charges	6	6	9	9	11	41	0.19	**VIII**
8	Weed infestation	5	6	8	7	7	33	0.21	**VII**
	Total	**90**	**90**	**90**	**90**	**90**	**450**		
	Marketing Issues								
1	Price fluctuations	68	55	62	58	57	300	2.04	**I**
2	Lack of storage facilities	15	26	20	22	24	107	0.68	**II**
3	Delay in payment	7	9	8	10	9	43	0.28	**III**
	Total	**90**	**90**	**90**	**90**	**90**	**450**		

Farmers were asked to list out their problems. Problems were ranked according to priority of farmer. All these were sorted and screened and finally major constraints were identified. Ranks are given according to RPI value as shown in Table 4.17. High value of RPI has given first rank. The major production problem faced by the Banana growers was losses due to high wind velocity with RPI value 0.66 having rank I followed by high prices of seedlings with RPI value 0.65 (rank II) and lack of quality seedlings with RPI value 0.33 (rank III), lack of credit facilities, disease occurrence, inadequate labour availability, weed infestation etc. Marketing problem faced by growers were price fluctuation with RPI value 2.04 (rank I) followed by lack of storage facilities and delayed payment with RPI value 0.68 and 0.28.

5. SUMMARY AND CONCLUSIONS

5.1 SUMMARY

Banana (*Musa paradisiaca* L.) belong to the family Musaceae. It is one of the oldest fruit known to mankind. Its antiquity can be traced back to the garden of paradise where 'Eve' was said to have used its leaves to cover her modesty, may be one of the reason why banana is called the "Apple of paradise". It is also known as "Adam Fig". Though originated in South East Asia, it is widely grown in India, China, Philippines, Brazil, Indonesia etc. A banana is an elongated, edible fruit – botanically a berry. The fruit is variable in size, colour and firmness, but it is elongated and curved, with soft flesh rich in starch covered with a rind, which may be green, yellow, red, purple, or brown when ripe.

The medicinal uses of banana have earned it a place among the most healing herb around the world, with a long history of traditional applications. Banana is one of the best source of potassium which is necessary for maintain normal blood pressure and heart function. Banana powder is used as first baby food. Consumption of banana helps in lowering cholesterol. Also it has antacid effect that protect against stomach ulcer. Banana contains 25% of the recommended daily allowance for vitamin B6, necessary for producing antibodies and red blood cells. As it is high in iron, it stimulates the production of hemoglobin in the blood and so helps in cases of anemia. In India, total area under banana cultivation 884 thousand hectares with production of 30807.50 thousand MT with productivity of 34.90 T/ha in the year 2017-18. Maharashtra state in India ranks fourth in area (0.80 Lakh hectares) and third in production (42.09 Lakh MT) with productivity of 52.05 T/ha. In Solapur district 700 ha area is under banana cultivation. To know the production, costs, returns, profitability and marketing aspects of banana cultivation across different farms, the present study "Economics of Production and Marketing of Banana in Solapur District of Maharashtra" was undertaken with following objectives.

1. To study the resource use, costs and returns of banana production.
2. To estimate resource use efficiency of inputs.
3. To estimate the marketing costs, price spread and marketing efficiency of banana production.
4. To study the problems in production and marketing of banana.

The data regarding input use, cost and production of banana were collected from selected banana growers by survey method. The selected cultivators were interviewed personally with the help of schedule specially designed for the purpose. The information and data collected in present study for the year 2018-19.

The information on marketing cost and market margins were also collected from the selected intermediaries. Keeping in view objectives of study, the data were analyzed. Marketing costs, market margin, price spread and producer's share in consumer's rupee for each channel of marketing was calculated separately.

The sampling method followed for selection of banana growers consisted of three stage sampling viz., selection of tahsil, selection of villages and selection of banana growers. Out of eleven tahsil in district, two tahsil were selected purposively on the basis of highest area under banana. The total area under banana crop was found more in Malshiras and Madha tahsil. Three villages from each tahsil were selected purposively on the basis of area highest under banana. From each village 15 banana growers were selected on the basis of area i.e., below 0.40 ha, 0.41ha – 0.80 ha and above 0.81 ha which constituted a total sample size of 90 growers. Thus analysis was carried out in respect of 90 sample banana growers. These data was subjected to various statistical tools and techniques to derive meaningful results. The findings of the study are summarized below.

Based on size of holding under banana crop, banana growers were classified into three categories. Out of the total 90 sample of banana growers, 30 samples each of small, medium and large size groups were studied. The average age of banana grower (head of family) was 46.79 years with average education attained was 11.00. At overall level, average members in family were 6.92 person out of which, 2.79 people were actually working on the farm. At overall level majority (73.33 per cent) banana growers had farming as a main occupation without any subsidiary occupation, (13.33 per cent) had farming as main occupation along with business as subsidiary occupation, and (8.89 per cent) had service as a main occupation and (4.44 per cent) had business as their main occupation along with farming as subsidiary occupation.

Per farm average size of holding for banana was 0.67 ha. Average size of banana was 0.32 ha in small, 0.61 ha in medium and 1.07 ha in large size groups. Per farm net cultivated area was 2.22 ha (95.21 per cent) at overall level. The fallow area was 0.12 ha (4.79 per cent). The area under banana cultivation ranged from 13.91 per cent to 30.92 per cent with 22.73 per cent at the overall level. The cropping intensity was worked out to 126.27 per cent at the overall level.

Per hectare input utilized for banana, at overall level was 118.58 human days, 4427.88 seedlings, 22.68 tonnes of manure and 399.60 N, 126.11 P, 720.29 K kg fertilizer. Per hectare cost of cultivation of banana was worked out to Rs.324671.04. Among the different items of cost A, the imputed cost on seedlings was maximum i.e. Rs. 57857.67 (17.82 per cent).Cost A contributed 59.37 per cent to the total cost. Cost B contributed 93.11 per cent of total cost. In between three size groups, per hectare cost was highest in case of small size group (Rs.333214.76) followed by medium (Rs.321554.50) and large (Rs.319243.87). Cost C of small farmer was significantly higher than medium and large size group, while there was significant difference of Cost A between medium and small size group.

Per hectare gross returns received were Rs.609142.70 for small group, Rs.614926.70 for medium and Rs.659056.30 for large group. Per hectare gross returns for large group is more as compared to small and medium size groups. The benefit cost ratio at overall level was 1.93:1. The ratio was more than unity, indicated that the banana production is profitable. The Cobb-Douglas type of production function was found to be "best fit" to the present study, the elasticity coefficients for seed (X_1), manure (X_4), K (X_7) and irrigation cost (X_8) were positive and found statistically significant at 5 per cent level of probability. Male labour (X_2) was found negative and non-significant. Female labour (X_3) and plant protection cost (X_9) were negatively significant at 1 per cent level. Whereas, the elasticity coefficient for N (X_5) and P (X_9) found negative and statistically significant at 5 per level of probability. The R^2 was 0.92 indicating 92 per cent variation in the yield of banana caused by the input factors.

The ratio of MVP/P_X was greater than unity in case of Seed, manure and irrigation charges indicated the underutilization of these resource. The ratio of MVP/P_X was less than unity in case of male labour, female labour, N, P, K and plant protection charges etc. which showed excess utilization of these resources. Use of these resources should be curtailed down for maximization of profit.

The total production of banana at overall level was 563.11 qtls. Out of total quantity losses due to high wind velocity had maximum share around 0.42 per cent. The overall marketable surplus was 98.98 per cent. Further in the marketing of banana, following three marketing channels were observed in study area.

Channel-I: Producer-Consumer

Channel-II: Producer-Pre-harvest contractor-Wholesaler-Retailer-Consumer

Channel III: Producer-Wholesaler-Retailer-Consumer

Total quantity marketed per hectare, at overall level was 557.35 qtl, out of which 409.46 qtl. was marketed through Channel II, 40.65 qtl. was marketed directly through Channel I and 107.24 qtl. marketed through channel III. Cost of marketing in Channel I was very less (Rs.81.41), as it was direct channel from producer to consumer. Cost of marketing in channel II was highest for wholesaler (Rs. 325.00), cost incurred by pre-harvest contractor in Channel II was (Rs.50.50) and that by retailer was (Rs.92.00).

Net price received by producer in Channel I was Rs.1668.47, in Channel II it was Rs.1250.00 and in channel III it was Rs.1280.00. Total marketing cost and market margin in Channel II was Rs.827.50 and Rs.611.00 in Channel III. In Channel I, marketing cost (mainly because of transportation and losses faced by producer) was Rs.81.41 and there was no market margin involved. The producer's share in consumer's rupee was more in Channel I (95.35 per cent) followed by Channel III (67.69 per cent), Channel II (60.17 per cent). The marketing efficiency was much higher in channel I (21.49) than that of Channel III (3.09) and Channel II (2.51).

The major problems of banana growers in Solapur district were studied using RPI technique. In production and marketing of banana rank has given to problems faced by farmer and according to that losses due to high wind velocity was major problem followed by high prices of seedlings, lack of quality seedlings, lack of credit facilities, disease occurrence etc. Among the marketing problems price fluctuations was major problem followed by lack of storage facilities and delay in payment.

6.2 CONCLUSIONS

The present investigation was intended to depict the picture of the banana cultivation in Malshiras and Madha tahsil of Solapur district. The banana cultivation has assumed a pride place in economy as it is an important horticultural crop. In this investigation, it was found that all the banana growers in case of three groups was observed to be in profitable proposition.

1. Per hectare physical inputs used for banana at overall level was human labour (118.58 labour days), machine labour (13.61 hrs), manures (22.68 tonnes), fertilizers (399.60N, 126.115P and 720.29K), seedlings (4427.88 plants per hectare) and plant protection (Rs.7385.06). Use of manures was more in large size than small and medium group, use of machine labour was more in large group than medium and small group. In case of rest of inputs, their use were more in small group than medium and large size.
2. At overall level, per hectare cost of cultivation of banana was Rs.324671.07. The per hectare total cost of small size was significantly higher than medium and large size group. Cost ‘A’ contributed 59.37 per cent and Cost ‘B’ contributed 93.11 per cent of total cost. Among all costs incurred rental value of land had maximum share of 32.16 per cent.
3. At overall level, per hectare yield of banana was 563.11 qtl and per hectare gross returns were Rs.627708.57. Gross returns obtained to large size group was significantly higher than small and medium size group.
4. The benefit cost ratio at overall level was 1.93, indicating that banana production is profitable. Per quintal cost of production was Rs.576.58. Same trend observed among other size groups.
5. The R^2 was 0.92 indicating 92 per cent variation in the yield of banana caused by the input factors. The regression coefficients for seed (X_1), manure(X_4), K(X_7) and irrigation (X_8) were positive and statistically significant.
6. The ratio of MVP/Px is less than unity in case of male labour, female labour, nitrogen phosphorous and plant protection charges etc. which showed excess utilization of these resources. Use of these resources should be curtailed down for maximization of profit. Hence, hypothesis II was proved.

7. Per hectare total production of banana at overall level was 563.11 qtl. Total marketable quantity was 557.35 qtl. i.e. 98.98 per cent, same trend observed among other size groups.
8. At overall level, out of total marketable surplus, 7.23 per cent produce marketed through Channel I, 73.55 per cent through Channel II and 19.22 per cent through Channel III.
9. Total marketing cost and market margin in Channel II was Rs.827.50 and Rs.611.00.
10. Price paid by consumer was Rs. 1749.88, Rs. 2077.50 and Rs.1891.00 in Channel I, II and III, respectively. Price spread was Rs.81.41 in Channel I, Rs.827.50 in Channel II and Rs.611.00 in Channel III.
11. The producer's share in consumer's rupee was highest in Channel I followed by Channel III and Channel II. The marketing efficiency was much higher in channel I than that of channel II and Channel III.
12. The major problems observed in production and marketing of Banana in Solapur district rank wise were losses due to wind, high price of seedlings, disease occurrence, price fluctuations and lack of storage facilities etc.

6.3 POLICY IMPLICATIONS

- The resource use efficiency analysis indicated the excess use of chemical fertilizers and plant protection measures in the study area suggest that farmers should use appropriate quantity of fertilizers and plant protection chemicals to reduce cost of production.
- Individual purchasing of banana seedlings by banana growers should come together and place bulk order to get seedlings at cheaper rate.

6. LITERATURE CITED

Alagumani, T. (2005). Economic analysis of tissue-cultured banana and sucker-propagated banana. *Agric. Econ. Res. Rev.* **18**(1): 81-89.

Anap, V. N. and Dangore, U. T. (2013). Economics of production and marketing of banana in Wardha district. M.Sc. (Agri.) Thesis submitted to Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra.

Barkade, A.J., Lokhande, T. N. and Todkari, G. U. (2011). Economics of Onion Cultivation and its Marketing pattern in Satara District of Maharashtra, *Int. J. of Agric. Sci.* **3**(3): 110-117.

Begum, J. A. and Raha, S. K. (2002). Marketing of banana in selected areas of Bangladesh. *Econ. Affrs. Calcutta.* **47**(3): 158-166.

Bhardwaj, R. H., Sikka, B. H., Singh, A., Sharma, M. L., Singh, N. K. and Arya, A., 2011. Challenges and Constraints of Marketing and Export of Indian Spices in India, *Int. Conference on Technology and Business Management.* 28-30.

Chavan, A. A., Kalyankar, S. P. and Wakle, P.K. (2001). A study of marketing of banana in Parbhani market of Maharashtra state. *Bihar J. Agril. Mtkg.* **IX**(3): 316-318.

Dave, A. K., Zala, Y. C. and Pundir, R. S. (2016). Comparative economics of banana cultivation in Anand district of Gujarat. *Econ. Affrs.* **61**(2): 305-312.

Gajanana, T. M. (2002). Marketing practices and post-harvest loss assessment of banana var. Poovan in Tamil Nadu. *Ind. J. Agric. Mtkg.* **16**(1): 51-59.

Gajanana, T. M., Murthy, D. S., Sudha, M. and Dakshinamoorthy, v. (2009). Marketing and post-harvest losses in fruits: its implications on availability and economy. *Ind. J. of Agric. Econ.* **64**(2): 259-275.

Garde, N. A., Wahile, D. P., Gahane, D. S. and Thakare, D. K. (1992). Marketing efficiency and price spread in marketing of banana in Jalgaon market, Maharashtra. *J. Agric. Econ.* **4**(1): 36-37.

Guledgudda, S. S., Vishweshwar, Shripad and Olekar, J. N. (2002). Economics of banana cultivation and its marketing in Haveri district of Karnataka. *J. Agril. Mktg.* **16**(1): 51-58.

Gurikar R. (2014). Production and marketing management of onion in Gadag District-A management appraisal, thesis submitted to the University of Agric. Sci., Dharwad.

Hanumantraya, M. R., Kerutagi, M. G., Patil, B. L., Kanamandi, V. C. and Basavraj. (2009). Comparative economic analysis of tissue culture banana and sucker propagated banana production in Karnataka. *Karnataka J. Agri. Sci.* **22**(4): 810-815.

Jondhale and Nagargoje, S. R. (2018). Economic analysis of production and marketing of banana in Marathwada region. Ph.D. Thesis, (Unpublished) submitted to V.N.M.K.V., Parbhani.

Kameswara Rao, G. (2000). Comparative economics of banana and sugarcane cultivation in Tungabhadra command area of Karnataka. M.Sc. (Agri.) Thesis submitted to University of Agriculture Sciences, Dharwad(India).

Kukute, B. V., Shendage, P. N., Jadhav, K. L. and Nirgude, R. R. (2010). Marketing of banana in Pune district of Maharashtra. *Indian J. of Agril. Mktg.* **24**(2): 178-187.

Kumar, A. 2011. Economics of Production and Marketing of Ginger in Nainital District of Uttarakhand , *Int. J. of Agric. Mktg.* **49** (2):1-4.

Kumar, R., Jain, S., Kumar, L. and Sen, c. (2015). Resource use efficiency and constraints in production and marketing of tissue culture and sucker propagated banana. *Inter. J. of Agril. Sci. & Res.* **5**(1): 1-10.

Kumari, P., Kumar, S. and Ratnam, S. (2018). Price spread and marketing of banana in Vaishali district (Bihar). *Internat. J. of Chem. Stud.* **6**(3): 1966-1969.

Khedakar, S. R., Bondkar, U. S. and Daundkar, K. S. (2015). Economics of production of banana in Kolhapur district of Maharashtra. *Internat. Res. J. Agric. Eco. & Stat.* **6**(2): 336-341.

Mali, B. K., Bhosale, S. S., Shendage, P. N. and Kale, P. V. (2003). Economics of production and marketing of banana in Jalgaon district of Western Maharashtra. *Indian J. Agric. Mark.* **17**(1): 173-181.

Maurya, O. P., Singh, G. N. and Kushwaha, R. K. (1996). Profitability of banana plantation in Hajipur district in Bihar. *Bihar J. of Agril. Mktg.* **4**(1): 68-70.

Mishra, J. P., Ramchandra, and Rawat, S. K. (2000). Production and marketing of banana in Gorakhpur district of Uttar Pradesh. *Indian J. of Agril. Mktg.* **42**(4): 36-40.

More, S. S. (1999). Economics of production and marketing of banana in Maharashtra state. M.Sc. (Agri.) Thesis (Unpublished) submitted to University of Agriculture Sciences, Dharwad (Karnataka state).

More, S. S., Shelake, R. D., and Kalyankar, S. (2006). Labour utilization and input use pattern in banana cultivation. *Indian J. Agril. Mktg.* **48**(1): 21-23.

Mungalpara and Kaushik, U. (2017). Economics of production and marketing of banana in Bharuch district of South Gujarat. M.Sc. (Agri.) Thesis submitted to Navasari Agriculture University, Navasari.

Naduvrnamani, Raghavendra and Mamle Desai, N. R. (2007). Economics of red banana production under the contract farming in Karnataka. *Karnataka J. Agril. Sci.* **20**(4): 933-938.

Nayak, A. K., Kumar, D. and Singh, N. (2018). An economic analysis of marketing of banana in Durg district of Chhattisgarh. *Internat. J. of Agril. Econ, & Stat.* **9**(1): 1-8.

Nandi, J. A., Yurkush, E. N., Ashiko, T.G. (2011). Resource use efficiency among Ginger farmers in Kaduna state, Nigeria. *J. of Agric. Forestry and the Social Sci.* **2**(9):1-6.

Patil, S. B. (2005). Economics of production and marketing of banana in Jalgaon district. M.Sc. (Agri.) Thesis (Unpublished) submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Patil, S. S. and Leua, A. K. (2011). A comparative study on economics and marketing of tissue culture and sucker banana in South Gujarat. M.Sc. (Agri.) Thesis submitted to Navasari Agriculture University, Navsari.

Rane, A. A. and Bagade, S. R. (2006). Economics of production and marketing of banana in Sindhudurg district, Maharashtra. *Indian J. of Agril. Econ.* **20**(1): 38-45.

Sarode, S. C. (2009). Economics of banana marketing in Jalgaon district: An analysis across alternative channels. *African J. of Marketing Management.* **1**(5): 128-132.

Senthilnahan, S. and Shrinivasan, R. (1994). Production and marketing of Poovan banana in Tiruchirapalli district. *Indian J. of Agril. Mktg*. **8**(1): 46-53.

Singh, H. K., Singh, D., Singh, K. K. and Singh, S. (2017). Banana farming as a business: An economic study of banana growers in Fatehpur district of Uttar Pradesh. *Bull. Env. Pharmacol. Life. Sci.* **6**(3): 149-154.

Sudha, M.,Shrinivasa, M. D. and Gajanana, T. M. (2005). Post harvest handling and marketing of banana (CV Tella Chakkara Keli) in Rajahmundry region of Andhra Pradesh. *Ind. J. Agri. Mktg.* **19**(1): 25-37.

Suresh, A. and Keshavreddy, T. R. (2004). An economic analysis of banana cultivation in Pecchi command area of Thrissur district of Kerala state. *Agril. Situ. In India.* **61**(9): 629-631.

Telang, S. R. and Khobarkar, V. K. (2016). Economics of production and marketing of banana in Washim district. M.Sc. (Agri.) Thesis submitted to Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

Thomas, E. K. and Gupta, S. K. (1987). Economics of banana cultivation: A case study in Kottayam district of Kerala. *Indian J. of Agril. Econ.* **42**(3): 458-464.

Yadnik, P. S. (2005). Marketing management of banana cultivation in Jalgaon district. M.Sc. (Agri.) Thesis (Unpublished) submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Yadav (2000). A study of tissue culture banana cultivation in Parbhani district of Maharashtra state. *Karnataka J. Agril. Sci.* **18**(3): 735-739.

7. APPENDIX

Part-I

Questionnaire

"Economics of Production and Marketing of Banana in Solapur district of Maharashtra"

Name of Banana grower :

Age : Education: Occupation :

Village : Tal : District:

Phone No.

1. **Family information**

Sr. No.	Name	Relationship with head of family	Age (years)	Education	Occupation	Income (Rs.)

2. Land use Pattern

Sr. No.	Survey No.	Soil type	Total holding (ha.)	Permanent Fallow (ha.)	Operational holding (ha.)		Current fellow (ha.)	Land revenue (Rs.)	Present value (Rs.)
					Irrigated	Rainfed			

3. Cropping pattern (2018-19)

Sr. No.	Season	Crop	Area (ha)		Production (qt./tones)		Income (Rs.)
			Irrigated	Rainfed	Main	By	
1.	Kharif	1 2 3 4 5 6					
2.	Rabi	1 2 3 4 5 6					
3.	Summer	1 2 3 4 5 6					
4.	Annual	1 2 3 4					
5.	Fruit crops	1 2 3					
6.	Vegetables	1 2 3 4 5					

4. Buildings

Sr. No.	Building type	Size	Building year	Present Vale (Rs.)	Repairing charges (Rs.)	Remaining life (years)
1	House					
2	Farm house					
3	Cattle shed					
4	Store house					
5	Shop					
6	Other					

5. Irrigation Structure

Sr. No	Type	Digging/ Purchasing Year	Present value (Rs.)	Irrigation capacity (ha)	Remaining life (years)	Repairing Charges (Rs.)
1	Well					
2	Bore-well					
3	Pipe line(m/f)					
4	Electric motor (hp)					
5	Diesel engine					
6	Drip system					
7	Other					

6. Farm Implements and Machineries

Sr. No	Particulars	Number	Purchase Year	Purchase Cost (Rs.)	Repairing Charges (Rs.)	Remaining Life (Years)
A	**Implements**					
1	Wooden plough					
2	Iron plough					
3	Bullock card					
4	Harrow					
5	Seed drill					
6	Hoes					
7	Other					
B	**Machineries**					
1	Tractor					
a.	Trolly					
b.	Rotavator					
c.	Plough					
d.	Harrow					
2	Thresher					
3	Spray pump					
4	Other					

7. Livestock

Sr. No	Type	Number	Age (years)	Present value (₹)	Remaining life (years)	Medicinal Charges (₹)
1	Bullock					
2	Cow					
a.	Local					
	Milch					
	Dry					
b.	Hybrid					
	Milch					
	Dry					
c.	Calves					
3.	Buffalo					
a.	Pandharpuri					
	Milch					
	Dry					
b.	Other					
c.	Calves					
4.	Goat					
5.	Sheep					
6.	Poultry					
7.	Other					

8. Cost of cultivation

Area : Date of planting :

Variety : Planting distance :

Sr. No	Operation	Labour			Cost in Rs.			Total cost Rs.
		Male (days)	Female (days)	Machinery (hrs.)	Male	Female	Machinery	
A.	**Preperatory tillage operations**							
1.	Ploughing							
2.	Harrowing							
3.	Leveling							
4.	F.Y.M. application							
5.	Layout							
B.	**Planting**							
1.	Marking of land							
2.	Digging of pits							
3.	Planting suckers/seedlings in pits							
	Transportation							
C.	**Fertilizer application**							
1.	N							
2.	P							
3.	K							
4.	Micronutrients							
D.	**Intercultural operations**							
1.	Gap filling							
2.	Irrigation							
3.	Earthing up							
4.	Weeding							
5.	Desuckering							

6.	Detaching inflorence							
7.	Propping							
E.	**Plant protectin**							
1.	Fungicides							
2.	Pesticides							
F.	**Harvesting**							
G.	**Transportation**							

Yield :

a) Main produce: _______________Tonnes Value (Rs.) : ________

b) By-produce: _________________Tonnes Value (Rs.) : ________

9. Production and disposal of Banana

Sr. No.	Mode	Quantity (q)	Value (Rs.)
1	Total production (q/tones)		
2	Home consumption (kg/q)		
3	Gratis (kg/q)		
4	Wage payment (kg/q)		
5	Quantity sold (kg/q)		

10. Marketing cost of Banana

Sr. No.	Place of marketing	Monthly Qty. sold (q)	Packing cost (Rs.)	Transport cost(Rs.)	Market expenses(Rs.)			Total marketing cost (Rs.)
					Hamali	Other charges	Commission charges	

11 Marketing Channels

1.

2.

3.

4.

12 Problems in Banana production

1.
2.
3.

13. Problems in Banana marketing

1. Problems in grading

i.

ii.

2. Packaging problem

i.

ii.

3. Transport problems

i.
ii.

4. Marketing problems
i
ii
5. Do you think that commission charges are higher ? Yes/No
6. Does trader give money in time? Yes/No
7. What did you do when marketing is do not done in time?

PART II
MARKETING OF BANANA

1. General information :-

i. Name of Market :

ii. Distance :

2. Retention and marketed surplus of Banana (q/farm)

Sr. No.	Particulars	Qty.
1.	Production of main produce on farm	
2.	a) Retained for family consumption	
	b) Damage	
	c) Other	
	d) Total retention	
3.	Marketed surplus	
	Channel-I (Producer-Consumer)	
	Channel-II (Producer-Wholesaler-Consumer)	
	Channel-III (Producer-Village trader-Wholesaler-Consumer)	
	Total	

3. Cost of marketing incurred by producer

Sr. No	Items of cost	Channel-I	Channel-II	Channel-III
1.	Loading/Unloading charges			
2.	Transportation charges			
3.	Weighing and cleaning charges			
4.	Commission charges			
5.	Market fees			
6.	Deduction			
7.	Per quintal price received by producer			
	Total			

4. Cost of marketing incurred by_____________ :-

Sr. No.	Item of cost	Amount (Rs./q.)
1.	Labour charges	
2.	Transport charges	
3.	Communication charges	
4.	Weighing charges	
5.	Per quintal price received by village trader	
6.	Other	
	Total	

5. Cost of marketing incurred by_____________ :-

Sr. No.	Item of cost	Amount (Rs./q.)
1.	Labour charges	
2.	Transport charges	
3.	License charges	
4.	Electric charges	
5.	Shop tax	
6.	Communication charges	
7.	Depreciation repairs on fixed assets	
8.	Interest in fixed assets	
9.	Market fees	
10.	Per quintal cost received by wholesaler	
11.	Other	
	Total	

VITAE

MISS. REDE BHARATI HARISHCHANDRA

MASTER OF SCIENCE (AGRICULTURE)

IN

AGRICULTURAL ECONOMICS

2020

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