ECONOMICS OF PRODUCTION AND MARKETING OF JALGAON BRINJAL

by

Miss. Tadavi Heena Jumma
(Reg. No. 18/210)

AGRICULTURAL ECONOMICS SECTION

RCSM COLLEGE OF AGRICULTURE, KOLHAPUR

MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI-413722, DIST-AHMEDNAGAR
MAHARASHTRA, INDIA
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A Thesis submitted to the

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In partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

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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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This is to certify that the thesis entitled, **“EXPORT PROSPECTIVE AND COMPETITIVENESS OF PADDY FROM INDIA”,** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar (M.S.) in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY (AGRICULTURE)** in **AGRICULTURAL ECONOMICS,** embodies the results of a piece of *bonafide* research work carried out by **Miss. ATLA JYOTI SUKARU,** 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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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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$	:	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

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

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,

Min 〖OP〗^ * + 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	

$$\mathbf{Y_t = 125.77 - 6.60T + 0.42T^2 + 0.02T^3 + e_t}$$

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.

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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 JALGAON BRINJAL",** 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. TADAVI HEENA JUMMA,** 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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This is to certify that the thesis entitled, "**ECONOMICS OF PRODUCTION AND MARKETING OF JALGAON BRINJAL",** 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. TADAVI HEENA JUMMA,** under the guidance and supervision of **Dr. H. R. SHINDE,** Assistant Professor, Agricultural Economics Section, 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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Place: Kolhapur

Date: / / 2020 *(H. J. Tadavi)*

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LIST OF ABBREVIATIONS

ICAR	: Indian Council of Agricultural Research
%	: Per cent
/	: Per
et al.	: And others (et alli)
Fig	: Figure
i.e	: That is
viz.	: Videlicet (Namely)
Mha	: Million hectare
q	: quintal
hrs	: hours
kg	: kilogram
Qty	: Quantity
Dist	: District
Tal	: Tehsil
N	: Nitrogen
P	: Phosphorous
K	: Potash

ABSTRACT

ECONOMICS OF PRODUCTION AND MARKETING OF JALGAON BRINJAL

by

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(Reg. No. K-18/210)

A Candidate for the degree
of
MASTER OF SCIENCE (AGRICULTURE)

In
AGRICULTURAL ECONOMICS
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2020

Research Guide	:	Dr. H. R. Shinde
Department	:	Agricultural Economics

The study viz. “Economics of production and marketing of Jalgaon Brinjal in Jalgaon district of Maharashtra” was conducted in six villages of Yawal and Bhusawal tehsil of Jalgaon district. The objective of the study was to estimate the resource use, cost returns and productivity of brinjal. Besides this marketing practices and patterns of disposal, marketing cost and price spread were studied. The problems faced by the farmers in production and marketing of Jalgaon brinjal in Jalgaon district were also examined. The study was based on the primary data of brinjal growers for the year 2018-19, spread over the six randomly selected villages of two tehsils. From each selected village, 15 growers, 5 from each size group viz. small, medium and large were randomly selected.

Thus the total sample consisted of 30 farmers each of small, medium and large size groups, the average per hectare use of resources such as human labour, bullock labour, machine power, seeds and manure was 592.22 man-days, 11.70 pair days, 2.25 hours, 1.43 kg and 31.18 tonnes respectively. The average use of fertilizers was 286.75 kg nitrogen 391.26 kg Phosphorus and 387.91 kg potash per hectare at all level. Per hectare cost cultivation of brinjal was estimated to ₹ 439518.49. Among the items of total cost, the rental value of land, human labour, bullock labour, manure, PPC, etc. were the major items of cost in the total cost of cultivation of brinjal. The cost 'A' and cost 'B' were ₹ 235159.04 and ₹ 426659.67 respectively. The average production of 225.99 quintal per hectare of produce was obtained from Jalgaon brinjal. The gross

returns of obtained were ₹ 1016970.00 at the overall level with B:C ratio was 2.31 and profit at cost ‘C’ ₹ 577451.51.

The average per quintal cost of marketing of Jalgaon brinjal in channel I was ₹ 65 at the overall level. Major items of marketing cost were packaging charges and transportation charges. It accounted for 61.54 and 38.46 percent respectively, while in the case of channel II and channel III the cost of marketing was ₹ 108.3 and ₹ 231.75 respectictively which is greater than that of channel I.

Price spread in marketing of Jalgaon brinjal was minimum in channel I due to intermediaries. In channel I, the producer's share in consumer's rupee was highest (98.56 per cent). In channel II, it was (67.83) per cent and (54.09) per cent in channel III. The net price received by the producer was maximum (₹ 4435/quintal) in channel I than that of channel II (₹ 3391.7/quintal) and channel III (₹ 3218.25 /quintal)

Regression coefficient of manure, Nitrogen, Phosphorus, Potash and irrigation cost were positive and significant while male labour, female labour were positive but non-significant. Plant protection cost was negatively significant. At overall level, there was a large variation amongst farmers.

The major production problems faced by the cultivars were, disease and pest occurrence, lack of credit facility, lack of storage facility, labour availability irregular electricity supply and weed infection. The major marketing problems expressed by farmers were price fluctuations and lack of market information.

Looking to overall situation of Jalgaon brinjal marketing, it can be seen that the producer's share in consumer's rupee was more in channel I compared to channel II and III due to involvement of intermediaries. Farmers should do direct marketing through producer's organization. There should be dissemination of market information, so that farmers can get remuneration and higher quality for Jalgaon brinjal. There is a need to advise the growers to use pesticides in less quantity as there plant protection charges were high because there were excess utilization of pesticides in cultivation of Jalgaon brinjal.

TADAVI H. J. **1 to 73**

1. INTRODUCTION

1.1 General

India is second largest producer of vegetables next to China. India grows the maximum number of vegetables in one or the other parts of the country. Vegetable cultivation is spread all over the country and is no more confined to rural areas. Vegetable cultivation has become commercial venture since it provided to be intellectually satisfying and economically rewarding.

Brinjal has origin in India. Its botanical name is *Solanum melongena L*. It belongs to family *Solanceae*. Different varieties of brinjal from private sector are bioseed companys-brinjal trishul, Ankur-Ajay, Mauli-Vishal, Gaurav-Panchganga etc. and released by various agricultural universities are Pusa purle Long, Bhagyamathi, Green Spiny, Polur, Swarna Shobha (HABR-4), Kashi Prakash (IVBR-1), Krishna, Mnjari gota, Vaishali, Pragati, Phule harit. In brinjal no endogenous toxins or significant levels of anti-nutritional factors have been found till date. It is so not considered a pathogen and is not capable of causing any disease in humans, animals or plants. Brinjal fruit are available throughout the year. It is used in curry preparation giving the taste of non vegetable food. The Bhurta is common dish in North India, prepared from brinjal. Bhurta is also famous in Khandesh region. Apart from this it is used as medicine to cure toothache and for diabetic patient. Besides from fruit leaves and seeds used in medicine. It has about 1.4 per cent protein, 4 per cent carbohydrate, 0.3 per cent fat, 0.3 per cent minerals and 1.3 per cent fibre. Vitamin C content is around 6mg/100g and vitamin A is 30 I.U. White cultivars contain twice as much crude fibre as the purple and green cultivars. The amino acid content is more in the purple cultivars than the white varieties. On the contrary, potassium and chloride content is highest in green and lowest in purple variety. Sometimes brinjal fruits taste bitter which is due to the presence of glycoalkaloids that are of wide occurrence in plants belonging to Solanaceae family. Generally, high amount of glycoalkaloids (20 mg/100g fresh wt.) produces a bitter taste and off flavour. In most of the commercial cultivars of India, usually glycoalkaloid contents vary from 0.37 to 4.83 mg/ 100g fresh weight. Studies on organic and mineral element analysis of matured brinjal fruits revealed that copper content and polyphenol oxidase activity is higher in the purple coloured fruits than in white cultivars, whereas iron content and catalase activity is highest in the green and lowest in white cultivars. Studies also suggested that the green cultivar had better processing properties than the more popular purple cultivars. The white cultivars, long white and round white, lack anthocyanins.

The production and consumption of vegetables has expanded enormously in recent years, with the global growth in the production of more than 50% in the last decade.The rate of increasing is much higher than for other commodities. Vegetables constitute important part of varied and healthy diet and provides significant amount of vitamin, antioxidants and other substances that prevent disease and contribute to an improvement in the quality of life. As a consequence, It is expected that in the coming years, Vegetable crop production will continue its expansion.

1.2 History of Brinjal Cultivation In India

Brinjal is native of india. Brinjal or eggplant is an important crop of sub-tropics and tropics. The name brinjal is popular in Indian subcontinent and is derived from Arabic and Sanskrit whereas the name eggplant has been derived from the shape of the fruit varieties which are white and resemble in shape to chicken eggs. It is also called aubergine (French word) in Europe. The brinjal is of much importance in the warm areas of Far East, being grown extensively in India, Bangladesh, Pakistan, China and the Philipines. It is also popular in Egypt, France, Italy, and United states. In India, it is one of the most common, popular and principal vegetable crop grown throuout the country except in higher altitudes, It is a versatile crop adopted in different agro-climatic regions and can be grown throughout the year. It is a perennial but grown commercially as an annual crop. A number of cultivars are grown in India, consumer preference being dependent upon fruit colour, size and shape.

1.3 Nutritive Value of Brinjal

Brinjal fruit (unripe) is primarily consumed as cooked vegetable in various ways and dried shoots are used as fuel in rural areas. It is low in calories and fats, contains mostly water, some protein, fibre and carbohydrates. It is a good source of minerals and vitamins and is rich in total water soluble sugars, free reducing sugars, amide proteins among other nutrients.

1.4 Production Scenario of Brinjal

The area under brinjal cultivation in world were 17.28 lakh hectares and production of brinjal in world was 431.73 million metric tonnes. Whereas area under brinjal cultivation in India was 733.16 thousand hectares and production of brinjal in India was 12510.48 thousand metric tonnes. (Horticulture Statistics at a Glance 2018) Area under brinjal cultivation in Maharashtra was 22.48 thousand hectares and production of brinjal in Maharashtra was 429.91 thousand metric tonnes. (Horticulture and Statistics at a Glance 2018).

Table 1.1 Country wise area, production and productivity of Brinjal

Country	Area (Million Ha)	Production (Million Tonnes)	Yield (T/Ha)
China	0.78	32.03	40.96
India	0.66	12.6	18.90
Egypt	0.05	1.19	24.60
Indonesia	0.04	0.51	11.37
Turkey	0.02	0.85	34.46
Iran	0.02	0.68	30.84

(Source: Horticultural Statistics at a Glance,2018)

Table 1.2 Yearwise all India area, production and productivity of Brinjal

Year	Area (‘000 Ha’)	Production (‘000 MT’)	Productivity (MT/Ha)
2012 – 13	722.1	13443.6	18.6
2013 – 14	711.0	13558.0	19.1
2014 – 15	673.1	12588.5	18.7
2015 – 16	662.5	12515.2	18.9
2016 – 17	733.2	12510.5	17.1
2017 - 18	730.4	12800.8	17.5

(Source: Horticulture and Statistics at a Glance,2018)

Table 1.3 State wise Production of Brinjal in India (2017 -18)

Sr No	State	Production (‘000 MT)	Area (‘000 Ha)
1	West Bengal	3027.75	163.15
2	Odisha	2013.02	117.92
3	Gujrat	1423.00	70.88
4	Bihar	1241.71	58.22
5	Madhya Pradesh	1073.63	51.35
6	Chhattisgarh	705.40	37.93
7	Karnataka	431.80	17.04
8	Maharashtra	429.91	22.48
	Total	10346.22	538.97

(Source: Horticulture Statistics Division, Department of Agriculture, Coopn & Farmers welfare)

1.5 Importance of the Study

Jalgaon is known as city of Brinjals . Jalgaon received special recognition because of this vegetable. Light Green color brinjals from jalgaon are famous for bharit (mashed brinjal). Yaval and Bhusaval talukas in Jalgaon district are very famous for the brinjals that are specifically used for preparing bharit and hence they are locally known as “Bharit vanga”.

Bamnod village in Yawal Taluka is famous for large-sized variety of Bharit Brinjals. Farmers in this region specifically cultivate bharit vangi (mashed brinjal). Village rejoices unique medium spicy taste of Bharit in the form of small group parties and get-togethers. These bharit brinjals are grown in the area near Tapi river basin. Asoda is a village in Jalgaon District; Maharashtra state in western India, which itself is located on the northern Deccan Plateau. It is 5 km from Jalgaon, located within the productive, irrigated agricultural region of Khandesh. Asoda is famous for bharit brinjal cultivation. Other villages in which cultivation of bharit brinjal occurs are Mamurabad, Bhadli and Bhalod. Soil in Jalgaon which is black and well drained makes brinjal cultivation most favourable in this region. Bharit brinjal cultivars prefer small-sized seeds to get large brinjal crop from Khandesh's rich medium-black fertile soil. These large-sized bharit brinjals have now turned popular throughout the State.

Jalgaon Brinal recently got GI tag because of its uniqueness and to know the existing production level and marketing efficiency, the study on Economics of production and marketing of Jalgaon brinjal in jalgaon district is selected with following objective.

1.6 Objectives

1. To study the resource use, costs and returns of Jalgaon Brinjal.
2. To estimate resource use efficiency.
3. To estimate the marketing costs, market margin and price spread of Jalgaon Brinjal.
4. To identify the problems in production and marketing and suggest the measures.

1.7 Hypotheses

1. Null H_0 -: Jalgaon Brinjal is not a profitable crop.

   Alternate H_1 -: Cultivation of Jalgaon Brinjal is profitable.

1.8 Scope and Limitations of Study

There is great demand for fresh vegetables in the gulf countries throughout the year. The whole northern Europe imports large quantities of fresh vegetables during winter months. The market of these countries should be surged to know the consumers preferences. Quality of vegetables having the needed attributes can be grown and exported in these countries. Government should encourages such endeavors by providing necessary facilities *viz;* concessional air flights reasonable loans and initial permit to import any seed or any structural material for building necessary processing infrastructure as there is a scope for export of processed vegetables.

1.9 Limitations of Study

As the study concerned with specific area Jalgaon district and specified crop, the application of the results will be useful only for the area which is having similar situation for Jalgaon brinjal crop.

2. REVIEW OF LITERATURE

Review of literature published elsewhere related with the topic under study provides guidelines in formulating the frame work of the study, defining the objectives, selecting methodology and avoiding unnecessary duplication of efforts. It also provides a general orientation about the topic of investigation by creating an insight and a sense of interaction about the subject as a whole. An attempt is made in this chapter to review the past literature on the problem. The review of literature is grouped under the following headings

2.1 To study the Resource use, costs and returns of Brinjal

2.2 To estimate Resource use efficiency of inputs

2.3 To estimate the Marketing costs, price spread and marketing efficiency of Brinjal

2.4 To study the Problems in production and marketing of Brinjal

2.1. Resource Use, Costs and Returns

Lohar and Bansode (1984) made an attempt to study on the costs and returns of chillies in Kolhapur district (M.S.). It can be seen from the study that the per hectare cost A, cost B and cost C were ₹. 2647.45, ₹. 3832.80 and ₹. 4473.30, respectively. The cost C is the per hectare total cost of production of chillies. Out of this, the cost incurred on fertilizers and manures was ₹. 1355.00 (30.30%) respectively. The hired human labour and family labour occupied the second major cost i.e. ₹. 879.06 (19.66%). The per hectare gross receipts were ₹. 5250.00. The per hectae net profits at cost A, cost B and cost C were worked out to ₹. 2602.55 ₹. 1473.20 and ₹. 776.70, respectively. The per hectare estimated yield of chillies was 8.50 q per quintal cost of production was ₹. 526.36.

Aundhekar (1989) studied economics of vegetables cultivation in Parbhani district and concluded that on an average costs of bhendi, brinjal and tomato were worked out to ₹.14806.21, ₹. 20437.76 and ₹. 17063.26 per ha, respectively and corresponding output were ₹. 18687.40, ₹. 30981.24 and ₹. 25555.52 leaving a net profit of ₹. 3821.19, ₹. 10544.08 and ₹. 8492.25, respectively.

Ghulghule (1992) studied economics and marketing of major vegetables in the vicinity of Parbhani. His study revealed that per hectare cost of cultivation i.e. cost 'c' for brinjal, tomato and cauliflower were ₹. 1966.00, ₹. 8500 and ₹. 11637, respectively. Per ha net profit was highest for cauliflower (₹. 15674) followed by brinjal (₹. 6461) and tomato (₹. 1133). Input output ratio was also highest for cauliflower (1:2.34) followed by brinjal (1:1.65) and tomato (1:1.30).

Sharma *et al.* (1992) studied economics of vegetable farming in mid-hills of Himachal Pradesh. Vegetables selected for study were lady's finger, chilli, cauliflower and potato. Per hectare cost of cultivation for ladies finger was ₹. 3380 and net profit was ₹. 22127.

Lahale (1993) studied economics and marketing of selected vegetables in Akola district. The study found out the input utilization and cost of cultivation of guar, brinjal and bhendi and also examined marketing margin and price spread. The total cost of cultivation of guar, brinjal, bhendi was worked out to the tune of ₹. 8954.92, ₹. 11659.05 and ₹. 8143.34, respectively. He showed that the cost of cultivation was highest in brinjal and returns were highest in brinjal. It showed that as the level input increased the output also increased.

Jain and Gauraha (1996) made an attempt to study on economics of vegetable farming. The study was confined to the Bilaspur district of Chattisgarh region of Madhya Pradesh. They selected 27 vegetable growers from two villages of Mungeli tehsil of Bilspur district. They selected eight vegetables, i.e. Brinjal, potato, chilli, lady's finger, tomato, radish, cauliflower and cabbage.In case of production was ₹. 13550 per hectare. Average net return from lady's finger was ₹. 7816 per hectare.

Koshta and Chandrakar (1999) studied economics of production and marketing of vegetable crops in Durg district of Chattisgarh region. Study concluded that the maximum per quintal cost of production was found in lady's finger (₹. 164.32) followed by cow pea (₹. 150.66), cauliflower (₹. 119.29), tomato (₹. 116.03) and cabbage (₹. 71.69). The maximum per ha net returns and cost benefit ratio were obtained from cabbage and tomato crop enterprises.

Kale (2002) studied the economics of selected vegetables in the vicinity of Parbhani city. Vegetables selected for study were okra, brinjal, fenugreek and cauliflower. Per hectare total cost of cultivation in case of okra was ₹. 28584, whereas net returns obtained were ₹. 10295. The per kilo gram cost of cultivation calculated for okra was ₹. 4.40 and cost benefit ratio was 1:1.36.

Jadhav (2002) in his study on production and marketing of brinjal in phaltan area of Satara district revealed that, at the overall level, the cost of cultivation was ₹. 74241.36 i.e. Cost C while Cost A was 49.72 per cent and Cost was 86.10 per cent of the total cost.the major items of cultivation were hired human labour, plant protection, manures and imputed rental value of land. Cost of cultivation was highest in large size group followed by medium and small size groups.

Ganesh Kumar *et al.* (2004) studied economics of production and marketing of vegetable in Andaman and Nicobar Islands. The selected vegetables were bhendi, bottle gourd, pumpkin, cucumber, radish, bitter gourd, ridge gourd and brinjal etc. In these vegetables the cost of cultivation of bhendi was ₹. 36335/ha on hilly land and ₹. 24135/ha on valley land. Gross return from bhendi was ₹. 106633/ha and ₹. 35985/ha on hilly land and valley land, respectively, while net return was ₹. 70298/ha and ₹. 11850/ha on hilly land and valley land respectively. Cost benefit ratio of bhendi was 1:2.9 for hilly land and 1:1.5 for valley land.

Manoj Kumar Singh (2004) studied economics efficiency in vegetable business system of Mahakoshal region in Madhya Pradesh. He selected six vegetables for study *viz.* tomato, onion, arvi, okra, brinjal and patato. The cost of cultivation for okra was ₹. 10046.40 per hectare. Further, it also shows that about 95 per cent of cost of cultivation of these vegetable consist of human labour and working capital cost. The bullock labour cost for these vegetables ranges from 4 to 5 per cent, while per hectare net profit for okra was estimated to ₹. 31353.60.

Singh and Bankar (2006) studied an economic analysis of production and marketing of cauliflower in Durg district of Chhattisgarh state. It may be concluded that the average cost of cultivation of cauliflower per ha was ₹. 25228.57. Average production of cauliflower was estimated 218 q/ha. The cost of production was higher for large size groups of farms as compared to small and medium farms. Average per ha output (gross return) was ₹. 48156.20. Average per ha benefit cost ratio (BCR) was estimated to 1:1.91. It is concluded that the BCR increases with increase in size of farms.

Farinde *et al.* (2007) studied on an overview of production, processing, marketing and utilization of okra in Egbedore local government area of Osun state, Nigeria. The results show that the mean age of the respondents was 57.56 years; mean years of okra production experience was 16.91 years; mean farm size cultivated by the respondents was 1.5 ha, they were all married with 49 per cent literate. The mean person's day of family labour was 6.03 and that of hired labour was 1.25 persons day per month in three months. Majority of the respondents planted okra on a small scale destined by land tenure system and probably due to the problem of unavailability of storage, processing, and preservation facilities. Processing and preservation are carried out using traditional techniques of slicing, sun-drying and grinding (using mortar and pestle). Sliced and dried okra are stored in gourd,baskets and clay-pots. Okra is consumed fresh and dried mostly to make draw soup.

Singh *et al.* (2007) made an attempt to study production and marketing of hybrid tomato in Ghazipur district of Uttar Pradesh. This study indicates that, on an average per ha cost of cultivation come to ₹. 37646.65. It was observed that, the higher cost of cultivation came on lower strata i.e. ₹. 38615.72 as compared to upper strata i.e. ₹. 36677.56 per ha. On an average per ha goss return came to ₹. 84647.12 which was higher i.e. ₹. 87442.88 on lower strata than ₹. 812851.36 on upper strata. The net return was estimated to ₹. 47000.48 per ha which was higher on lower strata ₹. 48827.16 as compared to upper strata ₹. 45173.80 per ha. The cost of production per quintal was estimated to ₹. 116.18. The benefit cost ratio was worked out on an average came to 1:2.25, which was higher on lower on strata 2.26 as compared to upper strata 2.29.

Verma (2007) studied economics of production, resource use efficiency, marketing and constrains of potato in Indore district of Madhya Pradesh. The average per hectare cost of cultivation (cost C3) of potato was ₹. 36483.28. On an average, per hectare net return of potato was worked to ₹.24012.22. The average input-output ratio in production varied from 1:1.65 on cost C3 basis to 1:2.9 on cost A1 basis. The price of potato tends to be low during post-harvest period as compared to the pre-harvest period.

Ayodele and Shittu (2013) studied on consideration of costs and returns to nitrogen fertilization in okra production. The study showed that Value-Cost ratio (VCR) was highest at 60 kg N.ha-1 for the two varieties in 2007 and for NHAe 47-4 in 2008 but at 30 and 120 kg N. /ha for LD 88-1-8 and NHAe 47-4, respectively in 2009. The current economic environment in 2010, characterized by higher producer prices due to nationwide inflationary pressure on food items and regime of high fertilizer prices from a deregulating market necessitated an assessment of the returns from the responses to application of subsidized and unsubsidized urea. Profitability of N application increased as VCR rose to 1.57 and 2.39 for NHAe 47-4 and LD 88-1-8 at 60 kg N. /ha. This 60 kg N. /ha is the economic rate to recommend for fresh fruit production in sole okra.

Singh *et al.* (2016), studied on, an economic analysis of vegetable production in Meerut district of Uttar Pradesh. The average per hectare cost of brinjal at overall level was ₹ 1,19,686.64 and among different farm size of farms it was ₹ 1,17,125.98, ₹ 1,20,640.73 and ₹ 1,21,109.07 on marginal, small and medium size of farms respectively, indicating there by its direct relationship with the size of farms. The net returns per hectare amounted to be ₹ 1,47,517.93, ₹ 1,50,197.52 and ₹ 1,64,000.02 for small, medium and large size of farms, respectively.

Tambe (2017) studied production and marketing of *summer* tomato in Ahmednagar district of Maharashtra. She observed that the per hectare cost of cultivation for *summer* tomato was worked out to ₹ 2,59,279. The major items of cost were rental value of land and hired human labour. The B : C ratio was 1.82 and per quintal cost of production was ₹ 980.08. The results of estimated Cobb-Douglas production function indicated that the manures and phosphorus were highly significant, whereas potassium and irrigation charges were significant at 5 per cent level of significance and nitrogen was significant at 10 per cent level of significance influencing the yield of tomato. The profitability of tomato production could be maximized by increasing use of manures, nitrogen, phosphorus, potassium and irrigation.

2.2. Resource Use Efficiency

Nahatkar and Pant (1984) studied farm profitability and source productivity in the cultivation of brinjal (kh) in Chindwara district of Madhya Pradesh. They concluded that the cultivation of brinjal (kh) was more profitable on medium scale farming, for increasing profit from this crops, expenditure on human labour and irrigation should be minimized. More fertilizer should be used and better plant protection measures should be adopted.

Sharma and Singh (1990) studied resource use productivity in Punjab agriculture. The study revealed that the use of fertilizers was the most important factor providing impetus to crop productivity in the state. The next importance was the area under high yielding varieties. The impact of factorization, was positive and statistically significant. It may be urged that in fact it has played a complementary role in the production, process, raising in productivity of other inputs associated with the production process.

Dangat *et al.* (1991) studied resource use structure and resource productivity in tomato production by using Cobb-Douglas type of production function. Labour, plant protection measures and working capital (Including seed, manures and fertilizer and irrigation charges) were the major variables considered for study. Medium and large size group except human labour in medium size group. Plant protection in small size group and working capital in all the size groups of farms indicated the importance of these variables to which the crop output was highly responsive. There was a scope for increasing the profitability from tomato through increasing the use of these resources.

Sharma *et al.* (1992) studied economics of vegetable farming in mid hills of Himachal Pradesh. They concluded that the value of coefficients of multiple determinations (R^2) was significant and ranged between 0.633 to 0.856 indicated that the explanatory variables included in the function were sufficient enough to explain the variation in vegetable production by 63 to 85 per cent on the basis of elasticities of production. One per cent increase in the use level of human labour will lead to 0.67 per cent in chillies. Similarly the one per cent increase in the use of bullock labour leads to increase 0.37 and 0.32 in cauliflower and cabbage respectively. Significant coefficient of determination i.e. R^2 indicated that the independent variables viz., land, labour, seed and measures and fertilizers explained 94 per centof the variation in the yield. The highly significant elasticity of production of land, manures and fertilizers indicated that the further addition of these variables results in higher production of green chillies.

Singh *et al.* (1995) studied economics of cauliflower in the vicinity of Faizabad district of Utter Pradesh. The study concluded that the share of human labour was recorded non-significant in all sized farms except on large sized farms. The value of MVPs of irrigation, manures, fertilizers and plant protection measure (excluding medium farms) were significantly higher than the factor price suggesting the more productivity could be stepped up by enhancing the use of these inputs.

Manoj Kumar Singh (2004) studied economic efficiency in vegetable business system of Mahakoshal region in Madhya Pradesh. Vegetables selected for study were tomato, onion, arvi, okra, brinjal and potato. In all these crops the function fitted was found to explain nearly 87 per cent to 98 per cent (R^2= 0.8758 to $R^{2=}$ 0.9870) of the variation in the dependent variables i.e.

the gross value of vegetable crops indicating the variables left out from analysis do not play important role in explaining the variation in gross value from all vegetable crops. The elasticity of production of X1 variable (Rental value of land) for tomato, onion was found more than one, which indicates the increasing returns. It means if we increase each input by 1%, the gross value of produce would increase with increasing return. Remaining all variables for tomato, onion, arvi, okra, brinjal and potao was found less than one. This indicates thedeceasing returns. It means if we increase each input by 1%, the gross value of produce would increase with decreasing return.

Verma (2007) studied an economics of production, resource use efficiency, marketing and constraints of potato in Indore district of Madhya Pradesh. The Cobb-Douglas analysis revealed that the all farmers were utilizing seed, manures and fertilizers, human labour, bullock labour, machine power, plant protection and irrigation excessively on the farms. All farms R^2 i.e. coefficient of determination was 0.9609 and indicating the goodness of fit. Hence, there is lot of scope for increasing the use of these inputs (seed, manures and fertilizes, human labour, bullock labour, machine power) up to the optimum level in order to achieve their efficient use.

Singh *et al.* (2007) viewed on the economic study on production and marketing of hybrid tomato in Ghazipur district of Uttar Pradesh. This study indicates that, higher value of R^2 (coefficient of multiple determination) shows that included resources in the fitted function explaining more than 80 per cent of variation in the yield. In case of lower strata came to 85.10 per cent, upper strata was 82.02 per cent. The human labour and seed were found statistically significant at 1 per cent level of significance, in case of lower and upper strata. The effect of manure and fertilizer use was observed to be negative but statistically non-significant in both size groups of farms. Thus, the positive effect of human labour was obtained, return to scale in lower and upper farms were found to 0.417847 and 0.447419, respectively. The ratio of MVPs to factor cost for irrigation came to (0.1487) on lower strata, manures and fertilizers (-0.6097 and -0.8717) and plant protection (0.6450 and 0.6073) on lower and upper strata, respectively was found less than unity. The value of MVPs for human labour and seed were found more than unity in case of both lower and upper strata farms.

Sant kumar *et al.* (2011) studied on potential benefits of bt brinjal in India, an economic assessment. Results have shown that adoption of Bt brinjal hybrids would provide yield gain of 37 per cent and reduction in total insecticide-use of about 42 per cent over non-Bt hybrids. Other benefits like increase in additional brinjal production (30 thousand tonnes), savings from insecticides (`47 crore) against Fruit and Shoot Borer (FSB), increase in net returns (11029/ha), and reduction in price of brinjal output (3percent), etc. would be at 15 per cent adoption level. With increased adoption level of 60 per cent of Bt brinjal hybrids would provide, additional production of 119 thousand tonnes, savings from insecticides against FSB ₹ 187 crore, increase in net returns 44117/ha and kely reduction in brinjal price by 15 per cent. Simulation of gains adopting Bt brinjal hybrids has shown that country may gain aggregate direct economic benefits between 577 crore and 2387 crore annually at 15 per cent and 60 per cent adoption levels of bt brinjal hybrids, respectively. The major gains will accrue to consumers (66 per cent of total) and rest would go to the farmers. In brief, Bt brinjal offers a large scope to increase income of farmers, reduce its cost to consumers, improve food safety and reduce health hazards and environmental pollution. The results of study may be helpful in policy decision on Bt brinjal adoption in the context of smallholders agriculture.

Sorapong (2012) studied on okra (*Abelmoschus esculentus L.* moench) as a valuable vegetable of the world. The result showed that okra plays an important role in the human diet by supplying fats, proteins, carbohydrates, minerals and vitamins. Moreover, its mucilage is suitable for certain medical and industrial applications. Therefore, young fruits of okra have reawakened beneficial interest in bringing this crop into commercial production. The optimum yield of okra is approximately 6.6 t ha-1. Okra requires warm temperatures. The optimum temperatures are in the range of 20-30°C, with minimum temperatures of 18°C and maximum of 35°C. Okra needs rather high quantity of water despite having considerable drought resistance. The plant forms a deeply penetrating tap root with dense shallow feeder roots reaching out in all directions in the upper 45 cm of soil. Soil clamminess is essential during the continuation of growing period.

Dwibedy (2013) studied on estimation of price spread and marketing efficiency of brinjal in different marketing channels. The study showed that, three market channels were identified in the study area. These were Channel I: Farmer - Commission Agent-Wholesaler-Retailer- Consumer; Channel II: Farmer- Wholesaler- Retailer- Consumer and Channel III: Farmer- Organized Food Retail Chain-Consumer. The major findings revealed that the producer's share in consumer's rupee was 64.87 percent for Channel III, 49.85 percent for Channel II and 47.69 percent for Channel I. Channel III was found to be the most efficient market both by Shepherd's method and Acharya's method.

Sarswat *et.al.* (2014) studied on economics of brinjal production in South Gujrat. In that they revealed that, 775.3 gram seeds, 17.4 tonnes FYM, 115.6 kg nitrogen, 41.4 kg phosphorus, 40.5 kg and 19.6 kg micronutrients per hectare were used at overall level. For different operations on an overall level, the total labour utilization per hectare was 305.5 man days, 5.9 bullock days and 9.7 machine hours. Cost of cultivation per hectare and cost of production per quintal was ₹.64935 and ₹.470.77, respectively. The overall net income per hectare was ₹.38699. The return per rupee of investment was 1.59. Production function analysis for brinjal indicated that FYM, human labour, machine labour, irrigations and plant protection significantly affected the yield. This indicates the scope to use of these inputs.

Awunyo-Vitor *et al.* (2016) studied Resource use efficiency in Ghana district, The study showed that generally, maize farmers in Ghana were inefficient in their use of resources available to them. Fertilizer, herbicide, pesticides, seed, manure and land were underutilized, while labour and capital were overutilized by the farmers. The stuy further showed that maize farmers in Ghana exhibit increasing returns to scale, indicating that the farmers can increase their output by increasing their output by increasing the use of some of the key resources.

Qamar *et al*. (2017) studied economics of open field tomato production in panjab. The study revealed that education, extension agent contacts, experience, seed quantity, chemical applications and marketing cost had a positive and significant impact on revenue. R2 (0.856) and f-value (34.961) reflects the goodness of the regression model. It is summarized most of the reviews showed Cobb-Douglas production function in resource productivity analysis. Mostly review showed MVP to price ratio to know resource use efficiency.

2.3. Marketing Cost, Price Spread And Marketing Efficiency

Ramaswmy (1985) studied markeing of bhendi in Coimbatore district. An economic analysis showed that the share of the producer in consumers rupee was 38.00 per cent. The wholesaler's margin was estimated to be 25 per cent as against retailer's margin of 14 per cent.

Pawar *et al.* (1987) studied on price of some important vegetables in Pune and Bombay market. Net price received to producer in consumers rupee in Pune market for some important vegetables i.e. tomato, cabbage, cauliflower, brinjal and lady's finger, were ₹. 41.10, ₹. 40.72, ₹. 53.34, ₹. 53.79 and ₹. 48.47 per cent, respectively. Marketing cost of intermediaries for tomato, cabbage, cauliflower, brinjal, lady's finger was ₹. 47.12, ₹. 54.75, ₹. 42.62, ₹. 35.40 and ₹. 47.02, respectively. It is revealed from above figure that production of marketing margins are very high in the marketing of fruits and vegetables and the producer at the same get generally less than 50 per cent of the consumers price.

Hedgire *et al.* (1994) studied marketing of vegetables in Nanded city. In all 250 vegetable growers were selected for study. The result of the study revealed that overall market cost by grower was ₹.42.72/q in okra and ₹. 24.32/q in brinjal and losses during marketing were ₹. 7.42 and ₹. 7.89 for okra and brinjal. The producer's share in consumer rupee was 54.96 per cent for okra.

Parmar *et al*. (1994) studied marketing of vegetables in South Gujarat. Five major vegetable crops namely brinjal, tomato, cabbage, okra and cluster bean were studied. A sample of 40 growers for each vegetable crop was selected from 21 villages of Surat and Valsad district. They found that the per quintal cost of marketing of okra was nearly double in Surat market

(₹. 90.24) as compared to that in Navsari market (₹. 46.98). Producers share in consumer's rupee in case of okra was 52.49 per cent at Navsari market, while it was 48.39 per cent when okra was sold at Surat market.

Jadhav (2002) in his study on production and marketing of brinjal in phaltan area of Satara district revealed that, per quintal cost of marketing of brinjal in primary market was ₹.49.21 of the total cost of marketing, the item such as commission charges (39.83%) were transport cost (26.11%) and packing cost (19.87%) were observed to be most important item of cost. Per quintal cost of marketing for brinjal in terminal market was ₹. 91.19. The commission charges (36.77%), transport cost (41.52%) and packing cost (11.5%) were observed to be most important item of marketing cost.

Ganesh Kumar *et al.* (2004) studied economics of production and marketing of vegetables in Andaman and Nicobar Islands. Selected vegetables were bhendi, bottle gourd, pumpkin, cucumber, radish, ridge gourd, brinjal etc. Out of these vegetables the marketing cost of bhendi was ₹. 0.90/kg. In case of bhendi margin of wholesaler was ₹. 4.70/kg whereas, margin of retailer was ₹. 4.40/kg.

Manoj Kumar Singh (2004) studied economic efficiency in vegetable business system of Mahakoshal region in Madhya Pradesh. He selected six vegetables for the study viz., tomato, onion, arvi, okra, brinjal and potato. Marketing cost for these vegetables were ₹.40, ₹. 23, ₹. 25, ₹. 27, ₹. 28 and ₹. 26, respectively. Marketing margin of middlemen's was found to ₹. 215 for tomato, ₹. 132 for onion, ₹. 314 for arvi, ₹.230 for okra, ₹. 210 for brinjal and ₹. 145 for potato. Thus it is obvious that middlemen's marketing costs and margin in marketing of fruits and vegetables produce plays an important role.

Singh and Chauhan (2004) made an attempt to study marketing of vegetables in Himachal Pradesh. The selected vegetables for the study were tomato, pea, cauliflower, brinjal, French bean, lady's finger. They identified following marketing channels:

i) Channel-I : Producer-consumer

ii) Channel-II : Producer-retailer-consumer

iii) Channel-III : Produce-wholesaler/commission agent-retailer-consumer

They found that in case of lady's finger maximum quantity was sold though Channel-III (762.00%) followed by Channel-II (25.00%) and Channel-I (12.20). Marketing cost for lady's finger was ₹. 63.25/q in channel-I, ₹. 16.75/q in channel-II and ₹. 80.55 in channel-III. Producer's share in consumer's rupee in case of lady's finger was highest in channel-I it was 94.50 per cent followed by channel-II 78.98 per cent and channel-III 62.56 per cent. For lady's finger margin of retailer in channel-II was 14.3 per cent. Margin of wholesaler /commission agent and margin of retailer in channel-III for lady's finger was 78.86 per cent and 14.02 per cent respectively.

Navadkar *et al.* (2005) studied marketing of vegetables gown around Pune city. They identified following different marketing channels

a) Primary market:

i) Channel-I: Producer-consumer

ii) Channel-II: Producer- commission agent- retailer- consumer

b) Terminal market

i) Channel: Producer- commission agent- wholesaler- retailer- consumer

Average marketing cost of bhendi was ₹.50.26/q in primary market and ₹. 115.75/q in secondary market. Producer's share in consumers rupee for okra in primary market was 58.95 per cent while in secondary market it was 53.88 per cent.

Singh and Bankar (2006) studied on economic analysis of production and marketing of cauliflower in Durg district of Chhattisgarh state. They identified following two channels:

i) Channel-I: Producer- Primary wholesalers- secondary wholesalers- retailers- consumer

ii) Channel-II: Producer- retailers- consumers

It was noticed that producer's share in consumer's rupee was 60.87 per cent in channel-I and 43.99 per cent in channel-II. Producer's share in consumers rupee was higher i.e. 50 per cent when the farmer's sold their produce through channel-II in the study area as compared to 39.13 per cent in channel-I. Marketing efficiency was found to be higher in channel- II at 7.12 than in channel-I at 5.02.

Jain and Chetan (2007) made an attempt to study marketing of major horticultural crops in Dharsiwa block of Raipur district of Chhattisgarh, following two marketing channels were identified in their study.

iv) Channel-I: Producer- consumer

v) Channel-II: Producer- commission agent- retailer- consumer

It was observed that at overall basis 22.17 per cent vegetables sold through commission agent. As far as okra is concerned 69.93 per cent quantity was sold through channel-I while 30.07 per cent were sold through channel-II. Producer's share in consumer's rupee for okra in channel-I was 93.63 per cent while in channel-II it was 68.19 per cent.

Singh *et al.* (2007) made an attempt to study a production and marketing of hybrid tomato in Ghazipur district of Uttar Pradesh. They identified following marketing channels

i) Channel-I: Producer- consumer

ii) Channel-II: Producer- retailer- consume

iii) Channel-III: Producer- wholesaler- retailer- consumer

Study indicated that the per quintal cost of marketing incurred by producer was higher in channel-III (₹. 25/q) followed by channel-II (₹. 20.50/q) and channel-I (₹. 11.00/q). Producer's share in consumer's rupee was maximum in channel-I (98.04 per cent) followed by channel-II (84.16%) and channel-III (26.58%). Total marketing cost was higher in channel-III (26.58 per cent) followed by channel-II (7.69%) and channel-I (1.96%) of the consumer's rupee.

Patil *et al.* (2007) studied price spread in marketing of capsicum in Thane district of Maharashtra state. They identified following marketing channels

i) Channel-I: Producer- wholesaler/ commission agent- retailer- consumer
ii) Channel-II: Producer- village trader- retailer- consumer
iii) Channel-III: Producer- retailer- consumer

They viewed that per quintal total cost on marketing of capsicum was ₹. 110.76 for producer. It is observed from the study that, price per quintal cost paid by the consumer was ₹. 2160. Producer's share in consumer's rupee was highest in Channel-III (49.67%), whereas lowest in channel-I (27.28%). The total market margin by all intermediaries was highest in channel-I (₹. 1006.38) followed by channel-II (₹. 904.44) and Channel-III (₹. 689.44). Total marketing cost found highest in channel-I (₹. 1570.76) followed by channel-II (1356.75) and channel-III (₹. 1086.75), respectively.

Shelke (2009) made an attempt to study price spread in marketing of major vegetables in Parbhani market. In this study author selected five vegetables *viz.,* spinach, okra, bean, biter gourd and cabbage. Study revealed that in case of okra transportation cost and commission charges constituted to 69.45 per cent of the total marketing cost. Per quintal cost of marketing incurred was to the tune of ₹. 29.80. Produer's share in consumer's rupee was 41.72 per cent. Per quintal net price received by producer in okra marketing was ₹. 150.20. Price paid by consumer was ₹. 360 while profit of retailer was ₹. 146.60.

Thorat and Bhujbal (2010) studied marketing of vegetables in Junnar tehsil of Pune district. They selected four vegetables *viz.,* tomato, cabbage, cauliflower and bhendi. The total marketing cost was highest in case of bhendi, followed by tomato and cole crops. The total marketing cost of bhendi was ₹. 50.26 per quintal in primary market while it was ₹. 115.75 per quintal in secondary market, including cost of grading, packaging, transportation, commission charges, weighing charges were ₹. 1.44/q, ₹. 10.32/q, ₹. 12.78/q, ₹. 24.72/q and ₹. 1.00/q respectively in primary market, while cost of grading, packaging, transportation, commission charges, commission of Hundekari, Postage, weighing charges were ₹. 1.44/q, ₹. 12.72/q, ₹. 46.00/q, ₹. 38.25/q, ₹. 14.34/q, ₹. 1.00/q and ₹. 2.00/q respectively.

Zaman *et al.* (2010) studied on comparative profitability of winter vegetables in a selected area of Dhaka district. The study showed that Per acre gross margin and net return of brinjal were the highest and the corresponding figures were TK 130051.5 and TK 125226 respectively. The lowest gross margin and net return were found in the case of cabbage and these were TK 45185.5 and TK 37407 respectively. The highest share of total cost of each vegetable goes to labor. In case of brinjal, Benefit Cost Ratio (BCR) (3.2) was higher than BCR of cabbage (1.8), tomato (1.7) and cauliflower (1.6). BCR indicates that vegetable growing is a profitable farm activity in a short duration of time. So it is evident from the results that vegetable production is a profitable business.

Joshi (2011) studied analysis of marketed surplus and price spread of brinjal in western Uttar-Pradesh. The study revealed that the marketed surplus of the medium category of have slightly higher surplus than marginal, large and small categories of brinjal grower. Their relative proportion was 94.84 per cent, 94.51 per cent, 94.49 per cent and 94.48 per cent, respectively of the total production. The share of producer in consumer rupee is high in channel were there are less number of intermediaries. The marketing cost incurred by wholesaler in different channels were estimated 5.01 per cent, 6.39 per cent and 7.88 per cent of the consumer price respectively and their corresponding net margins were 9.68 per cent, 9.61 per cent and 10.23 per cent of the price paid by the consumer.

Bhatia *et al.* (2017) studied protected cultivation of tomato in Karnal district in Hariyana. The study revealed that producer obtained maximum share in consumer rupee from direct marketing of tomato i.e more than 90 per cent which may be due to non-existence of market intermediaries producer and consumer whereas least share in consumer rupee was observed in channel-IV (distant market) i.e 50.04 per cent which may due to large number of middle man involved in marketing chain of tomato as for as marketing efficiency concerns. Channel-I was found most efficient among all marketing channel.

2.4. Constraints And Suggestions

Vigneshwa (1986) studied dynamics of fruits and vegetables marketing in India. Problems noted in this study were:

i) Fluctuation in prices

ii) Excessive involvement of intermediaries

iv) Lack of transport and storage facilities

iv) Absence of grading and standardization

v) Other problems such as absence of financial facilities, non-availability of efficient marketing information, lack of packaging and non-existence of organization among the farmer.

Pawar and Yadav (1987) studied on the effect of imperfection of marketing system of fruits, vegetables and milk. They observed the following problems faced by farmers i.e.

i) Profit margins of the intermediaries was very high so producer get less than 50 per cent of consumer price.

ii) Lack of facilities, such as storage, grading, transport and processing of products and no facility of market intelligence service.

iii) There was no any co-operative organizations to encourage the competitive condition in the fruit and vegetable markets.

Lahale (1993) studied marketing of vegetables. He observed problems faced by farmers were remunerative prices are not received, non-availability of cold storage facility was the constraints opined by 43 per cent farmers, while 84 per cent farmers expressed high rate of commission and majority of farmers have expressed that weighing and auction was not done properly. Absence of proper transport facility was also a problem expressed by 50 per cent farmers.

Ghulghule *et al*. (1994) studied the marketing margin and price spread for selected vegetables in Akola market. They expressed that remunerative price was not received by 94 per cent farmers. Non availability of cold storage facilities and higher commission rates were the problems expressed by 43 and 84 per cent farmers respectively. Majority of farmers indicated that auction and weighmen was not done properly. Absence of proper transport expressed by 80 per cent farmers.

Parmar *et al.* (1994) studied marketing of vegetables in south Gujarat. They studied five major vegetables *viz.*, brinjal, tomato, cabbage, okra and cluster bean. They observed different marketing problems faced by vegetable growers such as credit shortage for marketing (24.40%), spoilage (68.46%), under pricing of producer (13.10%), pricing set according to quality (11.91 %), and malpractices in weighing (49.41%).

Patil *et al.* (1997) studied marketing of selected vegetables in Gultekadi market, Pune. Study revealed following problems:

i) Costly packing material.

ii) Non availability of transport facilities in time.

iv) High transport cost.

v) High rate of commission.

vi) Lack of storage facilities in the producing areas.

vii) The open auction method of sale is not strictly followed.

Gadre (2000) in his study on production and marketing of selected vegetables in Alibag tehsil of Raigad district (Maharashtra) reported that unsatisfactory marketing methods (40%), non-remunerative prices for product (48%), lack of market information (80%) as major constraints faced in marketing of onion in Alibag tehsil of Raigad district.

Nawadkar (2000) analysed in his study the income maximizing, vegetables in western Maharashtra found that, in marketing of vegetables the major problems faced by farmers were high cost of packaging material, high commission charges, high cost of transportation, absence of timely payment and malpractices adopted in the market by the intermediaries.

Suryawanshi (2000) studied the marketing of vegetables and found out the constraints of vegetable growers in Latur district. The study revealed that about 92 per cent farmers expressed remunerative prices are not received and about 88 per cent said high rate of commission and 96 per cent expressed weighing are improper, 74 and 70 per cent expressed losses during transportation and transportation facilities are not proper.

Radha and Prasad (2001) observed that the selected farmers were conducted opinion survey for analysing the problems in production as well as in the marketing of vegetables. Major constraints opined by farmers were like non availability of certified seed (86.66 per cent), storage problem (95.55%), malpractices in marketing (83.33%), grading problems (61.11%) and cedit facilities not available at regular time (74.44%).

Arora and Anilakumar (2003) conducted a study on an analysis of marketed surplus and marketing cost of vegetables in Uttaranchal. They observed the problems in marketing of vegetable such as costly packing material, excessive deduction by traders, lack of information about prices. The other problems experience by vegetable growers were improper weighment practices, delay in sale, delay in payment and lack of effective regulation of the markets.

Navadkar *et al*. (2005) made an attempt to study marketing of vegetables grown around Pune city. The study found that the important constraints faced by the sample growers in marketing of selected vegetables include high cost of packaging material (56.67%), high commission charges (68.33%), high cost of transportation (29.17%), absence of timely payment (40%) and malpractices adopted in the market (74.16%).

Patil *et al.* (2007) studied price spread in marketing of capsicum in Thane district of Maharashtra state. They found that major problem reported by the producers were high cost of packing materias (95.00%), farmer also reported that low and unremunerative prices to the producer (87.50%), higher wages of labour (80.00%), and wholesaler market is far away from producing area (77.50%). Other problems i.e. transporters do not take responsibility of loss of produce (52.50%), high cost of cold storage (62.50%), wide price fluctuation (40.00%) and high cost of transport (40.00%), etc.

Kaur and Gupta (2008) made an attempt to study problem and strategies in production and marketing of fruits and vegetables in India. Study revealed that number of fruits and vegetables processing unit are 5200. Only 2-3 per cent of the produce is processed in India as against Malaysia (83%), Thailand (72%) and Brazil (70%). Thirty per cent of fruits and vegetables go waste due to lack of proper processing and packaging. The important fruit and vegetable processing states are Maharashtra, Tamil Nadu, Andhra Pradesh and Karnataka.

Thorat and Bhujbal (2010) made an attempt to study marketing of selected vegetables in Junnar tehsil of Pune district. They found that important problems faced by vegetable growes in marketing of selected vegetables includes lack of cold storage facilities (80%), high cost of packing material (56.67%), high transportation charges (29.17%), malpractices and unauthorized deductions (74.16%), commission charges are high(68.33%), absence of open auction method of sale (37.50%), non receipt of payment in time (40.00%), low price to the produce (87.50%), absence of co-operative vegetable marketing society in study area.

Adeniyi (2011) studied on economic aspects of intercropping systems of vegetables (okra, tomato and cowpea).The result showed that the most favourable mix of vegetables which could be recommended for adoption to farmers was the intercrop of a pair rows of tomato with one row of cowpea (TC 2:1). The practice gave increased net returns of N32, 245.71 or US$214.97(21.04%) and N129, 823.22 or US$865.49(233.18%) over the sole cropping of tomato and cowpea respectively. This was also an increased net revenue of N46,427.07 or US$309.51(33.38%) above TO 2:1 and N98,319.81 or US$655.47 (112.78%) above OC 2:1 which were themselves optimal alternatives preferred to sole cropping of any of the vegetables involved. This result however, was in favour of extension policies towards popularizing the recommendation of alley farming for horticultural practice

Noisiru *et al.* (2012) studied on determinants of improved productivity of okra *(Abelmoschus esculentus)* by farmers in lowland areas of Ogun state, Nigeria. The results show that the mean age of the respondents was 26.80 years; 78 per cent of the respondents were male; mean years of okra production experience was 13.60 years; mean farm size cultivated by the respondents was 1.22 acres; while the mean years of education was 12.66 years. More than 70 per cent of the respondents planted okra on a small scale; the respondents had an average household size of 4.34 members. The most significant socio-economic variables include sex, household size and frequency of contact with ADP Officials. The economic variables most significant in the course of the study were family labour, fertilizer, herbicides and variety of seeds. Farmers cultivating improved seed varieties were observed to be more productive than others cultivating local seed varieties.

Bhatia *et al*. (2017) studied based on protected cultivation of tomato. The study was conducted in Karnal district of Hariyana having highest number of polyhouses in the state, require primary and secondary data were collected from related stake holder. Most of responder farmers expressed the problems of production and marketing growers whereas lack of polyhouse/ insurance schemes to mitigate risk arising due to damage of structure crop (84%), followed by attack of insect and pest as well as nematode (80%), supply of inferior polyhouse material/ lack of advice from service providers (80%). Whereas, lack of market information on price and demand in different market (80.67%), non-remunerative prices of produce (76%) where found most prominent constraints in marketing of produce.

3. METHODOLOGY

Methodology includes, salient feature of Jalgaon district, sampling design, analytical techniques, terms and concepts used in the study were described as follows.

A. Methodology

3.1 Sampling Design

The sampling design adopted for the investigation was two stage purposive and random sampling with sample tahsil as a primary unit of sampling and village as a secondary unit of sampling. Three villages each from Yawal and Bhusaval tehsil were selected purposively from for study on the basis of area under brinjal cultivation. The list of brinjal growers along with their operational area and area under brinjal cultivation for each of the selected villages were prepared on the basis of information obtained from village revenue office. The Brinjal growers were then arranged in descending order of their operational area for each of the selected villages and five growers from each of the three predetermined size classes (i.e. area under Brinjal cultivation) *viz.*, Group I (up to 0.40ha), Group II (0.41 to 0.80ha) and Group III (0.81 ha and above) thereby making a total of 15 growers for each village were selected randomly. Thus, the total sample size for the study was consists of 90 brinjal growers comprising 30 each size group.

Table 3.1 Distribution of sample farm

Sr. No.	Area	Yawal Tahsil	Bhusawal Tahsil	Total Growers
1.	0- 0.40 ha	15	15	30
2.	0.41 – 0.80 ha	15	15	30
3.	0.81 ha and above	15	15	30

3.2 Analysis of Data

Analysis of the data on physical resources use in Brinjal cultivation *viz*: Seedlings, Male labour, Female labour, Manures, Fertilizers, Irrigations and Plant protection etc., was carried out by tabular analysis.

3.2.1 Estimation of Costs and Returns

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

3.2.1.1 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 seeds were evaluated at the rate of seeds in the market.

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

7) 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.

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

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

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

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

12) 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).

3.2.2 Cost concept

The first objective of the study on cost and returns in brinjal production will be completed by analysing the data using standard cost concepts generally followed in farm management studies i.e. cost-A, cost-B and cost-C with the help of tabular analysis.

Cost A

It includes the cots on account of hired human labour, bullock labour(hired and owned), seeds(home produced and purchased), manures (owned and purchased),fertilizers, plant protection measures, machinery charges, land revenue and other cesses, interest on working capital, depreciation on Implements and machinery, repairs of machineries and irrigation charges etc.

Cost B

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

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 imputed value of family labours were added to cost 'B' to work out cost 'C'. Thus,

Cost 'C' = Cost 'B' + Imputed value of family labour.

3.2.3 Functional analysis

The data was further analyzed by making the use of different mathematical models (at least three) such as Translog, Linear, nonlinear i.e. Cobb-Douglas production function was the best suited model hence, it was used for estimating resource use efficiencies.

Cobb-Douglas production function of the following type will be used.

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

Where,

Y = Dependent variable (Output) in quintals

X_1 = Seeds (Kg)

X_2= Male Labour (days)

X_3= Female Labour (days)

X_4= Manures (quintals)

X_5= N (kg.)

X_6= P (kg.)

X_7= K (kg.)

X_8= Irrigation charges (₹.)

X_9=Plant protection measures (₹.)

bi's = Regression Coefficients

a = Constant.

e^u= error term

3.2.4 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) **Seeds (X1)**

Brinjal is propagated by seeds. Input has been expressed in terms of kg per hectare.

ii) **Male labour (X2)**

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 (X3)**

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 (X4)**

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

v) Nitrogen (X5)

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 (X6)

Same way the P205 contained in fertilizers is calculated and taken in kilogram.

vii) Potash (X7)

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

viii) Irrigation (X8)

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

ix) Plant protection (X9)

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

Output (Y)

The output has been used as a dependent variable for Jalgaon brinjal crop. Therefore, Jalgaon brinjal are taken in quantity in quintals.

3.2.5 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)

3.2.5.1 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,

MVP = bi $\frac{Y}{X}$ P_yWhere,

bi= Elasticity of production corresponding to the ith input

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

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

Py= Price of output.

3.2.6 Marketing Cost, Market Margin, and Price Spread

3.2.6.1 Total Marketing Cost

$$C = C_f + C_{m1} + C_{m2} \ldots\ldots\ldots\ldots C_{mi}$$

Where,

C = Total marketing cost.

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

C_{mi}= Cost incurred by i^{th} middleman in the process of buying and selling the product.

3.2.6.2 Price spread

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

$$P_s = C_p - P_f$$

Where,

P_s = Price spread

C_p= Consumer's price

P_f = Price received by farmer

3.2.6.3 Marketing margin

$$MT = \Sigma (S_i - P_i)/Q_i$$

Where,

MT = Total Marketing 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 i^{th} firm

3.2.6.4 Marketing efficiency

The marketing efficiency was calculated by using the modified method as suggested by Acharya and Agarwal (1999).

$$\mathbf{MME = RP/ (MC + MM)}$$

Where,

MME = Modified measure of marketing efficiency.

RP = Price paid by consumer or retailer's sale price.

MC = Total marketing cost

MM = Net marketing margin

3.3 Problems In Production and Marketing Of Brinjal

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 i^{th} constraint gave the ratio of number of responses for a particular constraint to the total responses as per equation given be

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

where,

$(RPI)_I$ = Response Priority Index for i^{th} constraint,

f_{ij} = Number of responses for the j^{th} priority of the i^{th} constraints.

(i=1, 2……, l; j= 1,2,3…..k),

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

$X_{[(k+1)-j]}$ = Scores for the j^{th} 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

B. Profile of Jalgaon District

3.4 Salient Feature Of Jalgaon District

Salient feature consists with location, soil, climate, population and cropping pattern of district whereas study has been undertaken

3.4.1 Location

Jalgaon district is located in north Maharashtra between 200 and 210 North latitudes and 740 55' to 760 28' East longitudes. The district consists of 15 talukas which include Jalgaon, Jamner, Erandol, Dharangaon, Bhusaval, Bodwad, Yawal, Raver, Muktainagar, Amalner, Chopda, Parola, Pachora, Chalisgaon and Bhadgaon. Brinjal cultivation in India is estimated to cover about 8.14 per cent vegetable area which contributes to 9 per cent of total vegetable production. The crop is largely grown in small plots or as inter crop both for cash and domestic consumption by farmers all over India. Maharashtra is one of the major brinjal producing states in India. Bharit Vangi ie Brinjals specifically used for preparing bharit is of great demand in Pune, Aurangabad and Mumbai cities. The famous dish, bharit prepared from these Jalgaon brinjals is served in German airlines as well. Even Tibetian people enjoy the taste of bharit by visiting Jalgaon in winter season. Asoda, Bamnod, Mamurabad, Bhadli, Bhalod and Bhusaval have higher cultivation of Bharit brinjal variety.

3.4.2 Soil

The soils of Jalgaon differ from rest of the Deccan trap soil area which are mostly alluvial in origin, transported from the mountain ranges. Deep black soils are observed in northern part of Amalner, Erandol, Jalgaon, Bhusaval and Edilabad talukas. Medium black soils are present in the central belt of the Tapi River and southern hills. In Tapi alluvial basin soils are black alluvial clay present in the southern parts of Yaval, Raver, Chopda, Jalgaon, Bhusaval, Chalisgaon, Amalner, and Bhadgaon. Loamy soils are present in the southern-most part of Amalner, Erandol, Jalgaon and Bhusaval. For high yield of brinjal, deep, fertile and well-drained is required. Generally, siltloam and clay loam soils are preferred for brinjal cultivation. Bharit brinjal grows well in black well drained soil which is present near Tapi river basin. So bharit brinjal is cultivated on large scale in the villages near Tapi river basin.

3.4.3 Climate

Climate of Jalgaon is hot and humid. The climate of district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season i.e. from June to September. Thus this unique combination of climate, soil and rainfall of Jalgaon district is favourable for high yielding and good quality of Jalgaon brinjal The optimum temperature for growth and brinjal fruit set is 20-30°C .While the temperature of Jalgaon ranges from 10.8 to 42.2^{0}C. Cultivation of bharit brinjal in Jalgaon occurs from November to January due to favourable climatic conditions. During winter i.e. from November to December the temperature fluctuates between 20-30°C which makes it suitable for brinjal cultivation. The annual rainfall in the district varies from about 660.40mm-763.40mm.

3.4.4 Population

According to 2011, Jalgaon had population of 4,229,917 of which male and female were 2,197,365 and 2,032,552, respectively. In 2001 census, Jalgaon had a population of 3,682,690 of which males were 1,905,493 and remaining 1,777,197 were females. Jalgaon District population constituted 3.76 per cent of total Maharashtra population. In 2001 census, this figure for Jalgaon District was at 3.80 per cent of Maharashtra population.

There was change of 14.86 per cent in the population compared to population as per 2001. In the previous census of India 2001, Jalgaon District recorded increase of 15.53 per cent to its population compared to 1991

3.4.5 Cropping Pattern

The cropping pattern of Jalgaon district was studied for the year 2010-11 and presented in Table 3.1. The proportion of area occupied by cereals was 21.27 per cent while that of pulses was only 10.48 per cent. Cotton alone account for 53.48 per cent of the total cropped area. The sugarcane crop contributes about 6.49 per cent area of the total cropped area. The area under banana was 570.16 hectares.

Table 3.2 Cropping pattern of Jalgaon district

Sr. No	Particulars	Area('00' ha)	Percentage to gross cropped area (per cent)
1	Paddy	7.07	0.06
2	Maize	150.06	1.36
3	Wheat	536.63	4.87
4	Kh Jowar	1181.69	10.72
5	Rabi Jowar	180.48	1.64
6	Bajra	289.17	2.62
	Total cereals	**2345.10**	**21.27**
7	Tur	119.12	1.08
8	Moong	255.12	2.31
9	Udid	530.12	4.81
10	Kulith	1.45	0.01
11	Gram	250.18	2.27
	Total pulses	**1155.99**	**10.48**
12	Groundnut	190.74	1.73
13	Sunflower	25.12	0.23
14	Safflower	3.98	0.04
15	Soybean	33.58	0.30
16	Sugarcane	715.20	6.49
17	Cotton	5896.13	53.48
18	Chilli	27.14	0.25
19	Garlic	1.11	0.01
20	Potato	0.09	0.00
21	Onion	23.10	0.21
22	Brinjal	6.18	0.06
23	Tomato	1.85	0.02
24	Banana	570.16	5.16
25	Citrus	29.12	0.26
26	Grapes	0.70	0.01
	GCA	**11025.29**	**100.00**

4. RESULTS AND DISCUSSION

Based on objectives and methodology as mentioned in previous chapters, a systematic study was conducted and results obtained from analysis of data have been presented in this chapter as follows.

4.1 General information about Jalgaon brinjal growers

4.2 To study the resource use, costs and returns of Jalgaon Brinjal

4.3 To estimate resource use efficiency

4.4 To estimate the marketing costs, market margin and price spread of Jalgaon brinjal

4.5 To identify the problems in production and marketing and suggest the measures

4.1 General Information

General information of the selected brinjal grower for the present study helps to understand the grower's background and socio-economic conditions of brinjal growers under the following sub heads.

4.1.1 Average Family Size and It's Composition

The information about the size and family gives an idea about the available labour force and also indirectly indicates the consumption needs of the family. The details about the size and compositions of the selected farm families growing brinjal is presented in the Table 4.1.

It can be seen from the table that, at the overall level the average size of family was 5.06 consisting 51.40 per cent male and 38.53 per cent females.

Percentage of members working on farm was highest in small size of group, followed by medium and large size of group and they were 52.94, 52.53, 47.26, respectively. At overall level age is 48.24 years. The average family size of the small size group was found to be 5.10, consisting of 49.02 per cent males and 38.63 per cent females and 12.35 per cent childrens. Percentage of members working on the farm was 52.94 per cent. In small size group age was 46.37 years.

In medium size group average Family size was 5.14 consisting 54.47 per cent male, 36.38 per cent females and 9.14 per cent childrens. Percentage of members working on farm was 52.53, age was 51.13 years.

In large size group average size of family was 4.93 consisting 50.71 per cent male 40.57 per cent females and 8.72 per cent children. Percentage of members working on farm, age in years was 47.26 and 47.23, respectively.

Table 4.1 Average Family size and composition of Jalgaon brinjal farmers (Numbers)

Sr. No.	Particulars	Size Groups			
		Small	**Medium**	**Large**	**Overall**
1	**Family size (Number)**				
a	**Male**	2.50 (49.02)	2.80 (54.47)	2.50 (50.71)	2.60 (51.40)
b	**Female**	1.97 (38.63)	1.87 (36.38)	2.00 (40.57)	1.95 (38.53)
c	**Children**	0.63 (12.35)	0.47 (9.15)	0.43 (8.72)	0.51 (10.07)
	Sub Total	5.10 (100.00)	5.14 (100.00)	4.93 (100.00)	5.06 (100.00)
2	**Members working on Farm**	2.70 (52.94)	2.70 (52.53)	2.33 (47.26)	2.58 (50.96)
3	**Age (years)**	46.37	51.13	47.23	48.24

(Figures in the parentheses are percentage to the total)

4.1.2 Educational Status of Jalgaon Brinjal Growers

Education is an important factor influencing managerial ability and technical knowledge of the farmers. The information regarding education is presented in Table 4.2.

At the overall level 21.11 per cent of family members were having education upto degree level, 40.00 per cent members having education upto higher secondary level, 14.44 per cent family members having education upto secondary level, 20.00 per cent family members having education upto primary level and 4.44 per cent family members were illiterate.

4.2 Educational Status of Jalgaon Brinjal Farmers (Numbers)

Sr. No.	Particulars	Size Groups			
		Small	**Medium**	**Large**	**Overall**
1	**Up to Primary**	5.00 (16.67)	7.00 (23.33)	6.00 (20.00)	6.00 (20.00)
2	**Up to Secondary**	4.00 (13.33)	5.00 (16.67)	4.00 (13.33)	4.33 (14.44)
3	**Up to Higher secondary**	13.00 (43.33)	11.00 (36.67)	12.00 (40.01)	12.00 (40.01)
4	**Up to Degree**	6.00 (20.00)	6.00 (20.00)	7.00 (23.33)	6.33 (21.11)
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 the parentheses are percentage to the total)

It was observed that in small size group 20.00 per cent family members were educated upto degree level, 43.33 per cent members were upto higher secondary level, 13.33 per cent upto secondary level, 16.67 per cent family members were upto primary level and 6.67 per cent family members were illiterate. It was observed in small size group.

In medium size group, 20.00 per cent family members were educated upto degree level, 36.67 per cent upto higher secondary level, 16.67 per cent upto secondary level, 23.33 per cent upto primary level and 3.33 per cent family members were illiterate.

In large size group 23.33 per cnt of family members were educated upto degree level, 40.00 per cent upto higher secondary, 13.33 per cent upto secondary level , 20.00 per cent upto primary level and 3.33 per cent family members were illiterate in large size group.

4.1.3 Land Use Pattern of Jalgaon Brinjal Farmers

The land is important capital assets for the farmers. The particulars regarding average holding size, cultivable land and gross cropped area are given in table 4.3.

The average land holding was 2.63, 2.89 and 3.92 hectare in small, medium and large size group of sample farmers respectively with an overall average holding of 3.15 hectares. The net sown area at the overall level was 3.03 hectares, which accounted for 96.35 per cent of total holdings. At the overall level the area under permanent fallow land was 3.65 per cent. At overall level, the gross cropped area was 3.81 hectares and cropping intensity was 126.04 per cent.

In small size holding the net sown area was 2.54 hectares, which accounted for 97.03 per cent, the gross cropped area was 3.26 hectares and cropping intensity was 128.35 per cent

In medium size holding the net sown area was 2.81 hectares, which accounted for 97.20 per cent, the gross cropped area was 3.57 hectares and cropping intensity was 127.05 per cent.

In large size holding the net sown area was 3.74 hectares, which accounted for 95.41 per cent, the gross cropped area was 4.59 hectares and cropping intensity was 122.73 per cent.

Table. 4.3 Land utilization pattern of Jalgaon brinjal farmers (Area:- ha)

Sr.no.	Particulars	Small	Medium	Large	Overall
1	Total land holding	2.63 (100.00)	2.89 (100.00)	3.92 (100.00)	3.15 (100.00)
2	Permanent fallow	0.08 (2.97)	0.081 (2.80)	0.18 (4.59)	0.12 (3.65)
3	Net cropped area	2.54 (97.03)	2.81 (97.20)	3.74 (95.41)	3.03 (96.35)
4	Gross cropped area	3.26	3.57	4.59	3.81
5	Cropping intensity (%)	128.35	127.05	122.73	126.04

(Figures in the parentheses are percentage to the total)

4.1.4. Cropping Pattern of Jalgaon Brinjal Growers

Table. 4.4. Cropping pattern of Jalgaon Brinjal Growers **(ha / farm)**

Sr. No.	Particulars	Small	Medium	Large	Overall
A	**Kharif season**				
1	Cotton	0.15	0.19	0.17	0.17
		(4.58)	(5.38)	(3.78)	(4.58)
2	Groundnut	0.14	0.14	0.13	0.14
		(4.24)	(3.78)	(2.88)	(3.64)
3	Brinjal	0.25	0.61	1.12	0.66
		(7.80)	(17.09)	(24.34)	(16.41)
	Sub total	0.54	0.94	1.42	0.97
		(16.62)	(26.25)	(31.00)	(24.63)
B	**Rabi season**				
1	Wheat	0.22	0.20	0.24	0.22
		(6.68)	(5.51)	(5.26)	(5.81)
2	Sorghum	0.14	0.19	0.19	0.17
		(4.24)	(5.23)	(4.09)	(4.52)
	Sub total	0.36	0.38	0.43	0.39
		(10.92)	(10.74)	(9.35)	(10.33)
C	**Summer season**				
1	Groundnut	0.09	0.08	0.08	0.08
		(2.84)	(2.10)	(1.78)	(2.24)
2	Fruit- Veg.	0.26	0.25	0.31	0.27
		(8.08)	(7.00)	(6.69)	(7.26)
3	Fodder(Sorghum)	0.03	0.05	0.04	0.04
		(1.01)	(1.43)	(0.83)	(1.09)
	Sub total	0.39	0.38	0.43	0.40
		(11.93)	(10.53)	(9.30)	(10.59)
D	**Annual crop**				
1	Maize	0.07	0.06	0.12	0.08
		(2.15)	(1.68)	(2.61)	(2.15)
2	Onion	0.19	0.14	0.16	0.16
		(5.67)	(3.92)	(3.55)	(4.38)
	Sub total	0.26	0.20	0.28	0.25
		(7.82)	(5.60)	(6.16)	(6.53)
	Perenial crop				
1	Banana	1.23	1.39	1.60	1.41
		(37.73)	(38.94)	(34.86)	(37.17)
2	Ber	0.27	0.22	0.33	0.27
		(8.23)	(6.25)	(7.19)	(7.22)
	Sub total	1.50	1.67	1.93	1.70
		(45.96)	(45.19)	(42.05)	(44.39)
	Gross cropped area	**3.26**	**3.57**	**4.59**	**3.81**
		(100.00)	**(100.00)**	**(100.00)**	**(100.00)**
	Net crooped area	**2.54**	**2.81**	**3.74**	**3.03**
	Cropping intensity (%)	**128.35**	**127.05**	**122.73**	**126.04**

(Figures in the parentheses are percentage to the total)

The cropping pattern is another vital factor influencing the level of expenses on the farm and returns from farm business. It is also indicator of the economic condition of selected farm families.

At the overall level, Banana occupied the highest i.e. 37.17 per cent of gross cropped area. Followed by brinjal 16.41 per cent, fruit vegetables 7.26 per cent, ber 7.22 per cent, wheat 5.81 per cent, cotton 4.58 per cent, groundnut 3.64 per cent, sorghum 4.52 per cent, onion 4.38 per cent, groundnut 2.24 per cent, maize 2.15 per cent and fodder (sorghum) 1.09 per cent respectively. At the overall level cropping intensity was 126.04 per cent. Among the different size of holding the cropping intensity was 128.35 per cent, 127.05 per cent and 122.73 per cent in small, medium and large size groups, respectively.

The cropping intensity of small size group was more than medium and large size groups. At the overall level gross cropped are was 3.81 ha. It was 3.26,3.57, 4.59 ha. In small, medium and large size groups, respectively.

4.2 Resource Use, Costs And Returns of Jalgaon Brinjal

Per ha physical inputs used in brinjal production were estimated and presented in Table 4.5 It can be observed from the table that, at the overall level, the use of total human labour was 592.22 man days per hectare, comprising 136.13 male labour and 456.09 female labour days. The average per hectare labour utilization was 566.69, 611.21 and 598.75 man days for small, medium and large size of groups. At the overall level, per hectare use of bullock labour was 11.70 pair days. The per hectare bullock power utilization was observed more in case of small group of holding (12.46 pair days) than large (11.39 pair days) and medium (11.26 pair days) size group of holdings. At the overall level 1.43 (kg) seeds were used. Seeds were used more in medium size group (1.79 kg) followed by small size group (1.32 kg) and large size group (1.19 kg). At the overall level, the use of manure was 31.18 tonnes per hectare. The use of manure was found more in medium size group of holdings than small and large size group of holdings. At the overall level, per hectare use of chemical fertilizers i.e Nitogenous, Phosphorus and Potash was 286.75, 391.26 and 387.91 kg ha respectively. The farmers from medium size group had used more fertilizers than small and large size groups. At the overall level per hectare irrigation cost was (6122.55 ₹) Per hectare irrigation costs were more in medium size group (₹ 6182.75) than large (₹ 6144.75) and small (₹ 6040.48) size groups.

Table. 4.5. Per hectare physical inputs used in Jalgaon brinjal production

Sr. No.	Particulars	Size of group holding			Overall
		Small	Medium	Large	
1	Human labour (Days)	566.69	611.21	598.75	592.22
	Male	139.25	142.19	126.94	136.13
	Female	427.44	469.02	471.81	456.09
2	Bullock Labour(Pair day)	12.46	11.26	11.39	11.70
3	Machine labour(Hours)	4.55	1.47	0.73	2.25
4	Seed (kg)	1.32	1.79	1.19	1.43
5	Manures (Tonnes)	32.10	33.33	28.10	31.18
6	Fertilizers (kg)				
	N	304.81	284.12	271.33	286.75
	P	368.20	384.71	420.87	391.26
	K	384.04	408.63	371.05	387.91
7	Irrigation costs (₹)	6040.48	6182.75	6144.41	6122.54
8	Plant protection (₹)	15799.17	15696.93	14752.02	15416.04

It can be observed from the table that, at overall level, the plant protection costs was ₹ 15416.04. The use of plant protection was found more in small (₹ 15799.17) size group of holding than medium (₹ 15696.93) and large (₹ 14752.02) size group of holding.

4.2.1. Cost of cultivation of Jalgaon Brinjal

Per hectare cost of cultivation of brinjal was worked out by using standard cost concepts. The information on various items of cost of cultivation of brinjal in jalgaon district for different size groups of holdings is presented in table 4.6.

It can be observed from the table that, at the overall level per hectare cost of cultivation of brinjal i.e. Cost ‘C’ was ₹ 439518.49. Amongst the different items of cost, rental value of land was the major item of cost which accounted for ₹ 185871.48 (44.49%) followed by manure ₹ 62357.79 (14.93%), hired human labour ₹ 72834.60 (16.57%) where male ₹ 27225.24 (6.19%) and female ₹ 45609.36 (10.38%), fertilizer ₹ 34488.13 (7.85%), plant protection ₹ 15416.04 (3.51%), family labour ₹ 12858.13 (3.08%), where male labour ₹ 10335.80 (2.47%), female ₹ 2523.02 (0.60%), bullock labour ₹ 1644.95 (2.92%), interest on working capital ₹ 13140.88.(2.99%), seed ₹ 7170.99 (1.72%), irrigation ₹ 6122.55(1.39%), machinery ₹ 5975.20 (1.41%), interest on fixed capital ₹ 5629.22 (1.35%), incidental charges ₹ 1811.67 (0.43%), Repairs ₹ 1192.76 (0.29%), land revenue ₹ 210.83 (0.05%) of the total cost of cultivation of brinjal, Cost ‘A’ was ₹. 235159.04 (53.50%) and Cost ‘B’ was ₹ 4426659.67 (97.07%). In case of cost 'B' and cost 'C' It was seen that, the cost was decreasing with increase in size group of holding. The per quintal cost of brinjal cultivation was observed to be high for small size of holdings as compared to medium and large size group of holdings.

Table 4.6 Itemwise cost of production of Jalgaon brinjal **(per ha)**

Sr.	Particulars	Group			
No.		Small	Medium	Large	Overall
A.	Cost of Cultivation				
i)	Hired Labour				
	Male	27850.73 (6.26)	28437.87 (6.34)	25387.13 (5.97)	27225.24 (6.19)
	Female	42744.43 (9.61)	46902.47 (10.46)	47181.17 (11.09))	45609.36 (10.38)
	Total labour	70595.16 (15.87)	75340.34 (16.80)	72568.3 (17.06)	72834.60 (16.57)
ii)	Bullock labour	12463.69 (3.09)	11083.2 (2.73)	11387.96 (2.94)	11644.95 (2.92)
iii)	Seed	6594.54 (1.48)	8957.73 (2.00)	5960.71 (1.40)	7170.99 (1.63)
iv)	Machinary	10977.06 (2.47)	4729.72 (1.05)	2218.82 (0.52)	5975.20 (1.35)
v)	Manure	64204.84 (14.44)	66665.53 (14.86)	56202.99 (13.22)	62357.79 (14.19)
vi)	Fertilizer	37909.08 (8.52)	35782.74 (7.98)	29772.58 (7.00)	34488.13 (7.85)
vii)	Irrigation	6040.48 (1.36)	6182.75 (1.38)	6144.41 (1.44)	6122.55 (1.39)
viii)	PPC	15799.17 (3.55)	15696.93 (3.50)	14752.02 (3.47)	15416.04 (3.51)
ix)	Repairs	1132.09	1256.55	1189.63	1192.76
		(0.25)	(0.28)	(0.28)	(0.27)
x)	Incidental charges	1884.79 (0.42)	1792.08 (0.40)	1758.14 (0.41)	1811.67 (0.41)
xi)	Working Capital	227600.903 (51.45)	227487.557 (50.98)	201955.54 (47.74)	219014.67 (49.83)
xii)	Interest on working	13656.05	13649.25	12117.33	13140.88

To be continued…

	capital @6%	(3.07)	(3.04)	(2.85)	(2.99)
xiii)	Depreciation	1348.61 (0.30)	2097.1 (0.47)	4932.27 (1.16)	2792.66 (0.64)
xiv)	Land revenue	210	208.5	214	210.83
		(0.05)	(0.05)	(0.05)	(0.05)
	Cost A	**242815.57** **(54.59)**	**243442.41** **(54.87)**	**219219.14** **(51.55)**	**235159.04** **(53.50)**
xv)	Rental value of land	177836.49 (39.98)	190107.69 (42.39)	189670.04 (44.60)	185871.41 (42.29)
xvi)	Interest on F.C.	3536.23 (0.80)	4259.86 (0.95)	9091.56 (2.14)	5629.22 (1.28)
	Cost B	**424188.288** **(95.65)**	**437809.965** **(97.88)**	**417980.75** **(98.29)**	**426659.67** **(97.07)**
	Family labour				
i) ii)	Male Female	16625.95 (3.74) 3962.9 (0.89)	8571.18 (1.91) 2124.94 (0.47)	5810.28 (1.37) 1481.23 (0.35)	10335.80 (2.35) 2523.02 (0.57)
	Total	20588.85 (4.63)	10696.12 (2.38)	7291.51 (1.71)	12858.83 (2.93)
	Cost C	**444777.14** **(100.00)**	**448506.08** **(100.00)**	**425272.26** **(100.00)**	**439518.49** **(100.00)**
B.	**Output** Main produce By produce	 194.23 0.00	 216.32 0.00	 267.43 0.00	 225.99 0.00
	Gross value	874035.00	973440.00	1203435.00	1016970.00
C.	**Per Qtl. Cost of Production**	**2289.95**	**2073.35**	**1590.22**	**1984.51**

The per hectare total cost of cultivation for small, medium and large size group was ₹. 444777.14 ₹. 448506.08 and ₹. 425272.26 respectively. There was higher variation in use of different inputs among all types of size groups which has resulted into vast difference in cost of cultivation of brinjal.

4.2.2. Costs, Returns, Gross Income and B:C Ratio of Jalgaon Brinjal

The information on per hectare cost, returns, gross income and B:C ratio of brinjal are presented in Table 4.7.

From the above table it is observed that, per hectare gross income received by brinjal growers was ₹. 874035.00, ₹ 973440.00 and 1203435.00 for small, medium and large size group of holdings respectively. At the overall level it was ₹ 1016970.00 with per hectare production of 225.99 quintals of brinjal. Among the different size of holdings per hectare yield were 194.23, 216.32 and 267.43 quintals in small, medium and large size groups respectively. It indicates that per hectare yield of brinjal was highest in large size group. The per hectare profit at

Table 4.7 Costs, returns, gross income and B:C ratio (per ha)

Sr. No.	Particulars	Size Group			
		Small	Medium	Large	Overall
1	Gross returns	874035.00	973440.00	1203435.00	1016970.00
2	Costs (₹.)				
	i) Cost A	242815.57	243442.41	219219.14	235159.04
	ii) Cost B	424188.29	437809.96	417980.75	426659.67
	iii) Cost C	444777.14	448506.08	425272.26	439518.49
3	Profit (₹.)				
	i) Cost A	631219.43	729997.59	984215.86	781810.96
	ii) Cost B	449846.71	535630.04	785454.25	590310.33
	iii) Cost C	429257.86	524933.92	778162.74	577451.51
4	Production	194.23	216.32	267.43	225.99
5	**Benefit - Cost ratio**	**1.97**	**2.17**	**2.83**	**2.31**

cost C was highest in case of large size group (₹. 778162.74.) followed by medium size group of farm (₹. 524933.92) and small size group (₹.429257.86).

The benefit cost ratio at cost 'C' was highest in case of large size group (2.83) of holding. Followed by medium size group (2.17) and small size group (1.97) of holdings. At overall level, benefit cost ratio was 2.31.

The cultivation of brinjal is economically viable as the benefit cost ratio at all the levels of cost and groups were observed more than unity, Hence the hypothesis that Jalgaon Brinjal is Profitable is proved.

4.2.3. Results of Cobb-Douglas Production Function

It can be revealed from the table that, at the overall level the value of co-efficient of multiple determination was estimated 94 per cent. The value of co-efficient of multiple determination thus indicated that the nine resource variables jointly together explained 94 per cent variation in the output of brinjal.

Table 4.8. Results of estimated Cobb-Douglas Production Function

Sr. No.	Variables	Regression coefficients
1	Constant (Intercept)	1.12 1.25
2	Seed (X1)	-0.002 NS 0.01
3	Male (X2)	0.003NS 0.03
4	Female (X3)	0.06 NS 0.05
6	Manure (X4)	0.18** 0.03
7	Nitrogen (X5)	0.10*** 0.03
8	Phosphorus (X6)	0.14*** 0.04
9	Potassium (X7)	0.05*** 0.02
10	Irrigation Cost (X8)	0.48*** 0.09
11	Plant Protection Cost (X9)	-0.29*** 0.10
	R^2	**0.94**

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The regression co-efficient of nitrogen(X_5), phosphorus(X_6), potassium(X_7), Irrigation cost(X_8) were positive and highly significant at 1 per cent level of significance. The regression co-efficient of Manure(X_4) were positive and significant at 5 per cent level of significance, this indicates that there is scope to increase the use of these resources to increase the production. Positive and significant coefficients indicated that, one per cent increase in the use of N, P, K, Irrigation cost and Manure would increase the yield by 0.10, 0.14, 0.05, 0.48 and 0.18 per cent respectively.

While plant protection cost(X_9) was negatively significant at 1 per cent level of significance, however seed(X_1), male(X_2) and female(X_3) were Non-significant.

4.3. Resource Use Efficiency

Table 4.9. Resource Use Efficiency

Sr. No.	Resources	M.V.P.	F.C.(Px)	MVP/FC	Remarks	
1	Seed (X_1)	-2234.28	5000	-0.45	Excess utilized	NS
2	Male (X_2)	28.61	200	0.14	Excess utilized	NS
3	Female (X_3)	157.59	100	1.58	Excess utilized	NS
4	Manure (X_4)	2948.68	2000	1.47	Under utilized	**
5	Nitrogen (X_5)	398.64	11.91	33.47	Under utilized	***
6	Phosphorus (X_6)	387.55	37.5	10.33	Under utilized	***
7	Potassium (X_7)	143.48	28	5.12	Under utilized	***
8	Irrigation Cost (X_8)	86.70	1	86.70	Under utilized	***
9	Plant Protection Cost (X_9)	-21.09	1	-21.09	Excess utilized	***

An efficiency of resource use on the sample farm was judged with the help of MVP/FC ratio.

It was observed from table that, MVP/FC ratio for the variables seed (X_1), male (X_2) and plant protection cost (X_9) was less than unity showing that optimum resource use efficiency was not achieved and in case of variables female (X_3), manure (X_4), N (X_5), P (X_6), K(X_7) and irrigation cost (X_8) were greater than unity, this implied that higher resource use efficiency was achieved. In case of these variables analysis revealed that the profitability of brinjal production could be maximized by increasing the use of female labour, manure, nitrogen, phosphorus, potassium and irrigation charges.

4.4 . Marketing of Jalgaon Brinjal

The climatic variation in India helps to produce a variety of fruits and vegetables. Many times, the production of these commodities fall short of effective demand. The marketing of the farm produce is equally important from the farmers point of view. The return to producer largely depends on the way in which these operations were performed. It is strongly applicable to agricultural produce like fruits and vegetables. At most care is required to be taken while making it for marketing

4.4.1 Harvesting

Without affecting the quality of brinjal the harvesting should be done at proper stage of maturity. Careless handling results in reducing the market value and keeping quality. The most importanf factors that determine the quality of product were careful picking operations, suitable packing material and quick transportation. The carelessness in any of these operations adversely affected the quality and value of the produce which influences the prices of the product. Harvesting stage generally depends on the type of marketing channel through which the produce is to be sent.

4.4.2 Production and Disposal Pattern of Jalgaon brinjal

The total produce of brinjal was disposed off as home consumption, gratis, losses due to pests and diseases and rest was marketed. The information regarding disposal pattern of brinjal is given in table 4.10.

At an overall level total quantity of brinjal produced was 225.99 q per hactere. Out of this total production 0.15 per cent, 0.81 per cent and 1.22 per cent were used for home consumption, gratis and losses due to pests and diseases, respectively. Marketed surplus at the overall level was 97.82 per cent.

It can be seen from the table that, total quantity of brinjal produced per farm were 194.23q, 216.32q and 267.43q in small, medium and large size groups, respectively and in case of small size group home consumption, gratis, losses due to pests and diseases and marketed surplus was 0.16, 0.94, 1.16 and 97.74 percent, respectively.

Table 4.10 Production and disposal pattern of Jalgaon brinjal (q / farm)

Sr. No.	Particulars	Group			
		small	medium	large	Overall
1	Total production	194.23 (100.00)	216.32 (100.00)	267.43 (100.00)	225.99 (100.00)
2	Home consumption	0.31 (0.16)	0.43 (0.20)	0.25 (0.09)	0.33 (0.15)
3	Gratis	1.83 (0.94)	1.72 (0.79)	1.85 (0.69)	1.8 (0.81)
4	Losses due to pests and diseases	2.25 (1.16)	2.85 (1.32)	3.2 (1.20)	2.76 (1.22)
	Marketed surplus	**189.84 (97.74)**	**211.32 (97.69)**	**262.13 (98.02)**	**221.09 (97.82)**

(Figures in parentheses are the percentage to the total)

In medium size group total production (216.32q) includes home consumption (0.20%), gratis(0.79%), losses due to pests and diseases (1.32%) and marketed surplus (97.69%) and in case of large size group total production was (267.43q), home consumption (0.09%), gratis (0.69%), losses due to pests and diseases (1.20%) and marketed surplus (98.02%), respectively to total production.

4.4.3. Packaging

Packing is the most important function. Ideal packing reduced losses in transport, increase keeping quality and ultimately fetches good prices in the market. It was noticed that packing material was selected on the basis of market preference, durability of packing material, suitability for handling and ability of maintaining keeping quality, distance to market and mode of payment.

For brinjal most of the farmers have used plastic crates in place of wooden boxes and corrugated boxes. About 22.39 per cent farmers have their own plastic crates and the remaining 77.61 per cent farmers have hired from the transport companies at 8 per cent trip per crates. About rent of plastic crates, 26.85 per cent farmers said that it was reasonabl and 73.15 per cent farmers opined that it was costly. Wooden boxes were used by the wholesaler to sell the produce in distance market like Nashik and Vashi Furthermore, it was noticed that in case of plastic crates as well as wooden boxes, grass and newspaper were used at the top and bottom.

It was observed that majority of the farmers used plastic crates as a packing material as it was reported that is is cheap, suitable for maintain good condition for longer period and can be used for number of times as compared to the wooden boxes which are costly and not being returned by the traders, plastic crates have capacity of 18 kg.

4.4.4. Transportation

After proper packing, the transportation to different market place is very important for speedy delivery with minimum deterioration for getting better prices. The conventional methods of transport for carrying the brinjal are load, bullock cart, tractors, rickshaws etc. These modes of transport are generally used for primary, secondary and terminal markets, respectively.

4.4.5 Marketing Channel of Jalgaon Brinjal

Marketing channels state that how produce passes through different marketing agencies from producer till it reaches to the consumer. It is essential to point out different marketing channels used in brinjal marketing during present study. Following were different marketing channels observed during the stuay.

Channel-I : Proucer – Consumer

Channel-II : Producer – Retailer – Consumer

Channel-III : Producer – Wholesaler – Retailer – Consumer

The detailed information on the quantity of produce sold through different marketing channels by the brinjal growers presented in table 4.11. It could be seen that there are three marketing channels were observed in brinjal marketing. The marketing channel-III (Producer – Wholesaler – Retailer – Consumer) was the most preferred

Table 4.11 Channelwise quantity sold **(q / ha)**

sr no	Marketing channel	group			
		small	medium	large	overall
1	I (P-C)	11.95 (6.29)	9.18 (4.34)	7.25 (2.76)	9.46 (4.47)
2	II (P-R-C)	34.8 (18.33)	30.76 (14.56)	28.85 (11.01)	31.47 (14.63)
3	III (P-W-R-C)	143.09 (75.38)	171.38 (81.10)	226.03 (86.23)	180.16 (80.90)
	Total quantity marketed	**189.84 (100.00)**	**211.32 (100.00)**	**262.13 (100.00)**	**221.09 (100.00)**

(Figures in parentheses are the percentage to total)

(P-C=Producer-Consumer,P-R-C=Producer-Retailer-Consumer,P-W-R-C=Producer-Wholesaler-Retailer-Consumer)

channel among the other two marketing channel and through which 80.90 per cent of the total produce was marketed followed by channel-II (Producer – Retailer – Consumer) through which

14.63 per cent of the total produce was marketed. Quantity marketed through channel -I (Producer – Consumer) constituted 4.47 per cent of the total produce.

In case of small size group, the maximum quantity 75.38 per cent were marketed through channel-III (Producer –Wholesaler – Retailer – Consumer) followed by channel – II (Producer – Retailer – Consumer)18.33 per cent and channel – I (Producer – Consumer) 6.29 per cent.

The brinjal growers from medium size group sold the highest quantity of produce 81.10 per cent through channel-III (Producer –Wholesaler – Retailer – Consumer) followed by channel-II (Producer – Retailer – Consumer) 14.56 per cent and channel-I (Producer – Consumer) 4.34 per cent.

In case of large group, the maximum quantity 86.23 per cent of total produce was marketed through channel-III(Producer –Wholesaler – Retailer – Consumer) followed by channel-II (Producer – Retailer – Consumer) 11.01 per cent and channel-I (Producer – Consumer) 2.76 per cent.

4.4.6. Cost of Marketing through Different Channels of Jalgaon Brinjal

Various marketing functions *viz.,* packing, transportation and handling of produce, etc, are required to be performed in the marketing of Jalgaon Brinjal. The cost incurred for performing these operations are very important in Jalgaon Brinjal marketing.

Table 4.12. Channelwise marketing cost **(₹ / q)**

Sr. No.	Particulars	channel I P-C	channel II P-R-C	Channe-lIII (P-W-R-C)		
				Nashik	Mumbai	Overall
1	Packaging charges	40 (61.54)	42 (38.78)	41 (19.66)	40 (15.69)	40.5 (17.48)
2	Transport charges	25 (38.46)	66.3 (61.22)	155 (74.34)	200 (78.43)	177.5 (76.59)
3	Hamali	0.00 (0.00)	0.00 (0.00)	10.00 (4.79)	12.5 (4.90)	11.25 (4.85)
4	Weighing charges	0.00 (0.00)	0.00 (0.00)	2.5 (1.21)	2.5 (0.98)	2.5 (1.08)
	Total marketing cost	**65 (100.00)**	**108.3 (100.00)**	**208.5 (100.00)**	**255 (100.00)**	**231.75 (100.00)**

(Figures in parentheses are the percentage to the total)

The per quintal marketing cost of Jalgaon Brinjal in different marketing channels on performing the operations such as packing, transportation and commission charges are worked out and presented in table 4.12.

It can be seen from the table that, the per quintal cost of marketing of Jalgaon Brinjal for channel-I, Channel-II and Channel-III was ₹. 65, ₹. 108.3, ₹. 231.75 respectively. Thus, per quintal cost of marketing was highest in Channel-III (Producer – Wholesaler – Retailer – Consumer). Among the marketing cost transport charges and packing charges were the major items and contributed highest share in the total cost of marketing. Transport charges are contributed maximum cost in Channel-II and Channel-III. Transport charges contributed 76.59 per cent in Channel-III.

4.4.7. Price spread and Marketing Efficiency in Different Marketing Channels

Table 4.13. Channelwise price spread **(₹ / q)**

Sr. No	Particulars	channel I (P-C)	channel II (P-R-C)	Channel III (P-W-R-C)		
				Nashik	Mumbai	Overall
1	Gross price received by the producers	4500.00 (100.00)	3500.00 (70.00)	3400.00 (57.63)	3500.00 (58.33)	3450.00 (57.98)
	Market expenses incurred by producer	65.00 (1.44)	108.30 (2.17)	208.50 (3.53)	255.00 (4.25)	231.75 (3.89)
	Net price received by the producers	**4435.00** (98.56)	**3391.70** (67.83)	**3191.50** (54.09)	**3245.00** (54.08)	**3218.25** (54.09)
2	**Wholesaler**					
	Purchase price of wholesaler			3400.00 (57.63)	3500.00 (58.33)	3450.00 (57.98)
	Expenses incurred by the wholesalers			530.00 (8.98)	510.00 (8.50)	520.00 (8.74)
	Commission received by the wholesalers			680.00 (11.53)	690.00 (11.50)	685.00 (11.51)
	Price received by the wholesalers			4610.00	4700.00	4655.00
3	**Retailer**					
	Purchase price of retailer		3500.00 (70.00)	4610.00 (78.14)	4700.00 (78.33)	4270.00 (71.76)
	Expenses incurred by the retailer		570.00 (11.40)	530.00 (8.98)	525.00 (8.75)	527.50 (8.87)
	Commission received by the retailer		930.00 (18.60)	760.00 (12.88)	775.00 (12.92)	767.50 (12.90)
	Price received by the retailer		5000.00	5900.00	6000.00	5950.00
4	**Price paid by the consumer**	**4500.00** (100.00)	**5000.00** (100.00)	**5900.00** (100.00)	**6000.00** (100.00)	**5950.00** (100.00)
5	**Price spread**	65.00	1608.30	2708.50	2755.00	2731.75

(Figures in parentheses are the percentage to total)

Price spread is the difference between the price paid by the consumer and price received by the producer. This consists of marketing costs and margins of the different channels. The costs and margins of agency in different channels were worked out and details are presented in Table 4.13. It is observed from the table 4.13, the net price realized by the producer was ₹. 4435, ₹. 3391.70 And ₹. 3218.25 in Channel-I, Channel-II and Channel-III, respectively. Price spread was the minimum (₹. 65.00) in channel-I (Producer – Consumer). As there no market margins between producer and consumer. Price spread was maximum in channel-III (₹. 2731.75), followed by channel-II (₹ 1608.30). This is due to fact that with increases in internediatories price spread also increases. The price paid by consumer was highest in channel-III followed by channel-II. Table 4.13. shows that Producer's share in consumer's rupee was the highest (98.56%) in channel-I followed by channel-II (67.83%) and channel-III (54.09%).

Table 4.14 Channelwise Marketing Efficiency **(₹ / q)**

Channel		**Price paid by consumer**	**Net price realized by producer**	**Marketing cost**	**Marketing margin**	**MC+MM**	**MME %**
channel I		**4500.00**	4435.00	65.00		65.00	68.23
channel II		**5000.00**	3391.70	678.30	930.00	1608.30	2.11
	Nashik	**5900.00**	3191.50	1268.50	1440.00	2708.50	1.18
Channel III	Mumbai	**6000.00**	3245.00	1290.00	1465.00	2755.00	1.18
	Overall	**5950.00**	3218.25	1279.25	1452.50	2731.75	1.18

Marketing efficiency was worked out by using modified method as suggested by Acharya and Agrawal from the table 4.14 it was seen that, the marketing efficiency was maximum for Channel-I (68.23%), followed by Channel-II (2.11%) and Channel-III (1.18%) respectively. Channel-I was the most efficient channel in marketing of Jalgaon Brinjal.

4.5 Constraints Faced by Jalgaon Brinjal growers in Production and Marketing of Jalgaon Brinjal

The Jalgaon Brinjal crop is more sensitive to vagaries of weather and diseases. It also requires proper cultivation operations for better productivity.

At the time of survey, questions were asked to the sample cultivators to understand the problem faced by them in production and marketing of Jalgaon Brinjal. The information obtained on the problems of Jalgaon Brinjal in production and marketing at the cultivator's level has been confirmed in following table.

Table 4.15. Constraints in production of Jalgaon Brinjal

Constraints in production and marketing of Jalgaon Brinjal were calculated by using Response Priority Index Method and results are given in following table.

Sr. No.	Problems	RPI	Rank
1	Disease and Pest occurrence	0.8200	I
2	Weed infestation	0.1000	VII
3	Lack of credit facility	0.2311	IV
4	High price of Seeds	0.2978	II
5	Inadequate labour availability	0.1978	V
6	Irregular electricity supply	0.1044	VI
7	High cost of pesticides	0.2333	III

It is observed from table 4.15 that, in production constrains, disease and pest occurrence was major problem which was expressed by (Rank I). followed by high price of seeds (Rank-II), high cost of pesticides (Rank-III), lack of credit facility (Rank-IV), inadequate labour availability (Rank-V), irregular electricity supply (Rank-VI), weed infestation (Rank-VII).

Table 4.16. Constraints in marketing of Jalgaon Brinjal

Sr. No	Problems	RPI	Rank
1	Price fluctuations	0.4889	I
2	Lack of storage facilities	0.2000	III
3	Lack of Market information	0.3089	II

It is observed from Table 4.16 that, in marketing constraints price fluctuations was major problem which was expressed by (Rank-I), followed by lack of market information (Rank-II) and lack of storage facilities (Rank-III), respectively.

5. SUMMARY AND CONCLUSION

Jalgaon Brinjal has origin in India. Its botanical name is *Solanum melongena L*. It belongs to family *Solanceae*. Different varieties of Jalgaon Brinjal from private sector are bioseed companys-Jalgaon Brinjal trishul, Ankur-Ajay, Mauli-Vishal, Gaurav-Panchganga etc. and released by various agricultural universities are Pusa purle Long, Bhagyamathi, Green Spiny, Polur, Swarna Shobha (HABR-4), Kashi Prakash (IVBR-1), Krishna, Mnjari gota, Vaishali, Pragati, Phule harit. It is used in curry preparation giving the taste of non-vegetable food. The Bhurta is common dish in North India, prepared from Jalgaon Brinjal. Bhurta is also famous in Khandesh region. Apart from this it is used as medicine to cure toothache and for diabetic patient. Besides from fruit leaves and seeds used in medicine. To know the production, cost, returns, profitability and marketing aspects of Jalgaon Brinjal cultivation across different farms, the present study “Economics of production and Marketing of Jalgaon Brinjal” was undertaken with following specific objectives.

1. To study the resource use, costs and returns of Jalgaon Brinjal.
2. To estimate resource use efficiency.
3. To estimate the marketing costs, market margin and price spread of Jalgaon Brinjal.
4. To identify the problems in production and marketing and suggest the measures.

The sampling design adopted for the investigation was two stage purposive and random sampling with sample tahsil as a primary unit of sampling and village as a secondary unit of sampling. Three villages each from Yawal and Bhusaval tehsil were selected purposively from for study on the basis of area under Jalgaon Brinjal cultivation. The list of Jalgaon Brinjal growers along with their operational area and area under Jalgaon Brinjal cultivation for each of the selected villages were prepared on the basis of information obtained from village revenue office. The Jalgaon Brinjal growers were then arranged in descending order of their operational area for each of the selected villages and five growers from each of the three predetermined size classes (i.e. area under Jalgaon Brinjal cultivation) *viz.*, Group I (up to 0.40ha), Group II (0.41 to 0.80ha) and Group III (0.81 ha and above) thereby making a total of 15 growers for each village were selected randomly. Thus, the total sample size for the study was consists of 90 Jalgaon Brinjal growers comprising 30 each size group.

At the overall level the average size of family was 5.06 consisting 51.40 per cent male and 38.53 per cent females. Percentage of members working on farm was highest in small size of group, followed by medium and large size of group and they were 52.94, 52.53, 47.26 respectively. At overall level age is 48.24 years.

At the overall level 21.11 per cent of family members were having education upto degree level, 40.00 per cent members having education upto higher secondary level, 14.44 per cent family members having education upto secondary level, 20.00 per cent family members having education upto primary level and 4.44 per cent family members were illiterate.

The average land holding was 2.63, 2.89 and 3.92 hectare in small, medium and large size group of sample farmers respectively with an overall average holding of 3.15 hectares. The net sown area at the overall level was 3.03 hectares, which accounted for 96.35 per cent of total holdings. At the overall level the area under permanent fallow land was 3.65 per cent. At overall level, the gross cropped area was 3.81 hectares and cropping intensity was 126.04 per cent.

At the overall level, Banana occupied the highest i.e. 37.17 per cent of gross cropped area. Followed by Jalgaon Brinjal 16.41 per cent, fruit vegetables 7.26 per cent, ber 7.22 per cent, wheat 5.81 per cent, cotton 4.58 per cent, groundnut 3.64 per cent, sorghum 4.52 per cent, soybean 4.38 per cent, groundnut 2.24 per cent, maize 2.15 per cent and fodder (sorghum) 1.09 per cent respectively. At the overall level cropping intensity was 126.04 per cent. Among the different size of holding the cropping intensity was 128.35 per cent, 127.05 per cent and 122.73 per cent in amall, medium and large size groups, respectively.

At the overall level, the use of total human labour was 592.22 man days per hectare, comprising 136.13 male labour and 456.09 female labour days. The average per hectare labour utilization was 566.69, 611.21 and 598.75 man days for small, medium and large size of groups. At the overall level, per hectare use of bullock labour was 11.70 pair days. At the overall level 1.43 (kg) seeds were used. At the overall level, the use of manure was 31.18 tonnes per hectare. At the overall level, per hectare use of chemical fertilizers i.e Nitogenous, Phosphorus and Potash was 286.75, 391.26 and 387.91 kg ha respectively. The farmers from medium size group had used more fertilizers than small and large size groups. At the overall level per hectare irrigation cost was (6122.55 ₹).

At overall level, the plant protection costs was ₹ 15416.04. The use of plant protection was found more in small (₹ 15799.17) size group of holding than medium (₹ 15696.93) and large (₹ 14752.02) size group of holding.

At the overall level per hectare cost of cultivation of Jalgaon Brinjal i.e. Cost ‘C’ was ₹ 439518.49. The per hectare total cost of cultivation for small, medium and large size group was ₹. 444777.14, ₹. 448506.08 and ₹. 425272.26, respectively. There was higher variation in use of different inputs among all types of size groups which has resulted into vast difference in cost of cultivation of Jalgaon Brinjal.

Per hectare gross income received by Jalgaon Brinjal growers was ₹. 874035.00, ₹ 973440.00 and 1203435.00 for small, medium and large size group of holdings respectively. At the overall level it was ₹ 1016970.00 with per hectare production of 225.99 quintals of Jalgaon Brinjal. The cultivation of Jalgaon Brinjal is economically viable as the benefit cost ratio at all the levels of cost and groups were observed more than unity.

The regression co-efficient of N(X_5), P(X_6), K(X_7), Irrigation cost(X_8) were positive and hoghly significant at 1 per cent level of significance. The regression co-efficient of Manure(X_4) were positive and significant at 5 per cent level of significance, this indicates that there is scope to increase the use of these resources to increase the production. Positive and significant coefficients indicated that, one per cent increase in the use of N, P, K, Irrigation cost and Manure would increase the yield by 0.10, 0.14, 0.05, 0.48 and 0.18 per cent respectively.

While plant protection cost(X_9) was negatively significant at 1 per cent level of significance, however seed(X_1), male(X_2) and female(X_3) were non-significant.

The results revealed that, MVP/FC ratio for the variables seed (X_1), male (X_2) and plant protection cost (X_9) was less than unity showing that optimum resource use efficiency was not achieved and in case of variables female (X_3), manure (X_4), N (X_5), P (X_6), K(X_7) and irrigation cost (X_8) were greater than unity, this implied that higher resource use efficiency was achieved. In case of these variables analysis revealed that the profitability of Jalgaon Brinjal production could be maximized by increasing the use of female labour, manure, nitrogen, phosphorus, potassium and irrigation charges.

At an overall level total quantity of Jalgaon Brinjal produced was 225.99 q per hactere. Out of this total production 0.15 per cent, 0.81 per cent, 1.22 per cent was used for home consumption, gratis and losses due to pests and diseases, respectively. Marketed surplus at the overall level was 97.82 per cent.

It can be seen from the table that, total quantity of Jalgaon Brinjal produced per farm were 194.23q, 216.32q and 267.43q in small, medium and large size groups, respectively.

The marketing channel-III (Producer –Wholesaler – Retailer – Consumer) was the most preferred channel among the other two marketing channel and through which 80.90 per cent of the total produce was marketed followed by channel-II (Producer – Retailer – Consumer) through which 14.63 per cent of the total produce was marketed. Quantity marketed through channel -I (Producer – Consumer) constituted 4.47 per cent of the total produce.

The per quintal cost of marketing of Jalgaon Brinjal for channel-I, Channel-II and Channel-III was ₹. 65, ₹. 108.3, ₹. 231.75 respectively. Thus, per quintal cost of marketing was highest in Channel-III (Producer – Wholesaler – Retailer – Consumer).

The net price realized by the producer was ₹. 4435, ₹. 3391.7 And ₹. 3218.25 in Channel-I, Channel-II and Channel-III, respectively. Price spread was the minimum (₹. 65.00) in channel-I (Producer – Consumer). As there no market margins between producer and consumer. Price spread was maximum in channel-III (₹. 2731.75), followed by channel-II (₹ 1608.30). This is due to fact that with increases in intermediaries' price spread also increases. The price paid by consumer was highest in channel-III followed by channel-II. Table 4.13 shows that Producer's share in consumer's rupee was the highest (98.56%) in channel-I followed by channel-II (67.83%) and channel-III (54.09%).

The marketing efficiency was maximum for Channel-I (68.23%), followed by Channel-II (2.11%) and Channel-III (1.18%) respectively. Channel-I was the most efficient channel in marketing of Jalgaon Brinjal.

It was observed that disease and pest occurrence was major problem faced by Jalgaon Brinjal growers which was expressed by Rank I. followed by price fluctuations in market (Rank-II), lack of market information (Rank-III), high price of seeds (Rank-IV), high cost of pesticides (Rank-V), lack of credit facility (Rank-VI), lack of storage facility (Rank-VII), inadequate labour availability (Rank-VIII), irregular electricity supply (Rank-IX) and weed infestation (Rank-X), respectively.

5.2 CONCLUSIONS

The present study was intended to depict the picture of the jalgaon brinjal growing enterprise in Jalgaon district the prominent jalgaon brinjal growing district in Maharashtra state.The foregoing discussion on various aspects of the study leads to draw the following conclusions.

1. The per hectare human labour requirement for Jalgaon brinjal cultivation was found to be 592.22 man days, per hectare use of human labour, manures, phosphorous, potash, irrigation charges, seed, were highest for medium size group of holding

2. At the overall level, the total cost of cultivation was ₹. 439518.59 i.e. Cost C while Cost A was 53.50 per cent and Cost B was about 97.07 per cent. The major items of cost of cultivation were rental value of land, manure, hired human labour, fertilizer, plant protection.

3. Cost of production was highest in medium size farms, followed by large and small group of holdings. The profit at Cost A , Cost B and Cost C was highest in large size group of holdings followed by medium and small size group of holdings. It shows increasing trend per hectare profit with increasing size of holdings.

4. The benefit cost ratio at the overall level was 2.31 it is greater than 1, therefore, Jalgaon brinjal is profitable crop and hence the hypothesis is proved that Jalgaon brinjal is profitable.

5. The fertilizers, irrigation charges, manure were positive and highly significant showing the scope to increase the use of these resources to increase production, while plant protection cost was negatively significant and seed, male, female were non-significant.

6. The foregoing analysis revealed that, the profitability of brinjal production could be maximized by increasing the use of female labour, manure, nitrogen, phosphorous, potassium and irrigation charge

7. Per quintal marketing cost for different marketing channels was ₹. 65, ₹. 108.30, ₹. 231.75 for channel I, channel II and channel III respectively.

8. The items such as transport and packaging were observed to be more important items of cost. These costs can be minimized through certain measures like efficient transport facilities.

9. In channel I, the producer's share in consumer's rupee was 98.56 per cent, in channel II, 67.83 per cent and in channel III, 54.09 per cent. Thus in channel I producer's share in consumer's rupee was more than channel II and III, margin of wholesaler and retailer was 11.5 and 12.90 per cent

10. The major constraints faced by the Jalgaon brinjal growers in production and marketing of Jalgaon brinjal were disease and pest occurrence, price fluctuations, lack of market information, high price of seeds, high cost of pesticides, storage facility, inadequate labour availability etc.

5.3 POLICY IMPLIFICATION

1. The production function analysis indicated that the coefficient of plant protection measures was negatively significant which emphasizes the need of dissemination of detailed knowledge regarding appropriate qualitative and quantitative use of pesticides and fungicides among the Jalgaon brinjal producers by arranging training programs of state agriculture department.
2. The producer's share in consumer's rupee was more in channel I as compared to channel II and channel III due to involvement of middlemen, therefore study suggest that farmer should be motivated to form Jalgaon brinjal Producers Organization to minimise number of middlemen's in distant marketing and accrue more share in consumers rupee.
3. Many of the sample Jalgaon brinjal growers reported that they have lack of market information so it is suggested that State Agriculture Department should organize trainings regarding market intelligence.

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APPENDIX-I

Title: ECONOMICS OF PRODUCTION AND MARKETING OF JALGAON BRINJAL

SCHEDULE-I

PRODUCTION OF BRINJAL CROP

1] Socio-economic status of Brinjal grower

1. Name :

2. village : Tehsil : District:

3.Social category : SC / ST/ OBC / SBC / OPEN

4. Experience in year :

5.Age in year :

6.Educational level : Illiterate/Primary/High school/Higher secondary/College

7. Family size (No.) : Full time workers :

8. Occupational level : Agricultural/Industry/Service

9. Land holding (ha.) : Soil type : Light/Medium/Heavy

Rainfed land……....ha, Irrigated land………..ha, Uncultivated land…..... ha

10. Land revenue (₹.) :

11. Period of crop (months) :

12. Source of income other than farming (₹.):

2] Cropping Pattern :

Kharif			**Rabi**			**Summer**			**Perennial**		
Crop (Variety)	**I (ha)**	**R (ha)**	**Crop (Variety)**	**I (ha)**	**R (ha)**	**Crop (Variety)**	**I (ha)**	**R (ha)**	**Crop (Variety)**	**I (ha)**	**R (ha)**

3] Live stock :

Sr. No.	**Name of livestock**	**No**	**Age**	**Present value (₹)**
1.	Bullock pair			
2.	Local Cow			
3.	Cross bred cow			
4.	Local Buffalo			

5.	Improved buffalo			
6.	Goat			
7.	Sheep			
8.	Poultry			

4] Machinery:

Sr. No.	Assets	No./Qty.	Age	Present value (₹)
1.				
2.				
3.				
4.				

5] Irrigated Structure:

Sr. No.	Assets	No./Qty.	Age	Present value (₹)
1.	Well			
2.	Electric motor			
3.	Shed for electric motor			
4.	Pipeline (length)			
5.	**Total**			

6] Commonly used assets:

Sr. No.	Assets	No/Qty	Age	Present value (₹)
1.	Plough			
2.	Harrow			
3.	Seed drill			
4.	Hoe			

5.	Bullock cart			
6.	Sprayer			
	a)Hand sprayer			
	b)Foot sprayer			
	c)Power sprayer			
7.	Farm building			
	Total			

7] Operation wise labour requirement in crop:

Area:………….ha Period of crop:....................months

Operation	**No.**	**Human labour**				**Bullock pair day**	**Machine Power Hours**
		Hired male (day)	**Hired female (day)**	**Family male (day)**	**Family female (day)**		
Ploughing							
Clod crushing							
Application of manure							
Seed bed preparation							
Raising of seedlings							
Irrigation							
Transplanting							
Application of fertilizers							
Interculture							
a)Weeding							
b)Hoeing							

Spraying of pesticide/ fungicide/ insecticide							
Harvestings							
1st harvesting							
2nd harvesting							
3rd harvesting							
4th harvesting							
5th harvesting							

Rate of labours:

1) Male per day (₹) :

2) Female per day (₹) :

3) Bullock pair per day (₹):

4) Machinery charge/hr (₹):

8] Use of physical inputs in brinjal crop production:

Sr.No.	**Particulars**	**Unit**	**Quantity**	**Rate/Unit**	**Value (₹)**
1.	Seed of brinjal	Kg			
2.	Type of fertilizers	Bag			
I)	10:26:26				
II)	12:32:36				
III)	Urea				
IV)	DAP				
V)	Single super phosphate				
VI)	Murate of potash				
3.	Manure	q.			
4.	Plant protection	kg/lit			
	Insecticides				

	a)				
	Pesticides				
	a)				

9] Yield of brinjal crop:

Particulars	**Quantity (q)**	**Rate/q**	**Value (₹)**
1st harvesting			
2nd harvesting			
3rd harvesting			
4th harvesting			
5th harvesting			

10] Constraints and Suggestions of brinjal growers :

1) Constraints :

I)

II)

III)

IV)

2) Suggestions :

I)

II)

III)

IV)

SCHEDULE-II

MARKETING OF BRINJAL

1] Marketed surplus of Brinjal crop

Sr.No.	Particulars	Quantity (q.)	Market Place	Distance (km.)
1.	Production of main produce on the farm			
2.	Marketed surplus			
	a) Channel-I (Producer-consumer)			
	b) Channel-II(Producer-retailer-consumer)			
	c) Channel-III(Producer-wholesaler-retailer-consumer)			

2] General Information

Marketing channel	Name of market	Distance (km.)
Channel-I		
Channel-II		
Channel-III		

3] Cost of marketing incurred by producer

Sr.No.	Item of cost	Channel-I	Channel-II	Channel-III
1.	Packaging			
2.	Loading charge			
3.	Transport charge			
4.	Unloading charge			
5.	Commission charge			
6.	Market fees			
7.	Losses			

4] Cost of marketing incurred by wholesaler

Sr. No.	Item of Cost	In Maharashtra	Amount(₹./q.)
1.	Labour charge		
2.	License charge		
3.	Shop tax		
4.	Electric charge		
5.	Storage charge		
6/	Market fees		
7.	Losses		

5] Cost of marketing incurred by retailer

Sr. No.	Item of cost	Channel-II	Channel-III	Amount(₹./q)
1.	Labour charge			
2.	License charge			
3.	Shop tax			
4.	Electric charge			
5.	Storage charge			
6.	Market fees			
7.	Losses			

APPENDIX – II

Advertised under Rule 41 (1) of Geographical Indications of Goods (Registration Protection) Rules, 2002 in the Geographical Indications Journal 80 dated 02nd February, 2016

G.I. APPLICATION NUMBER-501

Application Date: 30-09-2014

Application is made by **Navnirmiti Shetkari Mandal,** Asoda, Jalgaon, Taluka: Asoda, District: Jalgaon – 425 101, Maharashtra, India. for Registration in Part A of the Register of **JALGAON BRINJAL** under Application No: 501 in respect of Brinjal falling in Class – 31 is hereby advertised as accepted under Sub-section (1) of Section 13 of Geographical Indications of Goods (Registration and Protection) Act, 1999.

A)	**Name of the Applicant**	**:**	Navnirmiti Shetkari Mandal
B)	**Address**	**:**	Navnirmiti Shetkari Mandal, Asoda, Taluka: Asoda, District: Jalgaon – 425 101, Maharashtra, India
C)	**Types of Goods**	**:**	**Class 31** – Brinjal

D) **Specification:**

- The golden-brown color and tempting taste after roasting the brinjals make this variety popular among people. Jalgaon Brinjal is specifically used for making traditional spicy dish „Khandeshi bharit‟. „Khandeshi bharit‟ made from Jalgaon Brinjal is gaining attention now a days globally.
- The traditional Jalgaon Brinjal variety is preserved and maintained by the farmers for more than five centuries.
- Jalgaon Brinjal is large in size as with soft skin and has less number of thorns. The weight of brinjal is approximately 500g to 2500g. More specifically brinjals from Bamnod village in Yaval Taluka of Jalgaon has a characteristic large size
- Brinjals produced in Jalgaon district secrete more amount of oil on roasting which gives very distinct taste to Bharit i.e. mashed brinjal.
- The Jalgaon Brinjal has less number of seeds inside the brinjal pulp.
- Shape of Bharit Brinjal of Jalgaon is four times larger than regular brinjal .
- Presence of rich medium black fertile soil in Khandesh (Jalgaon is located within

the productive irrigated, agricultural region of Khandesh) makes brinjal cultivation more favourable.

- The climate of Jalgaon district is prominently responsible for the higher yield and better quality of Jalgaon Brinjal variety.
- Bharit Brinjal cultivated in Jalgaon district is long, oval and slender shaped.
- Colour of Jalgaon Brinjal is pale green with white stripes.

E) Name of the Geographical Indication:

JALGAON BRINJAL

A) Description of the Goods:

Jalgaon Brinjal

- Color: Pale green color with white stripes.
- Shape: long slender shaped and oval shaped
- Size: large sized which is four times larger than normal size.
- Yield: 250-300 quintals/ha
- Seed: Less in number
- Plant Height: 5-6 ft
- Weight:500g to 2500g
- Taste: Less bitter
- Thorns : Less
- Fruit skin :Soft
- Pulp Quantity :High

B) Geographical area of Production and Map as shown in page no: 32

Jalgaon district is located in north Maharashtra between 200 and 210 North latitudes and 740 55‟ to 760 28‟ East longitudes. The district consists of 15 talukas which include Jalgaon, Jamner, Erandol, Dharangaon, Bhusaval, Bodwad, Yawal, Raver, Muktainagar, Amalner, Chopda, Parola, Pachora, Chalisgaon and Bhadgaon.

Brinjal cultivation in India is estimated to cover about 8.14% vegetable area which contributes to 9% of total vegetable production. The crop is largely grown in small plots or as inter crop both for cash and domestic consumption by farmers all over India. Maharashtra is one of the major brinjal producing states in India.

Bharit Vangi ie Brinjals specifically used for preparing bharit is of great demand in Pune, Aurangabad and Mumbai cities. The famous dish, bharit prepared from these Jalgaon brinjals is served in German airlines as well. Even Tibetian people enjoy the taste of bharit by visiting Jalgaon in winter season. Asoda, Bamnod, Mamurabad, Bhadli, Bhalod and Bhusaval have higher cultivation of Bharit brinjal variety.

The area under cultivation of Jalgaon Brinjal in Jalgaon district is 150-200 Ha.

C) Proof of Origin (Historical records):

India is the centre of Origin for Brinjal or eggplant. Brinjal is considered as native to India where the major domestication of large fruited cultivars occurred. Brinjal has been cultivated in India for the last 4000 years or so and has many historical references in different languages. Maharashtra is the sixth largest brinjal producing state in the country and contributes to 5% of the total production of brinjals in the country.

Jalgaon is the city in western India, to the north of Maharashtra State which is located on the northern Deccan plateau. Jalgaon is located within the productive irrigated, agricultural region of Khandesh.

The historical evidences of the spicy „Khandeshi bharit" were found in the Marathi literature by the famous poet Shri. Narayan Vyas Bahaliye of „Mahanubhav Community" in the 15^{th} century. It is stated that the traditional Jalgaon Brinjal variety is preserved since 15^{th} century. We find the reference of Jalgaon brinjal in tribal folk songs of Jalgaon district. The Leva Patil community in Jalgaon have the tradition of serving Brinjal dish which has led farmers to plant this type of brinjal in huge quantity.

Area in acres under Brinjal Cultivation in each taluka of Jalgaon District in 1956-57.

Sl No.	Taluka or peta	Brinjal
1	Amalner	80
2	Bhadgaon	37
3	Bhusawal	92
4	Chalisgaon	67
5	Chopda	52
6	Edlabad	26
7	Erandol	92
8	Jalgaon	86
9	Janmer	46
10	Pachora	51
11	Parola	27
12	Raver	78
13	Yawal	117
	District Total	**851**

From the above table it can be observed that large area in Yaval taluka was under brinjal cultivation even 60 years ago in Jalgaon.

D) Method of Production:

Brinjal plant is perennial. Presently commercial cultivation of brinjal, especially green bharit brinjal with white stripes has been started from many years. These bharit brinjals are used for making the popular dish known as „Wangyache Bharit" (mashed brinjal).

- The time of sowing of seed and transplanting of seedlings varies according to the agro-climatic regions. Brinjal cultivation is done in April, July and September. Planting season for bharit brinjal in Jalgaon is from November to January. Before planting the field is ploughed 4 times.
- Brinjal seeds are sown in rows 5 cm apart in the nursery beds which are 6-12 mm raised. The nursery beds are covered with plastic or straw mulch till the germination of seeds. Seedlings of 4-6 weeks old are transplanted in a well prepared field of which surface soil is mixed thoroughly with farm yard manure and small quantity of super phosphate. Before planting, beds are watered using drip system for 8-12 hrs.
- The planting distance depends on soil fertility, season and variety. Usually for bushy non spreading type spacing should be 50 cms from row to row and 60 cms from plant to plant. For spreading variety row to row spacing should be 75 cm to 90 cm and plant to plant should be 60-70 cm. Gap filling is done at the 7th day after transplantation. Inflorescence appears after 4-5 weeks of planting. Timely irrigation is mandatory for high yield of brinjal.
- Further harvesting is carried out just before maturity. Brinjals are ready for harvesting after 3.5 t o 4 months. Brinjals should be severed from the plant by cutting with small shears of knife. Fruits are allowed to gain good size and color till they remain bright, glossy in appearance. Grading of fruit is done according to the size of the fruit. Pest affected and damaged fruits are separated. The matured good quality brinjals are then packed and sent for marketing.
- Average yield comes to 250-300 quintal/ha.

Unique seed preparation adopted by Bharit Brinjal growers which is well noticed mainly at Asoda from Jalgaon district:

- In the month of January, good quality, big sized bharit brinjals are identified on the plant. When the color of these identified bharit brinjals turn yellow, they are plucked from the plant and sun dried for 8 da ys. After that brinjals are broked open and cleaned with water and seeds are separated. Seeds floating on water are discarded due to low quality. Seeds that are at the bottom of water are selected for germination. After germination, saplings are ready for transplantation in 10-15 days.

- Farmers prefer small-sized seeds to get large brinjal crop from Jalgaon's rich medium-black fertile soil. This large-sized bharit brinjals have now turned popular throughout the State.
- Farmers in Asoda village from Jalgaon are concentrating specifically on the growth of brinjals (green brinjals with white strips) that are used for peparing bharit which are locally called as “bharit vange”
- These special type of bharit green brinjals with white strips cannot grow in the region other than Jalgaon and if they are grown elsewhere, its unique taste is lost. Many new hybrid varities have been tried of these bharit brinjals but large demand is only for conventional variety.

The brinjals cultivated in this region are specifically used for preparing Bharit (mashed brinjal).

Preparation Method of Bharit from Jalgaon Brinjal:

1. Initially bharit brinjal (locally named as bharit vange) is roasted on stove that uses charcoal or wood as fuel (chula).
2. Roast the brinjal for about 30-40 mins until its cover turns blackish.
3. Oil which is secreted after raosting is more in case of jalgaon brinjal that itself gives brinjal its unique taste.
4. Then garlic cloves and chillies are shallow fried and grinded in mortar and pestle by traditional method.
5. Black covering of brinjals is further removed and they are smashed by pestle.
6. Onion and coriander leaves are to befinely chopped.
7. Oil is taken in thick bottom kadhai. Once oil is hot enough, coconut slices and peanuts are added and roasted until they turn golden brown.
8. Further add chopped green onion and coriander and fry for few minutes.
9. Further the grinded paste of garlic and chilly is added to the mashed brinjal along with salt and this mixture is then added to the oil which contains chopped onion, coriander, coconut pieces and peanuts.
10. Lower the flame and let it cook for few minutes covering the kadhai.
11. The bharit is ready which is served along with bhakri.

E) Uniqueness

1. Geographical Significance

Jalgaon is known as city of Brinjals . Jalgaon received special recognition because of this vegetable. Light Green color brinjals from jalgaon are famous for bharit (mashed brinjal). Yaval and Bhusaval talukas in Jalgaon district are very famous for the brinjals that are specifically used for preparing bharit and hence they are locally known as “Bharit vanga”.

Bamnod village in Yaval Taluka is famous for large-sized variety of Bharit Brinjals . Farmers in this region specifically cultivate bharit vangi (mashed brinjal). Village rejoices unique medium spicy taste of Bharit in the form of small group parties and get-togethers. These bharit brinjals are grown in the area near Tapi river basin.

Asoda is a village in Jalgaon District; Maharashtra state in western India, which itself is located on the northern Deccan Plateau. It is 5 km from Jalgaon, located within the productive, irrigated agricultural region of Khandesh. Asoda is famous for bharit brinjal cultivation. Other villages in which cultivation of bharit brinjal occurs are Mamurabad, Bhadli and Bhalod .

Soil in Jalgaon which is black and well drained makes brinjal cultivation most favourable in this region.

Bharit brinjal cultivars prefer small-sized seeds to get large brinjal crop from Khandesh's rich medium-black fertile soil. These large-sized bharit brinjals have now turned popular throughout the State.

Soil:

The soils of Jalgaon differ from rest of the Deccan trap soil area which are mostly alluvial in origin, transported from the mountain ranges. Deep black soils are observed in northern part of Amalner, Erandol, Jalgaon, Bhusaval and Edilabad talukas. Medium black soils are present in the central belt of the Tapi River and southern hills. In Tapi alluvial basin soils are black alluvial clay present in the southern parts of Yaval, Raver, Chopda, Jalgaon, Bhusaval, Chalisgaon, Amalner, and Bhadgaon. Loamy soils are present in the southern-most part of Amalner, Erandol, Jalgaon and Bhusaval.

For high yield of brinjal, deep, fertile and well-drained is required. Generally, silt- loam and clay loam soils are preferred for brinjal cultivation. Bharit brinjal grows well in black well drained soil which is present near Tapi river basin. So bharit brinjal is cultivated on large scale in the villages near Tapi river basin.

Rainfall:

The annual rainfall in the district varies from about 660.40mm-763.40mm

Temperature:

The optimum temperature for growth and Brinjal fruit set is 20-30°C .While the temperature of Jalgaon ranges from 10.8 t o 42.20C. Cultivation of bharit brinjal in Jalgaon occurs from November to January due to favourable climatic conditions. During winter i.e. from November to December the temperature fluctuates between 20-30°C which makes it suitable for brinjal cultivation.

Humidity:

Climate of Jalgaon is hot and humid. The climate of district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season i.e. from June to September. Thus this unique combination of climate, soil and rainfall of Jalgaon district is favourable for high yielding and good quality of Jalgaon Brinjal

Uniqueness of Jalgaon Brinjal:

„Vangyache bharit‟ is a special khandesh dish made typically by Leva Patil community of Jalgaon. „Bharit puri‟ or „bharit bhakri‟ with „koshimbir‟ is the best traditional spicy treat for many occasions for Leva patil community as well as other communities from Jalgaon. This „Bharit Vange‟ i.e. brinjal has turn into an identity of Jalgaon these days.

1. The golden-brown color and tempting taste after roasting the brinjals make this variety popular among people. Jalgaon Brinjal is specifically used for making traditional spicy dish „Khandeshi Bharit‟.
2. „Khandeshi Bharit‟ made from Jalgaon Brinjal is gaining attention now a day‟s all over Maharashtra state and also globally as German airlines have accepted its unique taste and have introduced mashed brinjal dish in their regular food menus in the airlines.
3. The traditional Jalgaon Brinjal variety is preserved and maintained by the farmers for more than five centuries.
4. Jalgaon Brinjal is large in size as compared to other varieties very heavy in weight. The weight of brinjal is approximately 100g to 500g. More specifically brinjals from Bamnod village in Yaval Taluka of Jalgaon has a characteristic large size.
5. Brinjals produced in Jalgaon district secrete more amount of oil on roasting which gives very distinct taste to bharit i.e. mashed brinjal.
6. The Jalgaon brinjal has less number of seeds inside the brinjal.
7. The shape of bharit brinjal of Jalgaon is four times larger than regular brinjal .
8. Presence of rich medium black fertile soil in Khandesh (Jalgaon is located within the productive irrigated, agricultural region of Khandesh) makes bharit brinjal cultivation more favourable.
9. The climate of Jalgaon district is prominently responsible for the higher yield and better quality of Jalgaon Brinjal variety.
10. Bharit brinjal cultivated in Jalgaon district is long and oval, slender shaped.

11 Colour of Jalgaon Brinjal is pale green with white stripes.

Comparative analysis of Jalgaon Brinjal with that of another traditional Amravati Bharit Brinjal:

Sl. No	Morphological Characters	Characteristics of Jalgaon Brinjal	Characteristics of Amravati Bharit Brinjal
1.	Colour	Green with white stripes	Greenish purple
2.	Size	Large	Smaller than Jalgaon Brinjal
3.	Weight	100 -500 gms	150-175 gms
4.	Oil secretion on roasting	Yes	No
5.	Thorns	Less	More as compared to Jalgaon Brinjal

F) Inspection Body

Navnirmiti Shetkari Mandal, Asoda, Jalgaon has constituted an Inspection structure to oversee the standards and quality assurance system for inspection of every step of production of Jalgaon Brinjal and statutory compliances thereof. This Inspection Body consists of President / Vice-President / Secretary / Treasurer of the Applicant Organization, Farmer Members, GI Experts, and Agriculture Experts. The quality of Jalgaon Brinjal will be monitored by an Internal Watchdog Mechanism in order to maintain the original physical and chemical characteristics as per GI registration. The system of internal watchdog mechanism will consist of following committee members:

i) Representative of Producer group of Jalgaon Brinjal

ii) Three (3) farmers from the area under cultivation

iii)GI Experts

iv) Agriculture Expert.

This committee will also help to regulate the use of Geographical Indications for the welfare of local farming community. The committee will frame the terms and conditions to use brand name of Jalgaon Brinjal by any of the marketing agency. The logo of Jalgaon Brinjal GI will be used to create brand image.

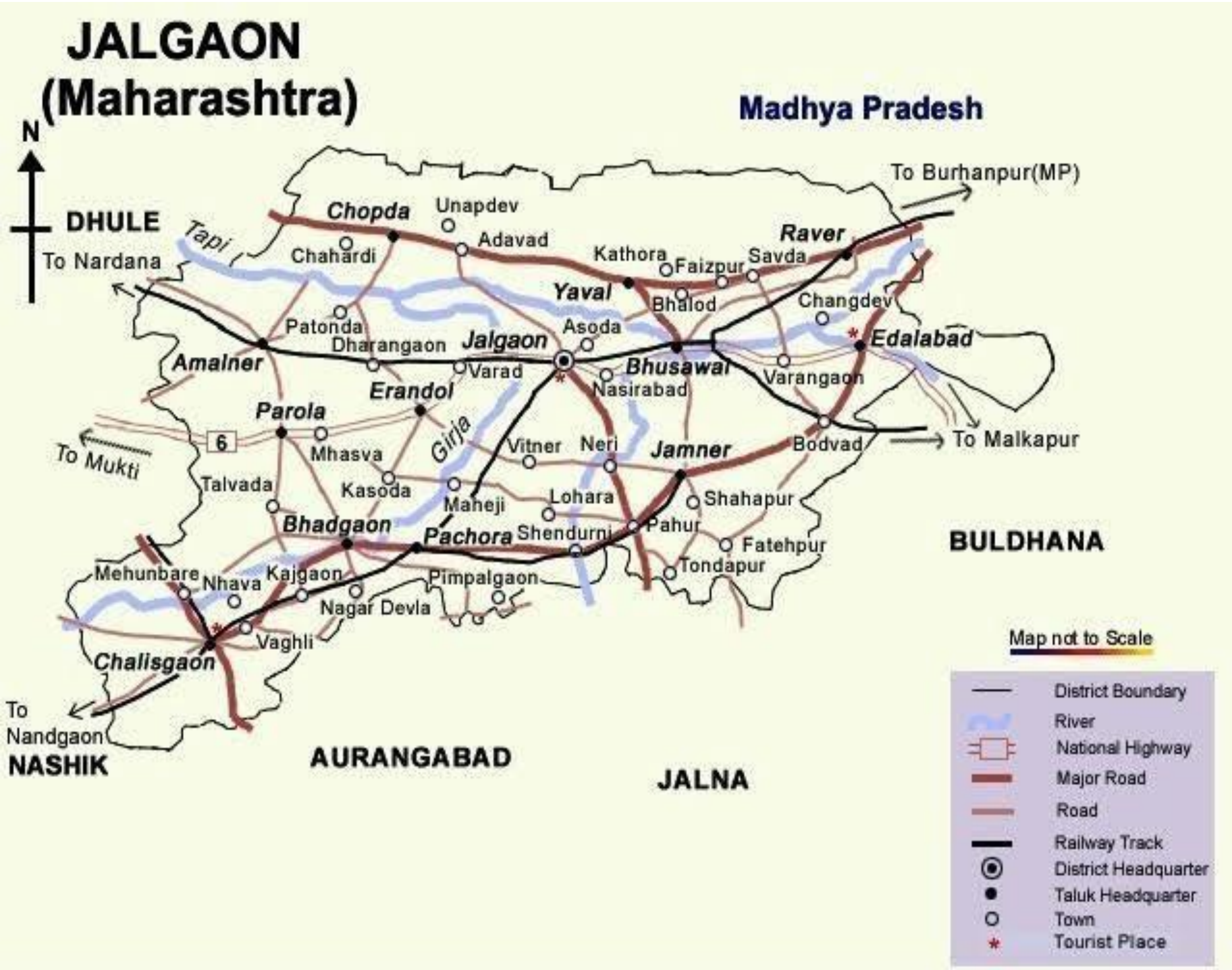
G) Others

Medicinal uses of Jalgaon Brinjal:

- It controls cholesterol and hence recommended for the people with high cholesterol content.
- Brinjal is very healty for diabetic patients as it acts as anti-diabetic.
- It is used for treating epilepsy and convulsions.
- It is used for treatment of cancers and measles.
- Brinjal is rich source of vitamin A,B & C, calcium, fibre, folic acid and potassium.
- It is used in treatment of obesity.
- It is used for reducing pains in the joints.

Culinary uses of Jalgaon Brinjal:

Jalgaon Brinjal is mainly used for preparation of bharit i.e. Mashed Brinjals.



VITAE

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MASTER OF SCIENCE(AGRICULTURE)

IN

AGRICULTURAL ECONOMICS

2020

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