PRODUCTION AND PROCUREMENT SCENARIO OF CEREALS IN MAJOR PRODUCING STATES OF INDIA

Thesis

Submitted to the Punjab Agricultural University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE
in
AGRICULTURAL ECONOMICS
(Minor Subject: Statistics)

By

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2020

CERTIFICATE – I

This is to certify that the thesis entitled, **"Production and procurement scenario of cereals in major producing states of India"** submitted for the degree of Master of Science in the subject of **Agricultural Economics (**Minor subject: **Statistics)** to the Punjab Agricultural University, Ludhiana, is a bonafide research work carried out by **Jeevitha G N (L-2018-BS-221-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

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

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CERTIFICATE II

This is to certify that the thesis entitled, **"Production and procurement scenario of cereals in major producing states of India"** submitted by **Jeevitha G N (L-2018-BS-221-M)** to the Punjab Agricultural University, Ludhiana, in partial fulfillment of the requirements for the degree of **M.Sc.** in the subject of **Agricultural Economics** (Minor subject: **Statistics**) has been approved by the Student's Advisory Committee along with External Examiner after an oral examination on the same.

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ABSTRACT

Cereals are the staple food for the vast majority of the people in India and across the world. The present study was conducted to examine the production, procurement, and storage scenario of cereals in the country and to bring out the problems encountered during the procurement, storage and handling of cereals by the procurement agencies. The time-series data on area, production, and productivity of cereals like rice, wheat, maize and jower were collected for the period from 1960-61 to 2017-18, from the Ministry of Agriculture and Farmers Welfare, GOI. Data on cereals procurement for the period from 2000-01 to 2018-19 and on storage capacities for the period from 2005-06 to 2020-21 were collected from the Ministry of Consumer Affairs, Food and Public Distribution, GOI and the official website of Food Corporation of India. Information regarding the problems faced during the procurement, storage and handling of cereals was gathered through an e-survey of officials from agencies involved in the procurement and/or storage of food grains in India. The analysis of compound growth rate of area, production and productivity revealed that the cereals like rice, wheat and maize showed significant and consistent growth in the area, production and productivity while jower showed significant downturn in the area and production over the study period elucidating the poor status of jower cultivation in the country. The procurement scenario of rice, wheat and coarse grains revealed that the quantity of rice and wheat procured has more than doubled over the study period, and the procurement as a percentage of production has also improved at the national level. The quantity of coarse grains procured at the national level has declined to half of the quantity procured in the initial year of the study period. The share of state agencies in rice procurement increased to above 98 per cent at national level while increase in the share of state agencies was relatively lesser in case of wheat procurement over the study period. The storage capacity with the FCI increased over the years which was mainly due to the increase in the hired capacity. The results of the survey revealed that the main problem faced during the process of procurement and storage were; the low quality of the grains brought to the procurement centers by the farmers, risk of damage due to biotic factors like insects, pests, rodents and birds. The requirement of large capital to run the FCI, the labour scarcity, especially in the peak periods of procurement, lack of advanced storage structures were the main concerns from the institutional point of view. The study identified some policy measures such as; increasing coarse grains production by giving incentives to farmers, enhancing the storage capacity of the FCI by building advanced storage structures at the key locations and developing improved scientific methods to ensure the safe storage of grains.

Keywords: Production, Procurement, Storage, Compound Growth Rate.

Signature of Major Advisor **Signature of the Student**

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ਸਾਰ ਅੰਸ਼

ਭਾਰਤ ਅਤੇ ਦੁਨੀਆ ਭਰ ਵਿੱਚ ਅਨਾਜ ਜ਼ਿਆਦਾਤਰ ਲੋਕਾਂ ਦਾ ਮੁੱਖ ਭੋਜਨ ਹੈ। ਮੌਜੂਦਾ ਅਧਿਐਨ ਦੇਸ਼ ਵਿੱਚ ਅਨਾਜ ਦੇ ਉਤਪਾਦਨ, ਖਰੀਦ ਅਤੇ ਭੰਡਾਰਨ ਦਾ ਮੁਲਾਂਕਣ ਕਰਨ ਅਤੇ ਅਨਾਜ ਦੀ ਖਰੀਦ ਸਮੇਂ ਖਰੀਦ ਏਜੰਸੀਆਂ ਨੂੰ ਅਨਾਜ ਦੀ ਖਰੀਦ, ਭੰਡਾਰਨ ਅਤੇ ਰੱਖ-ਰਖਾਅ ਸਬੰਧੀ ਆਉਣ ਵਾਲੀਆਂ ਸਮੱਸਿਆਵਾਂ ਦਾ ਪਤਾ ਲਗਾਉਣ ਲਈ ਕੀਤਾ ਗਿਆ। ਭਾਰਤ ਸਰਕਾਰ ਦੇ ਖੇਤੀ ਅਤੇ ਕਿਸਾਨ ਕਲਿਆਣ ਮੰਤਰਾਲੇ ਤੋਂ ਅਨਾਜ ਜਿਵੇਂ ਕਿ ਝੋਨਾ, ਕਣਕ, ਮੱਕੀ ਅਤੇ ਜਆਰ ਦੀ ਕਾਸ਼ਤ ਅਧੀਨ ਰਕਬੇ, ਉਤਪਾਦਨ ਅਤੇ ਉਤਪਾਦਕਤਾ ਸਬੰਧੀ ਸੰਨ 1960-61 ਤੋਂ 2017-18 ਤੱਕ ਦੇ ਆਂਕੜੇ ਇਕੱਠੇ ਕੀਤੇ ਗਏ। ਭਾਰਤ ਸਰਕਾਰ ਦੇ ਉਪਭੋਗਤਾ ਮਾਮਲੇ, ਖਾਧ ਅਤੇ ਜਨਤਕ ਵਿਤਰਣ ਮੰਤਰਾਲੇ ਅਤੇ ਐਫ.ਸੀ.ਆਈ. ਦੀ ਸਰਕਾਰੀ ਵੈਬਸਾਈਟ ਤੋਂ ਸੰਨ 2000-01 ਤੋਂ 2018-19 ਦੌਰਾਨ ਅਨਾਜ ਦੀ ਖਰੀਦ ਸਬੰਧੀ ਅਤੇ ਸੰਨ 2005-06 ਤੋਂ 2020-21 ਤੱਕ ਅਨਾਜ ਦੀ ਭੰਡਾਰਨ ਸਮਰੱਥਾ ਸਬੰਧੀ ਆਂਕੜੇ ਲਏ ਗਏ। ਭਾਰਤ ਵਿੱਚ ਅਨਾਜ ਦੀ ਖਰੀਦ ਅਤੇ ਭੰਡਾਰਨ ਦਾ ਕੰਮ ਕਰਨ ਵਾਲੀਆਂ ਏਜੰਸੀਆਂ ਦੇ ਅਧਿਕਾਰੀਆਂ ਤੋਂ ਈ-ਸਰਵੇ ਰਾਹੀਂ ਅਨਾਜ ਦੀ ਖਰੀਦ, ਭੰਡਾਰਨ ਅਤੇ ਰੱਖ-ਰਖਾਅ ਦੌਰਾਨ ਪੇਸ਼ ਆਉਣ ਵਾਲੀਆਂ ਸਮੱਸਿਆਵਾਂ ਸਬੰਧੀ ਜਾਣਕਾਰੀ ਲਈ ਗਈ। ਖੇਤਰ, ਉਤਪਾਦਨ ਅਤੇ ਉਤਪਾਕਦਤਾ ਦੀ ਚੱਕਰਵ੍ਰਿਧੀ ਵਾਧਾ ਦਰ ਦੇ ਵਿਸ਼ਲੇਸ਼ਣ ਤੋਂ ਪਤਾ ਚੱਲਿਆ ਕਿ, ਅਨਾਜ ਜਿਵੇਂ ਕਿ ਝੋਨਾ, ਕਣਕ ਅਤੇ ਮੱਕੀ ਦੀ ਕਾਸ਼ਤ ਅਧੀਨ ਰਕਬੇ, ਉਤਪਾਦਨ ਅਤੇ ਉਤਪਾਦਕਤਾ ਵਿੱਚ ਲਗਾਤਾਰ ਅਤੇ ਅਰਥਪੂਰਨ ਵਾਧਾ ਹੋਇਆ ਜਦੋਂਕਿ ਜਆਰ ਦੇ ਖੇਤਰ ਉਤਪਾਦਨ ਅਤੇ ਉਤਪਾਦਕਤਾ ਵਿੱਚ ਅਰਥਪੂਰਨ ਗਿਰਾਵਟ ਦਰਜ ਕੀਤੀ ਗਈ ਜਿਸ ਤੋਂ ਇਹ ਪਤਾ ਚੱਲਿਆ ਕਿ ਦੇਸ਼ ਵਿੱਚ ਜਆਰ ਦੀ ਖੇਤੀ ਦੀ ਹਾਲਾਤ ਦਾ ਪਤਾ ਚੱਲਿਆ। ਝੋਨੇ, ਕਣਕ ਅਤੇ ਮੋਟੇ ਦਾਣਿਆਂ ਦੀ ਖਰੀਦ ਦੀ ਸਥਿਤੀ ਤੋਂ ਇਹ ਪਤਾ ਚੱਲਿਆ ਕਿ ਅਧਿਐਨ ਅੰਤਰਾਲ ਦੌਰਾਨ ਖਰੀਦ ਕੀਤੇ ਗਏ ਝੋਨੇ ਅਤੇ ਕਣਕ ਦੀ ਮਾਤਰਾ ਵਿੱਚ ਦੋਗੁਣਾ ਤੋਂ ਜ਼ਿਆਦਾ ਵਾਧਾ ਹੋਇਆ ਹੈ ਅਤੇ ਰਾਸ਼ਟਰੀ ਪੱਧਰ ਉਪਰ ਉਤਪਾਦਨ ਦੀ ਪ੍ਰਤੀਸ਼ਤਤਾ ਦੇ ਤੌਰ ਤੇ ਖਰੀਦ ਵਿੱਚ ਵੀ ਸੁਧਾਰ ਹੋਇਆ ਹੈ। ਰਾਸ਼ਟਰੀ ਪੱਧਰ ਉਪਰ ਖਰੀਦ ਕੀਤੇ ਗਏ ਮੋਟੇ ਦਾਣਿਆਂ ਦੀ ਮਾਤਰਾ ਅਧਿਐਨ ਅੰਤਰਾਲ ਦੇ ਸ਼ੁਰੂਆਤੀ ਸਾਲਾਂ ਦੇ ਮੁਕਾਬਲੇ ਘੱਟ ਕੇ ਅੱਧੀ ਰਹਿ ਗਈ। ਰਾਸ਼ਰਰੀ ਪੱਧਰ ਉਪਰ ਝੋਨੇ ਦੀ ਖਰੀਦ ਵਿੱਚ ਰਾਜ ਦੀਆਂ ਖਰੀਦ ਏਜੰਸੀਆਂ ਦਾ ਹਿੱਸਾ ਵੱਧ ਕੇ 98 ਫੀਸਦੀ ਤੋਂ ਉਪਰ ਹੋਇਆ ਜਦੋਂਕਿ ਕਣਕ ਦੀ ਖਰੀਦ ਵਿੱਚ ਰਾਜ ਦੀਆਂ ਖਰੀਦ ਏਜੰਸੀਆਂ ਦਾ ਹਿੱਸਾ ਘੱਟ ਸੀ। ਕਿਰਾਏ ਦੀ ਸਮਰੱਥਾ ਵਿੱਚ ਵਾਧਾ ਹੋਣ ਕਾਰਨ ਐਫ.ਸੀ.ਆਈ. ਦੀ ਭੰਡਾਰਨ ਸਮਰੱਥਾ ਵਿੱਚ ਵਾਧਾ ਹੋਇਆ। ਸਰਵੇਖਣ ਦੇ ਨਤੀਜਿਆਂ ਤੋਂ ਪਤਾ ਚੱਲਿਆ ਕਿ ਕਿਸਾਨਾਂ ਵੱਲੋਂ ਖਰੀਦ ਕੇਂਦਰਾਂ ਉਪਰ ਵੇਚਣ ਲਈ ਲਿਆਏ ਗਏ ਅਨਾਜ ਦੀ ਘੱਟ ਗੁਣਵੰਤਾ, ਜੈਵਿਕ ਕਾਰਨਾਂ ਜਿਵੇਂ ਕਿ; ਕੀੜਿਆਂ, ਚੂਹਿਆਂ ਅਤੇ ਪੰਛਿਆਂ ਦੁਆਰਾ ਅਨਾਜ ਦਾ ਨੁਕਸਾਨ, ਅਨਾਜ ਦੀ ਖਰੀਦ ਅਤੇ ਭੰਡਾਰਨ ਸਮੇਂ ਪੇਸ਼ ਆਉਣ ਵਾਲੀਆਂ ਮੁੱਖ ਸੱਸਿਆਵਾਂ ਸਨ। ਐਫ.ਸੀ.ਆਈ. ਨੂੰ ਚਲਾਉਣ ਲਈ ਵਧੇਰੇ ਪੂੰਜੀ ਦੀ ਲੋੜ, ਮਜ਼ਦੂਰਾਂ ਦੀ ਕਮੀ ਖਾਸ ਤੌਰ 'ਤੇ ਉਸ ਸਮੇਂ ਜਦੋਂ ਅਨਾਜ ਦੀ ਖਰੀਦ ਦਾ ਕੰਮ ਪੂਰੇ ਜੋਰਾਂ ਤੇ ਹੁੰਦਾ ਹੈ ਅਤੇ ਭੰਡਾਰਨ ਲਈ ਵਿਕਸਤ ਥਾਵਾਂ ਦੀ ਕਮੀ, ਸੰਸਥਾਗਤ ਪੱਖੋਂ ਅਨਾਜ ਦੀ ਖਰੀਦ ਅਤੇ ਭੰਡਾਰਨ ਨਾਲ ਸਬੰਧਤ ਮੁੱਖ ਸੱਸਿਆਵਾਂ ਸਨ। ਕਿਸਾਨਾਂ ਨੂੰ ਮੋਟੇ ਦਾਣਿਆਂ ਦੀ ਕਾਸ਼ਤ ਵਧਾਉਣ ਵਾਸਤੇ ਪ੍ਰੇਰਿਤ ਕਰਨ ਲਈ ਆਰਥਿਕ ਲਾਭ ਦੇਣਾ ਚਾਹੀਦਾ ਹੈ, ਮੁੱਖ ਥਾਵਾਂ ਉਪਰ ਭੰਡਾਰਨ ਲਈ ਵਿਕਸਤ ਭੰਡਾਰਨ ਸੰਸਥਾਵਾਂ ਦਾ ਨਿਰਮਾਣ ਕਰਕੇ ਐਫ ਸੀ ਆਈ ਦੀ ਭੰਡਾਰਨ ਸਮਰੱਥਾ ਨੂੰ ਵਧਾਉਣਾ ਚਾਹੀਦਾ ਹੈ ਅਤੇ ਦਾਣਿਆਂ ਦੇ ਸੁਰੱਖਿਅਤ ਭੰਡਾਰਨ ਲਈ ਸੁਧਰੀਆਂ ਵਿਗਿਆਨਕ ਵਿਧੀਆਂ ਵਿਕਸਤ ਕਰਨੀਆਂ ਚਾਹੀਦੀਆਂ ਹਨ।

ਮੁੱਖ ਸ਼ਬਦ: ਉਤਪਾਦਨ, ਖਰੀਦ, ਭੰਡਾਰਨ, ਚੱਕਰਵ੍ਰਿਧੀ ਵਿਕਾਸ ਦਰ

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ਮੁੱਖ ਸਲਾਹਕਾਰ ਦੇ ਹਸਤਾਖਰ **ਵਿਦਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ**

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CHAPTER I

INTRODUCTION

India, being one of the most ancient civilizations, through its magnanimous evolution, is the largest democracy in the world. The country, with its distinct geography comprising of Northern mountain zone, plains of Ganga and Indus, the desert region and Southern peninsula, is the 7th largest country in the world located in south Asian subcontinent. It is the 2nd most populous country with population of 1.210 billion (1st March, 2011). Agriculture and its allied sectors being the main occupation of the country provides the livelihood for most of the people and contribute significantly to the country's gross domestic product. The country is emerging as the fastest growing economy of the world as a consequence of globalization and digitalization and democratic reforms. It is the 3rd largest economy by purchasing power parity and 6th largest economy by nominal GDP. In 2018-19, the agriculture sector accounted for 17.1 % of the country's GVA which needs to be increased in coming years. (Agricultural statistics at a glance, 2019)

India ranks first in the production of total pulses, millets and jute, second in production of wheat, rice, groundnut, sugarcane, cotton, tea, and third in production of total cereals. Total production of food grains in the year 2017-18 was 285.01 million tonnes while the total production of rice, wheat, coarse grains and pulses stood at 112.76, 99.87, 46.97, and 25.42 million tonnes respectively. India being an agrarian country, two-third of its population, directly or indirectly, dependent on agriculture. Food grains are the predominant crops, grown all over the country, occupying a major portion of the cropped area. Cereals are the staple food for the vast majority of the people. The per capita net availability of cereals in the year 2017-18 stood at 434.0gm per day (Agricultural statistics at a glance, 2019). They are the major source of nutrients such as carbohydrates, proteins, fiber, vitamins, and minerals. Coarse cereals contain high protein content and are the reservoirs of nutrition and they are important food and fodder crops in semi-arid regions. The area under coarse cereals contracted as the increased importance for rice and wheat was observed both on the demand and the supply side. The per capita consumption of coarse cereals has declined very sharply. The central reason for the decline in consumption of coarse cereals was the easy access and rising availability of rice and wheat as a result of policy measures and technologies that favored rice and wheat (Chand and Kumar, 2002) However, coarse grains are gaining wider importance in the present world of increasingly malnourished population and large climatic uncertainties.

Over the last two decades, food grain production has increased from 198 million tonnes to 269 million tonnes. Wheat and rice together constitute 75% of total food grain

production. The per capita availability of food grains has increased from 475 gm/day in 1996 to 484 gm/day in 2018, whereas per capita availability of pulses has increased from 33gm/day to 55gm/day. Undoubtedly there has been a significant surge in the production of cereals but the per capita net availability has not been improved at the same level as a consequence of ever-expanding population, losses, and wastage of grains (F&NSA, 2019)

A study on the trend of area, production, and productivity of major cereal in India and Nigeria was conducted for the period from 1982 to 2012 and the results showed that the growth trend for area was negative (-0.0750) and significant and for production, the growth trend was positive (0.84) and significant. The study suggested augmenting cereal production as the area under cereals declining and to improve productivity through the dissemination of high yielding varieties, adequate input supply, and transfer of technology to cereal producers (Ahmad *et al* 2015)

The study of growth rates for the area and production of food grains in India for the period from 1988-89 to 2017-18 showed that the area under food grains remained almost stagnant (0.001%) while the production growth was measured positive (0.41%) during the last decade. The technological changes in cultivation practices may be the reasons for this positive growth. Growth rates were found to be negative for the area under cereals while the productivity was positive as a consequence of technological interventions. The shift in the production pattern or low remunerative prices or bad weather conditions can be the reason for this negative growth rate of area under cereals. The declining area under cereals production is of foremost concern in the existing level of population and income growth (Ahmad *et al* 2019)

Although the per capita direct consumption was declining over the years, the total demand for food grains was projected to increase at the rate of 2 per cent per annum considering the growing population and the need for food grains as feed and for other related purposes (Chand, 2007).

Agricultural productivity has increased in recent years which was no doubt compelled by the improved investment in the field of agricultural research through the development of new technologies and infrastructure, particularly irrigation technology. To improve the agricultural marketing sector in India, The Government of India adopted various measures like establishment of regulated markets, enhancing storage capacity through the establishment of warehouses, providing for standardization of weights and measures, grading and standardization of produce, improvement of transportation facilities, etc.

Undoubtedly India has made rapid progress in the production of food grains during the late sixties wherein Punjab state has played a key role by augmenting food grain

production. However, the growth rate of Punjab has slowed down over the years and presently there is a plateauing of the productivity of two main food crops- rice and wheat. A burden on soil and water resources has been created due to the intensive rice-wheat cultivation in the state which has made the very sustainability of crop production questionable. So, Punjab, Haryana, and other high crop productivity regions deserve prompt national attention which is a must to achieve national food security (Dhillon *et al* 2010). Due to overexploitation of natural resources in the high crop productivity regions, the water table has gone down, the fertility of the soil has declined irreversibly and many such problems were being faced in recent years.

Food security being a complex multi-dimensional concept, includes food availability, access to food and absorption of the food or its utilization. Food security is a situation which exists when all the people at-all time have physical and economic access to sufficient, safe and nutritious food to meet the dietary needs and food preferences for active and healthy life (FAO, UN). As a consequence of the green revolution, which took place in 1960s, availability of food grains has hugely increased. Access to food can be seen as a function of the purchasing power of the people. To improve food access to vulnerable sections of society, the government has implemented the Public Distribution System (PDS) and the National Food Security Act (NFSA).

To maintain the food economy of the country, Govt. of India offers price support to the farmers for paddy and wheat through the Food Corporation of India and state agencies. Under this procurement policy, rice and wheat offered by the farmers are procured at minimum support prices by state government agencies and the Food Corporation of India (FCI) for central pool. Farmers are free to sell their produce in the open market to anyone or anywhere if a higher price is offered there for their produce. The main objective of the procurement policy is; to provide farmers with remunerative prices for their produce and avoid distress sale, maintaining buffers stock to provide poor and vulnerable sections of society with food grains at low and affordable prices, to stabilize the prices in the market and to ensure overall food security of the country. The Government of India announces Minimum support prices (MSPs) as per the recommendations of the Commission of Agricultural Costs and Prices (CACP). The procurement of wheat and rice in the country stood at 357.95 and 443.31 lakh tonnes respectively for the year 2018-1 (Agricultural Statistics at a glance, 2019)

The FCI, along with state agencies, establish purchase centers at various key locations and mandis to procure the grains. The location and number of these centers are decided by the state government taking into account various criteria to maximize the procurement.

Procurement of grains is usually carried out under the two systems i.e., Centralized Procurement System (non-DCP) and Decentralized Procurement System (DCP). Under centralized procurement, the procurement of food grains carried out either by FCI itself or the state agencies purchase the food grains for central pool and handover stocks to FCI for storage or subsequent issue through PDS or other welfare schemes.

Under the decentralized Procurement system, the state government directly undertakes procurement of wheat and rice and stores and distributes it through the distribution system and other welfare schemes. The expenditure incurred for procurement by the state government was then taken up by the Central Government at approved cost. In case of coarse grains procurement, the state government in consultation with FCI procures coarse grains to the extent of its need for delivery under the Public distribution system and other welfare schemes.

After the process of procurement, the movement and distribution of grains is also an important function of the FCI to ensure the proper distribution of food grains to the states as per the requirements of welfare schemes taken up by the governments. The FCI, to ensure food security of the nation, oversees the functions under the Targeted Public Distribution System (TPDS) and the NFSA.

In 2013, the National Food Security Act was launched by the GOI to make available sufficient quantities of quality food to the targeted population and thereby ensuring food and nutritional security. In a way, it was a constructive step to overcome some of the shortcomings faced by the TPDS. It includes both the universal approach, available to every Indian, like Midday Meal Scheme and Integrated Child Development Service Scheme while retaining the targeting approach of the PDS (George and McKay, 2019)

A large volume of the procured food grains needs to be stored by FCI, both for distribution through the PDS and other welfare schemes and for unforeseen contingencies. For this, FCI has a well-built network of storage depots and silos in key locations all over the country. FCI has provided guidelines and manuals to be followed by storage units in order to ensure the safe storage of grains. The FCI hires storage capacity from the Central Warehousing Corporation (CWC) and State Warehousing Corporation (SWC), state agencies, and other private parties. Apart from its owned storage capacity, under the Private Warehousing Scheme, it also hires temporarily from other parties as per the requirements of the particular procurement season.

Despite the much-concerned efforts to carry out all the operations smoothly, many problems are being faced during the procurement, storage, and handling of food grains by the agencies. There is a need to look into those problems and find appropriate solutions for the same in order to improve the efficiency of the system.

Food grains undergo a chain of operations such as harvesting, threshing, winnowing, bagging, transportation, storage, and processing before they reach the consumer, and there are considerable losses in the crop output at all these phases. The post-harvest losses of food grains in India amount to 12 to 16 million metric tonnes each year, an amount that could feed one-third of India's poor as stipulated by the World Bank (Singh, 2010)

The post-harvest losses at the farm level have been estimated to be 3.82 kg/ q for rice and 3.28 kg/q for wheat in 2003-2004.The losses have been highest during storage in both the crops (Basavaraja *et al* 2007). Thus, the reduction of post-harvest losses of food is a crucial component of ensuring the future global food security.

Storage facilities in India need to be strengthened by supplying them with the much-needed scientific storage and drying equipment. More research is required to develop management protocols on grain storage, drying, and quality management in silos for Indian climatic conditions, which will be useful to store grains for the Food Corporation of India, the Central Warehousing Corporation, and the State Warehousing Corporation in their storage facilities. The selection of good storage site, storage structure, implementation of Integrated Pest Management (IPM), ensuring proper aeration of grains needs to be emphasized followed by regular inspection of grain stocks (Sharon *et al* 2014)

Keeping such facts in view, the study entitled "Production and Procurement Scenario of Cereals in Major Producing States of India" was conducted with the following objectives

- To study the production status of cereals in major producing states of India.
- To analyze the quantum of cereals procurement and availability of storage facilities in the country.
- To bring out the problems encountered in procurement, storage and handling of cereals by procurement agencies.

Organization of the Study

The study has been organized into five chapters. The first and the present chapter give the introduction of the investigation. Chapter II explores the reviews of the relevant literature. Chapter III deals with the data and methodology used during the course of the study. Chapter IV discusses the results obtained by the empirical analysis and lastly, chapter V embodies the summary, conclusions, and policy implications emerging out of the study followed by the list of references.

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CHAPTER II

REVIEW OF LITERATURE

Many scholars have made their study on food grain production, its sustainability and on the food security status of the country. Reviewing those studies gives a wider understanding of the research problem. Under this chapter, some of the research literature relevant to the present study has been cited as they serve as a support to the study and aid in the discussion of the results obtained in the present study. The present chapter has been classified into the following sub-headings:

2.1 Status of the area, production and productivity of food grains in India

2.2 Procurement of food grains and the Public Distribution System in India.

2.3 Problems of food grain storage and India's food security.

2.1 Status of the area, production and productivity of food grains in India

Ryan and Asokan (1977) studied the effect of the green revolution in wheat on the production of pulses and nutrients in India. For the six major wheat-producing states in India, namely, Punjab, Haryana, Uttar Pradesh, Bihar, Rajasthan, and Madhya Pradesh, linear trend lines were fitted for the two study periods from 1954-55 to 1964-64 and from 1964-65 to 1974-75. During the latter period, 22 per cent of the expansion in acreage under wheat production was at the cost of a reduction in the area of pulses and 8 per cent of expansion of wheat acreage was at the expense of winter rice and barley. Increased cropping intensities resulting from the high yielding varieties (HYVs), expansion in irrigation, and an increase in net sown areas were the major reasons which have resulted in the vast growth in the area sown under wheat in the six states. If the HYVs of wheat had not been introduced, the total trend food grain production in 1974-75 in the six states would have been 13.4 per cent less. From the nutritional point of view, the substitution of wheat for chickpea that occurred after the Green Revolution has resulted in a substantial increase in the production of both energy and protein from each hectare.

Put and Spengen (1998) made a comparative analysis of cereal production and consumption patterns in semi-arid India. The results have shown that the semi-arid region of India was facing an insecure food position under average climatic conditions. The production of coarse grains in the semi-arid regions has not improved despite the major success achieved by innovations through the green revolution in the field of wheat and rice. They have analyzed 23 coarse grain-producing villages comparatively and have traced out the actual patterns of production. On matching the actual patterns of production with the basic calorie consumption requirements, it was confirmed that a large number of impoverished houses were an unavoidable consequence of dry grain farming mode in those regions.

Gadgil *et al* (1999) conducted a study on the growth and fluctuation of Indian food grain production. They have analyzed the disparities of all-India food grain production for the last four decades. The results have shown that the magnitude of the variation in the food grain production between 1996 and 1997 was very usual for the normal monsoon years. For the years with large anomalies in Monsoon rainfall, much larger yearly changes were expected. A genuinely interdisciplinary approach was suggested with the active participation of the farmers in identifying the optimal strategies to attain adequate growth rates which would help to sustain the per capita availability of food grains.

Veni and Alivelu (2005) analyzed the production and per capita availability of food grains in India. They have examined the composition of food grains production in India during the study period from 1950-51 to 2002-03, both at the macro and micro levels. The results showed that the total cereals, including rice, wheat and coarse cereals have exhibited a growth rate of 48.93 for the period from 1950-51 to 2002-03. The highest growth in production was seen in rice when compared to wheat and coarse cereals. Pulse production was dissatisfying which fluctuated much frequently. Among all the other states, Andhra Pradesh state stood first in the production of rice. The highest production of wheat and pulses was seen in the state of Uttar Pradesh. In the production of coarse cereals, Maharashtra state stood at the first place. The per capita availability of pulses per day has been lower than the average daily requirement while that of cereals has maintained the required levels. They have also demonstrated that the net availability of cereals is inadequate to meet the requirements of the growing population

Sharma *et al* (2006) conducted a study on the extent and source of instability in food grains production in India. They have inferred that the increase in the average production of major food grain crops, namely, rice, wheat, maize, bajra, pulses and the total food grains was more during the nineties than in the eighties. Decomposition analysis has shown that the main reason for this increase is the rise in mean yield. Jower, ragi and small millets were the only exceptions to this, as the increase in the area was the main reason for increased production. Meanwhile, around three-fifths of the total increase in food grains production was contributed by rice, one-third by wheat and one-tenth by maize. Major states contributing to the increased food grain production were Punjab, West Bengal, Haryana, Madhya Pradesh and Bihar. As the increase in the mean yield was the reason behind the increased total food grain production during the nineties, measures to strengthen the research and developement infrastructure in agricultural research institutes need to be considered. There exists a wide imbalance in the contribution of different states to the total grain production and Punjab alone has accounted

for one-fifth of the increase in food grain production. They have suggested increasing the production in the states like UP, Assam, Odisha which still have a negligible share.

Chand (2007) after examining the status of demand for food grain in India, concluded that although the per capita direct consumption of food grains is declining over the years, the total demand for food grains was projected to increase at 2 per cent per annum considering the growing population and the need for grains as feed and in other related purposes. The author has suggested accelerating the production three to four times to protect against the possible influence on the food security.

Shergill (2007) conducted a study on the sustainability of wheat-rice production in Punjab. The results obtained from the study showed that the Punjab state contributes more than 50 per cent of the central pool of cereal stocks. The question of sustainability of rice-wheat production at the present scale in Punjab has been a matter of concern on both economic and ecological grounds. The examination of empirical evidence on both economic and ecological aspects of wheat-rice cultivation in Punjab has shown that it was quite sustainable. The economics of rotation was sound with the assured domestic market for the coming few decades and the minimum support price scheme would continue in the future. Returns were high compared to the competing crop rotation combinations. The reduction in the water table has neither been caused by wheat-rice cultivation nor has the depletion level crossed the danger mark.

Goel (2011) scrutinized India's food security strategy and its impact on the food surplus state of Punjab. The study revealed that the public distribution system has managed to uphold its key role in creating food security in the country. The poverty level has continued to be high in the food surplus state of Punjab and it has varied across regions. The Punjab state has emerged as a major contributor to the rice and wheat procurement in the country. As a result, the rice-wheat cropping pattern has occupied most of the cropped area. The farmers were facing several environmental problems along with that of water depletion. They were unable to make large-scale shifts in their cropping patterns due to low socio-economic profile, and lack of adequate market infrastructure. Thus it has threatened farmer's own food security giving a new dimension to food security in the country.

Acharya *et al* (2012) conducted a study on the growth in area, production and productivity of major crops in Karnataka. They have analyzed the growth in area production productivity of different crops in Karnataka for the period 1982-823 to 2007-08 with the use of compound growth function. The results revealed that the area under pulse, vegetables and spices, and fruits and nuts have shown a positive growth while the area under cereals has shown significant negative growth. A considerable decrease in the area under jowar, bajra,

ragi, and minor millets was noted. Only the area under rice has recorded a mild annual increment. The area under oilseeds and commercial crops have shown negative growth which was not significant. Meanwhile, the production of oilseeds and commercial crops registered a positive growth which was not significant. The production of cereals, pulses, vegetables and fruits showed a significant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits. The productivity of oilseeds recorded moderately positive growth while for vegetables the growth in productivity was negative and insignificant.

Ganesh-Kumar *et al* (2012) examined the demand and supply of cereals in India. They have projected the future supply and demand up to the year 2025 for rice and wheat crops. The forecasts suggested that the country was likely to face the growing surplus in rice, from 15.5 -30.8 million tons in 2015 to 26.9-60.9 million tons in 2025 under reasonable scenarios on demand and supply. Though there could be a surplus of wheat, some deficits during 2025 cannot be ignored. The range of surplus for wheat is 5.0–20.4 million tons in 2015, while in 2025 it ranges from a deficit of 8.1 million tons to a surplus of 28.3 million tons. The author believed that managing the surplus rather than deficit could be the biggest policy challenge for the nation in the upcoming years, especially in the case of rice.

Larson *et al* (2014) made a study on the instability in Indian agriculture-a challenge to the green revolution technology. They have examined the factors responsible for instability in area, yield and production for major crops in India from1950 -1951 and to 2001–2002 which was further divided into a pre-Green Revolution and post-Green Revolution period. The results have shown that the main source of growth in crop production was yield increases, especially since the introduction of Green Revolution technology. Expansion of area under cultivation did happen but, that was not rapid enough to generate changes in the production. Results for the impact of Green Revolution technology on instability showed a decrease in production instability for wheat, total cereals, sugarcane, and total pulses for all of India. The Green Revolution technology undoubtedly succeeded in transforming India into a food secure country from being a large food importer. However, the Green Revolution technology may have failed to reduce the instability of agriculture during recent decades. Many of the problems associated with production instability have continued to persist, and the need to find the increased stability has continued to be a challenge.

Shekar (2014) examined the role of Punjab in food security of India. The production of major cereals like rice, wheat and maize showed consistent improvement while the pulses didn’t improve much. The production of rice and wheat during TE 1960-61 was 33.27 and 10.42 million tonnes which increased to 89.57 and 82.78 million tonnes respectively in TE

2010-11. The productivity of rice and wheat was more than doubled and that of wheat has increased by more than three times during the entire period. In Punjab, the earlier share of rice in total area under food grains was only 9.66 per cent which increased by five times in TE 2010-11 while the share of wheat in total area under food grains has remained at almost 57.84 per cent during the study period. Presently, in Punjab, the rice-wheat cropping system has occupied around 96 per cent of the total area under food grains. The procurement of wheat from Punjab state has increased to 61.63 percent in 2010-11 from 23.27 percent in 1966-67. Overall growth in area, production and productivity of rice was found to be more in Punjab when compared to India. However, both Punjab and India showed the same trend in the case of wheat. The overall sustainability of Punjab has improved over the years and was higher in 2010-11.

Ahmed *et al* (2015) conducted a study on the trend of area, production, and productivity of major cereals in India and in Nigeria. They have analyzed the trends for the period from 1982 to 2012. The results showed that the growth trend for cereals in India was negative (-0.0750) and significant and for production, the growth trend was positive (0.84) and significant. The growth trend for productivity in India was also positive (0.94) and significant. The computed growth rates were positive (1.056), (1.247), and (0.189) and significant at degree of probabilities 1%, 1% and 5% for the area, production, and productivity respectively. The productivities were higher in India for rice, wheat and maize than that of Nigeria while the reverse is the case in millets and sorghum. However, both the countries exhibited instability in area and production with a more than 10 per cent instability index and relatively stability was observed in productivity. The author has suggested emphasizing on augmenting the cereal production as the area for cereals is declining in both the countries. They have advised improving productivity by encouraging the dissemination of high yielding varieties, adequate input supply, and transfer of technology and/or advisory services to the cereal cultivating farmers.

Singh *et al* (2015) conducted a study on the status of pulse production in India They have stated that production of pulse/ legume crops has been stagnant over many years and as a result, the gap between demand and supply is widening continuously. India was a leading importer of pulses, about 20 per cent of the total pulses demand of the country was met by imports alone. They have suggested increasing the pulse production through gradual mechanization for production of pulses, establishing the public–private partnership to minimizing post-harvest losses, augmenting the pulse production by policy support for the value chain of pulse, enhancing seed replacement ratio and assuring disposal of critical inputs like seed, fertilizer, and pesticides.

Singh *et al* (2016) examined the trends of pulses production, consumption and import in India. They have analyzed the status of pulse crop in India as a whole and Bihar in particular. Bihar state, one among the pulse growing states of India, with a productivity of 839.3 Kg/ha in 2010-11 has been projected to attain the productivity of 1461.3 kg/ha by 2050-51, which was highest in eastern India. The author suggested that a small technological intervention has the potential to transform the rice fallow to rice-gram and rice-lentil systems which could bring about the pulse revolution in the country. With nearly 2.2 million ha of rice fallows in the country, the need was to diversify the cropping system from cereal-based to pulse-based cropping system with the help of some policy decisions like identification of additional rice fallow areas, mostly in eastern India, improved crop production techniques, enhancing seed replacement rate.

Handral *et al* (2017) studied the scenario of changing dynamics in production and productivity of major cereals in India. They have analyzed the trends in the area, production and productivity of rice, wheat and maize for the study period from 1990-91 to 2012-13. The compound annual growth rate (CAGR) and coefficient of variation were used to study the growth patterns and instability in the production and productivity of cereals over time. The results obtained from the study have shown that for both rice and wheat, the majority of the states have recorded increasing growth trends for the period. The instability also has increased in area, production and productivity for both rice and wheat. Maize has shown a considerable increase in the area, yield and production since 2000 due to its increasing demand for industrial usage and its growing commercial value with the emergence of new potential hybrids. The study has suggested making the policy intervention to achieve desired stability in the case of major cereals of India.

Singh *et al* (2017) analyzed the standpoint of Indian cereals saga and also tried to explore what could be the way forward. The study revealed that in food commodity export, cereals are leading and especially the Basmati rice. Our share in world trade was less than one per cent and it was found necessary to increase our share to around six per cent hurriedly. Undoubtedly cereals and coarse cereals were required to be emphasized in that direction.

2.2 Procurement of food grains and the Public Distribution System in India.

Pal and Bahl (1993) conducted a case study on the Government interventions in food grain markets in India. They have examined the cost involved and the effects of government interventions in food grain markets in India. The results showed that the interventions have not reduced the price spread but have been helpful in temporal and seasonal price stabilization and the access to food has increased significantly. The study revealed that the public distribution of food grains has exposed urban bias, particularly for wheat, and was

inconsistent with the incidence of poverty. Freight and interest payments have the highest share in the cost due to which the rate of subsidy has accentuated. The proper targeting of distribution to people below the poverty line, rational food grain movement, relief work, and the sale of excess food grains to buffer stock and public distribution at an economic price in the open market were some of the important measures suggested to reduce the food subsidies.

Gulati *et al* (1996) explored the successes and failures in Indian food grain marketing with a special regard to the Food Corporation of India. On evaluating the performance of food Corporation of India (FCI), the author has stated that the Food Corporation of India has improved the availability of food grains as a whole but it has failed in targeting the distribution of food grains to poor consumers and regions. It has failed to keep the operations economically efficient, and maintain the buffer stocks at the government stipulated levels and particularly in covering its costs by its revenues, while the gap between the two has been sharply widening over the years. This can be attributed to the excessive costs of its operations. The per-unit cost of its operations was considerably higher than that of private traders. The inefficiencies in its operations were mainly due to the lack of accountability and the learning that the government will cover the costs, if necessary.

Jha and Sriniasan (1996) examined the liberalization of food grain markets and gave the implications for food security and price stability in India. They have tried to find out the least cost way of achieving food security. The results of their study suggested that both the domestic and external trade of food grains has to be liberated from government interventions and the government's role of stabilizing the prices has been maintained. This would yield positive welfare benefits to the country's economy. However, the distribution of the benefits among the agents of the economy can vary over the situations.

Ramaswami and Balakrishnan (2002) conducted a case study of the Public Distribution System in India to analyze the food prices and the efficiency of public intervention. They have tried to answer whether and how the inefficiency of state institutions matters to food prices. In the background of the wheat subsidy scheme in India, the implications of quality differences between public and private grain supply have been modeled by the author. The inferior quality of public grain points to the inefficiency of government operations as both private and public grains are procured at similar prices. They have proposed and empirically validated a method to test for demand switches that occur as a result of quality preference. The results showed that the reduction in food subsidies lead to an increase in food prices and hurt the poor even when they were not major recipients of the subsidy. This can be seen as the consequence of inefficiencies in public interventions. The

finding of the study suggested that if the reduction in the food subsidy in India were to be accompanied by other institutional reforms, the market price of food may not rise.

Jha *et al* (2007) examined Indian wheat and rice sector policies and gave the implications of reform. They have concluded that decentralization was more likely to lessen government costs with a slight impact on consumers, producers, and/or trade. Lower price supports would benefit consumers at the cost of producers and greatly reduce the government costs. It could be possible to maintain producer support with less market distortion and reduced cost by the adoption of a U.S.-style deficiency payment programme but would require a viable practical system to make and monitor the payments to the farmers.

Basu (2010) studied the economics of food grain management in India. The main argument of the study was that in order to create a better food policy, we must look at the entire food system from production to distribution of food. Merely correcting any one segment of this complicated system would be most likely to end up in failure or, at best, would bring limited success. The author argues that the poor food grain storage, which has usually been stated as the central problem was not the only issue that needed to be taken care of. To achieve the lower food price, we need to redesign the mechanics of how we acquire and release food on the market and the industrial organization theory would help with this stubborn policy problem.

Khera (2011) studied India's Public Distribution System. The author examined the effectiveness of the Public Distribution System (PDS) in India as a public intervention for food security using the data collected through a field survey in Rajasthan. They found that the usage of the PDS services was low (only 13 per cent of BPL households in the sample were purchasing their full quota of grain and nearly one-third of the BPL households did not buy any grain from the PDS), many of households did purchase wheat from open markets at higher prices before exhausting their PDS quotas. This question of 'under-purchase' was analyzed by applying dual purchase model to find out both the supply-side and demand-side constraints. There was an exciting relationship between the market price of wheat and purchase of wheat from the PDS – so long as the difference between the market and the PDS price was less than Rs2.6 to 2.9/kg, BPL households bought more as the market price increased. An increase in the difference beyond this reduced what BPL households bought representing that the supply hypothesis was true .They have also found that the PDS has affected the composition of cereals consumed rather than level of cereal consumption.

Gopakumar and Pandit (2014) conducted a study on the production, procurement, and inflation in Indian food grain market. They have proposed a structural model that has explained the behavior of the food grain prices for the period from 1980-81 to 2011-12,

including the role of government interventions. Demand-side management turned out to be greatly significant in case of controlling inflation meanwhile increased capital stock was found to be important in the supply-side management. A significantly stabilizing role has been played by the government by its interventions in controlling inflations through procurement and off-take operations.

Dreze and Khera (2015) attempted to understand the leakages in the public distribution system. They have tried to resolve the issues of leakages in PDS using latest data and concluded that tough the leakages remain high (about 30 per cent for 2011-12). There was a clear evidence of improvement in recent years, especially in those states which boldly have undertaken PDS reforms. Recent improvements of Bihar state suggests that even the states with the worst governance were capable of improving their system of public distribution. The author has stated that the major source of leakage was the "above poverty line "quota which was due to be phased out under national Food Security. The implementation of the National Food Security Act (NFSA) would pave the best opportunity to phase out this quota. Delays in the release of Socio Economic and Caste Census (SECC) data has caused many states to hold their implementation of the NFSA which was needed to be resolved at the earliest possible.

Chatterjee and Kapur (2016) attempted to understand price variation in agricultural commodities in India in consideration with the MSPs, Government procurement, and agriculture markets. They have analyzed the huge overall variations in prices among the mandis and have found that about 39 per cent of variation was due to time and location factors while the other 37 per cent of the variation was the consequence of time-invariant, location-specific factors. Geographically selective government interventions in agriculture output markets, the market powers enjoyed by the mandis because of limitations in the APMC acts had a key role to play with these variations. Selective interventions of government caused 2 to 4 per cent variation in prices based on the crop. In case of paddy, this has improved terms of trade benefiting farmers but in case of wheat, it would work the other way around. They have also found that the farmers sell their produce in geographically isolated mandis, which face a low competition and enjoy higher market power at about 5 per cent lower prices in relation to areas where mandis having lesser market power.

Majumdar (2018) made a study on the procurement process and Agripreneurship in India. The author has opinioned that the Indian food security system needs fundamental reform and has suggested a public-private partnership model which consists of an element of agriprenureship in it, which would help in sustainable agriculture practices. Agriprenureship with ample training and support for capacity building and scalability could offer a robust model for sustainable agricultural practices and mitigation of poverty.

Raju *et al* (2018) conducted a case study on the state of Karnataka concerning the introduction of millets into the Public Distribution System. They have found from their study that the state has offered attractive procurement prices (which covers the actual cost of production and imputed cost of family labor) over and above the MSP to encourage farmers to grow millets. The government needs to procure 20 to 40 per cent of the total production of millets at current production levels in order to meet the requirements of the PDS. For achieving the same, local procurement and distribution need to be augmented which would make the supply of millets through PDS viable. Streamlining the procurement process, providing officials with suitable training in quality assessment, creating a longer procurement window linked with the harvest period of crop, lessening the time gap between procurement and payment are among the major tasks to be done. After the procurement, there are issues regarding the storage of millets as the prevailing arrangements are for the storage of rice and wheat. The consumer side demand for millets is high in Karnataka, for sorghum in northern Karnataka and for finger millet in southern Karnataka as they occupy an important part of the food basket. Millets may be the ideal crops on which to focus, given their high nutrition content and climate-stress resilience. Karnataka's experience put forward some insights into the potential and difficulties of introducing millets into the public distribution system.

Mogale *et al* (2019) attempted to develop a robust data-driven supply chain model for the efficient procurement of food grains in India. To minimize the total supply chain network costs and to determine the number and location of procurement centers, a mixed-integer linear programming model was formulated, following the data collected from three leading wheat-producing regions of India. The NK Hybrid Genetic Algorithm (NKHGA) was used to cluster the villages, in addition to a novel density-based approach to optimize the supply chain network. They have also indicated that the policymakers should emphasize creating an adequate number of procurement centers, in every surplus state, well before the start of the harvesting season. And the study was anticipated to be of advantage to the stakeholders such as farmers, procurement agencies, logistic providers, and also the government by aiding in making informed decisions.

2.3 Problems of food grain storage and India's food security.

Basavaraja *et al* (2007) conducted an economic analysis of post-harvest losses in food grains in India, a Case Study of Karnataka. The post-harvest losses at different stages for the major food grains i.e., rice and wheat have been estimated using the survey data collected from 100 farmers, 20 wholesalers, 20 retailers, and 20 processors in each crop in Karnataka for the year 2003-04. The results have shown that estimated postharvest losses at the farm

level stood at 3.82 kg/ q for rice and 3.28 kg/q for wheat. The losses were highest during storage for both the crops.

Buchan (2007) studied India's food policy paradox. The author pointed out that the procurement of food grains by the Food Corporation of India (FCI) has consistently been increasing above required levels whereas millions of people have continued to suffer from food insecurity. The main reason for that was the severely high government-induced Minimum Support Prices which has been imposed upon the producers of food grains. The overly full warehouses of food grains have created undue stress on the PDS which in turn has resulted in reduced off-take, inappropriate reform and increased food insecurity. The author suggested to revert back the MSP to its main function-procurement was equal to off-take, instead of its function as a price support scheme to the farmer to achieve food security in the country.

Singh (2010) tried to suggest a holistic approach for grain management in India. The author has proposed the "Our Grain in Our Village" scheme under which the promotion of local storage of important grains would be taken up in a systematic and scientific manner. The proposed scheme in a larger perspective would aid in saving grains from which would otherwise occur in the godowns of FCI. The author has opinioned that any kind of grain management scheme has to incorporate the issues of decentralization, reduction in handling costs, the involvement of a huge number of the rural mass, and self-sustaining frameworks in order to become successful and effective.

Tanksale and Jha (2010) attempted to develop a mathematical model to optimize food grains storage and transport for the public distribution system in India. They have applied linear programming based mathematical model for storage and transportation management of food grains in India for the public distribution system. Minimizing the total cost for inventory storage and monthly inter-state movement plans were the objectives. The results of the study showed that the demand for food grains in a state during a period was fulfilled at the beginning of that period and the procurement and transportation of food grains were carried out at the end of the period to achieve minimum total cost.

Jaswal (2014) examined the challenges to food security in India. The author concluded from the study that food security in India could only be achieved by paying higher attention to the issues such as climate change, integrated water management, agricultural pricing, inadequate storage capacity, unsuccessful delivery of public services, mismanagement of food products and crop insurance. Although efforts were made to increase production, very little has been done to reduce supply chain losses. In order to improve food security and reduce poverty, food wastage has to be addressed with special importance. It was

suggested to regulate the policies related to globalization for reducing the negative impacts on food security in India and to promote climate-friendly agricultural production systems and land-use policies to curb the effects of climate change.

Tanksale and Jha (2014) studied the issues regarding implementation of the National Food Security Act and have pointed out that the resource limitations, exploding population, inadequate infrastructure facilities, operational inefficiencies, and foulest performance of PDS are the main hurdles in the successful implementation of the proposed act. They have emphasized the need for major reforms in procurement, storage, transport, and distribution of food grain strategies

Sharon *et al* (2014) studied grain storage management in India. The study showed that in India, small farmers store their food grains using traditional structures. Surplus grains procured were stored in government agencies like Food Corporation of India (FCI), Central and State Warehousing Corporations. The Cover and Plinth (CAP) storage was the commonly used method of storage which was economical but some losses were inevitable. Very few scientific storage structures like silos are available with these agencies. Drying of harvested grains to safe moisture levels would reduce losses to a greater extent. However, the literature available was very less on the behavior of grains after harvest for Indian climatic conditions. Much research needed to develop suitable management guidelines for safe storage and drying to manage the quality of stored grains

Ali *et al* (2015) examined the grain drying and storage problems in India. The author stated that the awareness of availability of dryers and of their use, and advantages in drying food grain for better storage and marketing was lacking among crop growers. The production has increased over the years while the losses had remained constant at 10 per cent which showed that the losses were also increasing along with that of production. On an average 6 per cent of losses out of 10 per cent happen during storage. If the dryers and scientific storage structure were used, up to 6 per cent of losses could be reduced.

Dhingra (2016) studied the evolution and trends in food grain storage in India. The results showed that an economical and safe storage of food grains was essential for food security. Though the capacity of permanent storage structures was being augmented through various government schemes, the pace was slow. Some of the major strategies which needed to be implemented in both organized and unorganized sector were sanitation of structures, cleaning and drying of grains before storage, aeration and fumigation, frequent monitoring of grain. The needed infrastructure for the preventive treatments has to be made available in order to reduce the post-harvest losses and extend the storage life of grains. The author suggested that in the areas of impact of biotic and abiotic factors during storage, detection and

monitoring of spoilage, safe fumigants, uniform fumigation, etc., more efforts were required through research and development.

Pattanaik and Tripathi (2016) conducted a study on food grains storage and handling in India. They have suggested that in order to modernize the system of handling and storage of food grains, there exists a pressing need to speed up the participation of the private sector in creating silos for grain storage in the areas of procurement and consumption, precisely for strategic/buffer storage of wheat. Regular hygiene monitoring, prophylactic and curative treatments were prerequisites for the scientific storage to minimize the losses. To minimize the chemical pesticide application, an integrated approach is suggested over the chemical pesticide application though there is a high reliance on phosphate fumigation for longer preservation of grains.

Pandey (2018) made a case study on storage loss under bulk storage of rice. About 30 per cent of rice and wheat produced every year was procured by the Food Corporation of India. Most of the procured rice and wheat was stored warehouse by the FCI. The author has conducted an experiment to determine the weight gain/loss of stored grains as per the prescribed Performa at the FCI, Ranchi. At the time of procurement, initial moisture content of rice was found between 13.2 per cent to 13.7 per cent wet bases. After the 12 months of storage, the moisture content was found to be 12 per cent wet basis. The study depicted the variation of moisture content in stored rice as a bulk. An increasing trend in storage loss showed up to 12 months of storage. Maximum storage loss recorded was 1.17 per cent and the minimum was 0.56 per cent after 12 months and 3 months of storage respectively

Mahapatra and Mahanty (2018) studied India's National Food Security Programme. Their study has pointed out various strategic challenges faced by the National Food Security Programme. The low yield, small farm size, lack of financial support are the issues in production while the procurement is skewed with improper market integration. Non-optimally located storage facilities in addition to their inadequate capacity has made storage of grains troublesome. Uncoordinated transportation leading to multiple loading and unloading of food grains, improper distribution of grains and leakages were among the other inefficiencies of the programme. Large workforce, operational inefficiency and very high subsidy have made the financial viability of the programme questionable. Resistance to labor reforms and payment disparity were among the organizational concerns.

Prabhakaran *et al* (2018) carried out a survey on the quality of food grains procured from farmers in Punjab. The survey involved the collection of food grains (wheat and paddy) from farmers in mandis/procurement centers from the period 2008 to 2016. The analysis of paddy and wheat samples was carried out for their quality parameters in respect of the content

of various refractions such as, foreign matter, discolored, damaged grains, shrunken, weevilised, shriveled, immature grains and moisture. The results from the analysis revealed the extent of its quality. The refractions content of both paddy and wheat were observed to lie within the Government formulated quality specifications for their procurement during Kharif and Rabi marketing season.

Research gap and significance of the study

Although various studies have been undertaken either on production or procurement/ storage of cereals. But a few studies emphasize these issues collectively. This study will exclusively analyze the production scenario, procurement and storage of cereals in totality thus comprehensively studying interrelated issues. The emphasis will be on the production pattern and procurement/storage scenario of cereals along with associated problems, which would be helpful to the policy planners to suggest suitable remedial measures for better storage and handling of cereals in India which is urgently needed for ensuring food to ever-increasing population.

CHAPTER III

MATERIALS AND METHODS

The chapter deals with the sources of data and methodology of data analysis used in light of the stated objectives of the study. The data for this study has been collected from various published and unpublished sources. The research methodology has been discoursed in detail under the following heading:

3.1 Nature and source of data

3.2 Selection of crops and states

3.3 Period of study

3.4 Analytical tools used

3.1 Nature and Source of the data

The secondary data were collected to meet the first two objectives of the study. Time series data on area, production, and productivity of selected crops for selected states have been collected from various published and unpublished sources like the Ministry of Agriculture and Farmers Welfare, Govt. of India. The time-series data on procurement of cereals and coarse grains in India were collected from Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India. The time-series data on storage capacity available in India has been obtained from the official website of Food Corporation of India, Department of food and Public Distribution System, Govt. of India. In order to achieve the third objective of the analysis, the primary data was obtained. An e-survey of officials from agencies/ institutions involved in the procurement and/or storage of food grains in India was conducted. Using a loosely structured e-questionnaire consisting of both open-end and closed-end questions along with some Likert scale questions, the relevant information on problems faced during the procurement, storage and handling of cereals was gathered. The agencies/institutes engaged in the procurement and/or storage of food grains from which the information was collected were the Food Corporation of India (FCI), Central Warehousing Corporation (CWC), and State Warehousing Corporation (SWC), based nationwide.

3.2.1 Selection of States

The states with more than 10 million tonnes of rice production were selected as the major producing states for rice, and the states with more than 10 million tonnes of wheat production were selected as the major producing states for wheat. The states with more than one million tonnes of maize production were selected as major producing states for maize while the states with more than one lakh tonnes of jower production were selected as major producing states for jower.

3.2.2 Selection of crops

The present study is focused on cereal grains, particularly rice, wheat, maize, jower and coarse grains.

3.3 Period of study

The status of area, production and productivity of rice, wheat, maize and jower was analyzed for the study period from 1960-61 to 2017-18. The procurement scenario of rice, wheat, and coarse grains was analyzed for the period from 2000-01 to 2018-19. The storage facilities available in India were studied for the period from 2005-06 to 2020-21.

3.4 Analytical tools used

3.4.1 Estimation of growth rates in the area, production and productivity of selected cereal crops for major producing states in India.

The growth rates were estimated to study the percentage increase or decrease in the selected variable per unit of time. The growth rates of area, production, and productivity for major cereals crops like rice, wheat, maize and jower was estimated using the exponential growth function of the form

$$\mathbf{Y_t = ab^t e^u}$$

Log transformation of the above function:

$$\mathbf{\ln Y_t = \ln a + t (\ln b)+u}$$

$$\ln b = \ln (1+r)$$

$$b = 1+r$$

$$r = b-1$$

$$r = [\text{Antilog } (\ln b)-1]$$

The compound growth rate was computed in percentage using the relationship

$$\mathbf{CGR\ (\%) = r * 100}$$

Where

Y_t= Absolute value of the dependent variable (E.g. Area, production, Productivity of major cereal crops) for the year t.

t = Time variable

a = Constant

b = Regression coefficient of time

u = Error term

r= Compound Growth Rate

The compound growth rates were also tested to determine their statistical significance.

3.4.2 Percentage share

Percentage share was calculated using the following formula:

$$\textbf{Per cent Share} = \frac{A}{B} \times 100$$

Where,

A = Part of a whole quantity

B = Whole quantity

3.4.3 Relative Importance Index (RII)

For the analysis of five-point Likert scale questions related to problems encountered in procurement, storage and handling of food grains, the Relative Importance Index was calculated, where weight is given to each type of response as per the judgment of the user.

In the present study,

1= Strongly Disagree

2= Disagree

3= Neutral

4=Agree

5= Strongly Agree

Then, RII is calculated using the following formula:

$$RII = \frac{\left(W_1 n_1 + W_2 n_2\right)}{A \times N}, (0 < RII < 1)$$

Where,

W=Weight of the option as decided by the user,

n = Number of response under each option

A= Highest weight given

N=Total number of respondents

3.4.4 Limitations of the Study

Considering the first two objectives of the present study, it was based entirely on secondary data collected from various published and unpublished sources. The reliability of the findings could, therefore, be subject to the precision and accuracy of the data available from such sources.

Any study which relies on a survey using a questionnaire, as in case of the third objective of this study, has certain fundamental limitations. The possibility of disparity between what was reported and what was the existential truth cannot be eliminated, no matter how carefully and sensitively the questionnaire has been constructed and filled in. This

usually happens due to the fact that the respondents may fail to report their true perception and even if they wanted to do so, they were bounded with instances of miscommunication. There was no way to absolutely eliminate the risk of errors sliding in. Some of the constraints of the study have been listed here to make the findings of the study interpreted in the right perspective and direction.

1. The respondents were not geographically uniformly distributed and were selected on the basis of convenience and their willingness to participate in the study.
2. Much difficulty was faced in obtaining information regarding their organization/ Agency.
3. The unsupportive behavior of respondents can affect the final results of the research.
4. Lack of understanding on the part of respondents may have contributed to faulty responses.
5. Time was a major factor that restricted the survey which may have impacted the recorded responses.

CHAPTER IV

RESULS AND DISCUSSION

The results obtained from the study, in accordance with the objectives, have been discussed in this chapter under the sections mentioned below.

Section I: Status of area, production and productivity of cereals in major producing states of India.

Section II: Quantum of cereals procured and availability of storage facilities in India.

Section III: Problems encountered in procurement, storage and handling of cereals by the agencies.

Section I: Status of area, production and productivity of cereals in major producing states of India.

This section deals with the status of area, production and productivity of cereals such as rice, wheat, maize and jower in major producing states of India. The data on area, production and productivity of rice, wheat, maize and jower, for the major producing states was collected for the period from 1960-61 to 2017-18 and compound annual growth rates (CAGR) were computed and presented in the subsections mentioned below.

4.1.1 Area under rice cultivation in major producing states of India

The Table 4.1.1 presents the area in lakh hectares under the rice cultivation in major producing states of India for the period from 1960-61 to 2017-18. Compound annual growth rates of area under rice cultivation for the major producing states has also been presented in the table.

At national level, CAGR for the area under rice cultivation showed significant growth of 0.41 per cent for the period from 1960-61 to 2017-18. Punjab state showed a growth of around 4.85 per cent, which was significant for the period. Uttar Pradesh state has shown a significant growth of 0.63 per cent. West Bengal state showed a significant growth of 0.38 per cent while the state of Andhra Pradesh has shown a growth of around -0.04 per cent, which was significant. The state with the highest CAGR was Punjab (4.85%) followed by Uttar Pradesh (0.63%) and West Bengal (0.38%). Andhra Pradesh state showed the lowest CAGR (-0.04%) for the period. Recently since 2013-14, the area under rice cultivation in Andhra Pradesh has been declining, which may be attributed mostly to the division of the state and partly to the failure of monsoons and decreased water availability in the state.

Table 4.1.1: Area under rice cultivation in major producing states of India

(In Lakh Hectares)

Year	Andhra Pradesh#	Punjab	Uttar Pradesh	West Bengal	All India
1960-61	29.61	2.28	41.84	46.05	341.28
1965-66	31.40	2.93	42.07	46.51	354.70
1970-71	35.21	3.90	45.62	49.56	375.92
1975-76	38.94	5.67	46.22	54.26	394.75
1980-81	36.00	11.78	52.92	51.76	401.52
1985-86	34.52	17.14	55.87	50.79	411.36
1990-91	40.36	20.24	56.17	58.13	426.87
1995-96	36.92	21.61	55.65	59.53	428.37
2000-01	42.43	26.11	59.07	54.35	447.16
2005-06	39.82	26.42	55.78	57.83	436.57
2010-11	47.51	28.31	56.57	49.44	428.62
2011-12	40.96	28.18	59.47	54.34	440.06
2012-13	36.28	28.45	58.61	54.44	427.54
2013-14	24.44	28.70	58.67	54.10	441.36
2014-15	23.94	28.94	58.72	53.76	441.10
2015-16	21.61	29.75	58.62	55.24	434.99
2016-17	21.05	28.98	59.92	54.97	439.93
2017-18	21.56	30.56	58.14	20.35	437.74
CAGR	**-0.04****	**4.85****	**0.63****	**0.38 ****	**0.41****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

Since 2013-14, area under cultivation of rice exclusively in AP not including Telangana.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

4.1.2 Status of rice production in major producing states of India.

The Table 4.1.2 presents the production of rice in lakh tons for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has also been presented in the table.

At the national level, rice production has shown a CAGR of around 2.31 per cent which was significant at 1 per cent level for the study period from 1960-61 to 2017-18. Punjab state ranks first in the growth of rice production with the highest CAGR of 7.22 per cent followed by Uttar Pradesh state which showed a growth of 3.33 per cent. West Bengal

Table 4.1.2: Rice production in major producing states of India

(In Lakh Tonnes)

Year	Andhra Pradesh#	Punjab	Uttar Pradesh	West Bengal	All India
1960-61	36.60	2.36	31.51	54.54	959.70
1965-66	39.61	2.93	23.42	48.93	1053.01
1970-71	47.86	6.88	37.01	61.40	1052.41
1975-76	64.51	14.47	42.94	68.66	1066.46
1980-81	70.11	32.23	55.70	74.66	1054.82
1985-86	76.14	54.49	83.15	79.91	1044.08
1990-91	96.54	65.35	102.60	104.37	1096.98
1995-96	90.14	67.68	103.63	118.87	1127.58
2000-01	124.58	91.54	116.79	124.28	896.83
2005-06	117.04	101.93	111.34	145.11	917.94
2010-11	144.18	108.37	119.92	130.46	959.70
2011-12	128.95	105.42	140.22	146.06	1053.01
2012-13	115.1	113.74	144.16	150.24	1052.41
2013-14	69.70	112.67	146.36	153.71	1066.46
2014-15	72.34	111.07	121.68	146.77	1054.82
2015-16	74.89	118.23	125.01	159.54	1044.08
2016-17	74.52	115.86	137.54	153.03	1096.98
2017-18	81.66	133.82	132.74	159.11	1127.58
CAGR	**1.87****	**7.22****	**3.33****	**2.46****	**2.31****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

Since 2013-14, production of rice exclusively in AP not including Telangana.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

state has shown a growth of 2.46 per cent for the study period. The lowest CAGR of 1.87 per cent was shown by the state of Andhra Pradesh. All the major producing states have shown a positive growth indicating the consistent increase in the production of rice, which was significant at 1 per cent level, for the study period from 1960-61 to 2017-18. As a result of the decreased area under rice in Andhra Pradesh, production has also been decreasing since then.

4.1.3 The productivity status of rice in major producing States of India

The Table 4.1.3 presents the productivity of rice in quintals per hectare for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has also been presented in the table.

At the national level, the productivity of rice has shown a significant CAGR of around 1.89 per cent for the study period from 1960-61 to 2017-18, indicating a consistent improvement in rice yield over the years. Uttar Pradesh stands first in the growth of productivity of rice with the highest significant CAGR of 2.60 per cent followed by Punjab state with a significant CAGR of 2.26 per cent. Andhra Pradesh has shown a significant growth rate of 1.91 per cent while the lowest CAGR of 1.53 per cent was showed by West Bengal. CAGR of all the major producing states were significant at the 1 per cent level for the study period. The notable growth in rice productivity witnessed in Uttar Pradesh can be attributed to the increased area under high yielding varieties of rice.

Table 4.1.3: Productivity of rice in major producing states of India

(In Quintals/ Hectare)

Year	Andhra Pradesh#	Punjab	Uttar Pradesh	West Bengal	All India
1960-61	12.36	10.32	7.53	11.84	10.13
1965-66	12.61	10.00	5.57	10.52	8.62
1970-71	13.59	17.64	8.11	12.39	11.23
1975-76	16.57	25.52	9.29	12.65	12.35
1980-81	19.48	27.36	10.53	14.42	13.36
1985-86	22.06	31.79	14.88	15.73	15.52
1990-91	23.92	32.29	18.27	17.95	17.40
1995-96	24.41	31.32	18.62	19.97	17.97
2000-01	29.36	35.06	19.77	22.87	19.00
2005-06	29.39	38.58	19.96	25.09	21.02
2010-11	28.43	38.28	21.20	26.39	22.39
2011-12	33.02	37.41	23.58	26.88	23.93
2012-13	31.06	39.98	24.60	27.60	24.62
2013-14	28.52	39.18	22.66	27.45	24.16
2014-15	30.22	38.38	20.72	27.30	23.91
2015-16	34.65	39.74	21.33	28.88	24.00
2016-17	35.40	39.98	22.95	27.84	24.94
2017-18	37.88	43.66	22.83	20.26	25.76
CAGR	**1.91****	**2.26****	**2.60****	**1.53****	**1.89****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

Since 2013-14, productivity of rice exclusively in AP not including Telangana.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

4.1.4 Area under wheat cultivation in major producing states of India

The Table 4.1.4 present the area in lakh hectares under wheat cultivation in major producing states of India for the period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, CAGR for the area under wheat cultivation showed a significant growth of 1.4 per cent for the period of 1960-61 to 2017-18. Haryana state has shown significant growth of 2.42 per cent. Madhya Pradesh state has showed a significant growth of 1 per cent .Uttar Pradesh has shown a growth of around 1.53 per cent , mostly similar to that of Punjab state which showed a significant growth of1.44 per cent . Haryana stands first in the growth of area under wheat cultivation with the highest CAGR (2.42 %) whereas Madhya Pradesh state has shown the least CAGR of 1 per cent for the study period.

Table 4.1.4: Area under wheat cultivation in major producing states of India

(In Lakh Hectares)

Year	Haryana	Madhya Pradesh	Punjab	Uttar Pradesh	All India
1960-61	6.29	30.92	13.99	39.39	129.27
1965-66	6.85	24.02	15.48	41.15	125.72
1970-71	11.29	34.03	22.99	59.07	182.40
1975-76	12.26	33.60	24.39	63.02	204.54
1980-81	14.80	33.65	28.12	81.12	222.79
1985-86	16.99	37.05	31.12	82.81	229.97
1990-91	18.50	38.34	32.72	85.68	241.67
1995-96	19.72	40.20	32.23	89.24	249.10
2000-01	23.55	33.11	34.08	92.39	257.31
2005-06	23.04	36.93	34.68	91.64	264.84
2010-11	25.15	43.41	35.10	96.37	290.69
2011-12	25.22	48.89	35.28	97.31	298.65
2012-13	24.97	53.00	35.12	97.34	299.95
2013-14	24.99	53.80	35.12	98.39	304.73
2014-15	26.01	60.02	35.05	98.46	314.66
2015-16	25.76	59.11	35.08	96.45	304.18
2016-17	25.58	60.28	34.95	96.55	307.85
2017-18	24.40	53.16	35.12	97.53	296.51
CAGR	**2.42****	**1.00****	**1.44****	**1.53****	**1.42****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

Source: Ministry of Agriculture and Farmers Welfare, Govt. of India.

4.1.5 Status of wheat production in major producing states of India

The Table 4.1.5 presents the production of wheat in lakh tons for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the production of wheat crop has shown a significant CAGR of around 3.95 per cent for the study period from 1960-61 to 2017-18.The highest CAGR of 4.95 per cent was shown by the state of Haryana while Punjab being the least with a growth of 3.78 per cent, which was significant for the period. Uttar Pradesh and Madhya Pradesh states have shown an almost similar CAGR of around 3.98 and 3.83 per cent respectively which were significant. All the major producing states have shown positive growths expressing a consistent increase in production of wheat, which was significant at 1 per cent level, for the period.

Table 4.1.5: Wheat production in major producing states of India (In Lakh Tonnes)

Year	Haryana	Madhya Pradesh	Punjab	Uttar Pradesh	All India
1960-61	8.13	19.52	17.32	39.45	109.97
1965-66	9.02	13.30	19.16	37.55	103.94
1970-71	23.42	25.92	51.45	76.90	238.32
1975-76	24.28	27.50	57.88	85.52	288.46
1980-81	34.92	31.44	76.77	133.85	363.13
1985-86	52.57	42.02	109.88	165.59	470.52
1990-91	64.40	58.33	121.55	202.29	551.35
1995-96	72.91	66.67	125.18	218.16	620.97
2000-01	96.69	48.69	155.51	251.68	696.81
2005-06	88.60	59.60	144.90	240.70	693.55
2010-11	116.30	76.27	164.72	300.01	868.74
2011-12	126.86	115.39	172.80	302.93	948.82
2012-13	111.17	131.33	165.91	303.02	935.06
2013-14	118.00	129.37	176.20	298.91	958.50
2014-15	103.54	171.04	150.50	224.17	865.27
2015-16	113.52	176.89	160.77	254.25	922.88
2016-17	115.47	179.39	164.40	300.56	985.10
2017-18	107.65	159.11	178.30	318.79	998.70
CAGR	**4.95****	**3.83****	**3.78****	**3.98****	**3.95****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

Source: Ministry of Agriculture and Farmers Welfare, Govt. of India.

4.1.6 The productivity status of wheat in major producing states of India

The Table 4.1.6 presents the Productivity of wheat in quintals per hectare for the major producing states of India for the study period of 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the productivity of wheat has shown a significant CAGR of around 2.44 per cent for the study period of 1960-61 to 2017-18 indicating a consistent improvement in wheat yield over the years. The state with the highest significant CAGR of 2.80 per cent was Madhya Pradesh followed by Haryana state with a significant CAGR of 2.47 per cent .Uttar Pradesh has shown significant growth rate of 2.40 per cent while the lowest CAGR of 2.30 per cent was showed by Punjab state. The CAGR of all the major producing states were significant at 1 per cent level for the study period of 1960-61 to 2017-18.

Table 4.1.6: Productivity of Wheat in Major Producing States of India

(In Quintals/Hectare)

Year	Haryana	Madhya Pradesh	Punjab	Uttar Pradesh	All India
1960-61	12.93	6.31	12.38	10.01	8.51
1965-66	13.17	5.54	12.37	9.12	8.27
1970-71	20.74	7.62	22.38	13.02	13.07
1975-76	19.80	8.19	23.73	13.57	14.10
1980-81	23.60	9.34	27.30	16.50	16.30
1985-86	30.94	11.34	35.31	20.00	20.46
1990-91	34.81	15.21	37.15	23.44	22.81
1995-96	36.97	16.58	38.84	24.45	24.83
2000-01	41.06	14.71	45.63	27.24	27.08
2005-06	38.44	16.13	41.79	26.27	26.19
2010-11	46.24	17.57	46.93	31.13	29.89
2011-12	50.30	23.60	48.98	31.13	31.77
2012-13	44.52	24.78	47.24	31.13	31.17
2013-14	47.22	24.05	50.17	30.38	31.45
2014-15	39.81	28.50	42.94	22.77	27.50
2015-16	44.07	29.93	45.83	26.36	30.34
2016-17	45.14	29.76	47.04	31.13	32.00
2017-18	44.12	29.93	50.77	32.69	33.68
CAGR	**2.47****	**2.80****	**2.30****	**2.40****	**2.44****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

4.1.7 Area under maize cultivation in major producing states of India

The Table 4.1.7 presents the area in lakh hectares under the cultivation of maize in major producing states of India for the period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the area under cultivation of maize has shown a CAGR of 1.02 per cent which was significant at 1 percent level for the study period of 1960-61 to 2017-18. Tamil Nadu stood first in growth of area under maize cultivation with the highest CAGR of 8.35 per cent followed by Karnataka and Maharashtra with the CAGR of around 7.93 and 7.58 per cent respectively. Madhya Pradesh state has shown growth of 1.09 per cent, which was significant. Bihar and Uttar Pradesh have shown a negative and significant growth of -0.77 per cent and -1.29 per cent respectively pointing to the decrease in area under maize in those states. Rajasthan state has shown a significant growth of 0.70 per cent. West Bengal has shown significant growth of 1.59 per cent. Andhra Pradesh and Telangana are the two states which have shown a non-significant growth of 0.84 per cent and 2.33 percent respectively.

4.1.8 Status of maize production in major producing states of India

The Table 4.1.8 presents the production of maize in lakh tonnes for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the production of maize has shown significant CAGR of around 3.13 per cent for the study period from 1960-61 to 2017-18. Tamil Nadu ranks first in growth of maize production with the highest CAGR of 10.96 per cent followed by Madhya Pradesh and Karnataka with the growth of 9.45 per cent and 8.98 per cent respectively. West Bengal has shown a growth of 5 per cent whereas Andhra Pradesh state has shown quite similar growth of 5.31 per cent for the study period. Bihar state has shown significant growth of 1.92 per cent while Rajasthan has shown almost similar growth of 2.13 per cent. Uttar Pradesh state has showed a relatively low CAGR of 0.58 per cent. Maharashtra has shown significant growth of 2.55 per cent .Telangana state being the only state with a non-significant growth rate, has the least CAGR of -1.38 per cent whereas CAGR for maize production of all other major producing states were significant at the 1 per cent level for the study period.

Table 4.1.7: Area under maize cultivation in major producing states of India

(In Lakh Hectares)

Year	AP	BR	KA	MP	MH	RJ	TN	TS	UP	WB	All India
1960-61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1965-66	2.13	8.33	0.15	5.24	0.33	6.89	0.04	0.00	11.79	0.51	47.98
1970-71	2.56	9.91	0.64	5.91	0.42	7.58	0.14	0.00	15.08	0.51	58.52
1975-76	3.05	9.36	1.78	6.49	0.61	6.86	0.25	0.00	13.96	0.53	60.31
1980-81	3.21	8.82	1.44	7.79	0.86	9.00	0.20	0.00	12.24	0.53	60.05
1985-86	2.89	6.70	1.67	8.39	0.77	9.75	0.16	0.00	12.00	0.56	57.97
1990-91	3.09	6.65	2.52	8.77	1.09	9.84	0.28	0.00	10.85	0.65	59.04
1995-96	3.33	7.18	3.65	8.57	2.32	9.11	0.47	0.00	10.90	0.45	59.79
2000-01	5.28	6.21	6.69	8.40	3.30	9.71	0.82	0.00	9.08	0.35	66.11
2005-06	7.58	6.49	9.36	8.62	4.73	10.04	2.03	0.00	8.14	0.51	75.88
2010-11	2.33	6.46	12.88	8.31	8.91	11.43	2.31	5.11	7.27	0.89	85.53
2011-12	2.73	6.75	13.49	8.63	8.81	10.39	2.81	5.91	7.45	0.98	878.12
2012-13	3.09	6.86	13.22	8.45	8.22	9.86	2.91	6.63	7.36	1.06	86.73
2013-14	3.56	7.32	13.77	8.68	10.01	9.27	3.45	6.70	7.67	1.29	90.66
2014-15	3.03	7.07	13.37	11.32	10.77	8.92	3.22	6.92	7.17	1.52	91.85
2015-16	2.33	7.05	12.20	10.98	10.67	8.73	3.55	5.73	7.04	1.54	88.06
2016-17	2.50	7.21	13.70	12.84	11.48	9.19	3.15	8.02	7.39	1.61	96.33
2017-18	3.36	6.77	13.07	13.53	10.64	8.70	3.25	6.30	7.24	2.36	93.80
CAGR	**0.84^{NS}**	**-0.77****	**7.93****	**1.09****	**7.58****	**0.70****	**8.35****	**2.33^{NS}**	**-1.29****	**1.59****	**1.02****

***Note**: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant*

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

Table 4.1.8: Maize production in major producing states of India

(In Lakh Tonnes)

Year	AP	BR	KA	MP	MH	RJ	TN	TS	UP	WB	All India
1960-61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1965-66	1.68	9.25	0.11	5.97	0.33	5.32	0.03	0.00	8.18	0.38	47.05
1970-71	3.44	11.13	2.05	6.27	0.42	9.30	0.15	0.00	17.96	0.48	74.86
1975-76	4.98	9.39	5.33	7.36	0.89	7.83	0.27	0.00	10.14	0.61	72.56
1980-81	7.25	8.70	3.71	7.13	1.52	7.86	0.21	0.00	8.94	0.56	69.57
1985-86	4.14	8.77	3.65	7.09	1.03	6.44	0.29	0.00	14.62	1.03	66.43
1990-91	6.46	10.38	6.37	12.37	1.35	13.03	0.44	0.00	14.32	0.82	89.62
1995-96	8.77	13.69	11.42	11.50	3.38	8.12	0.75	0.00	14.98	1.07	95.34
2000-01	15.81	14.97	21.36	12.18	3.03	10.16	1.40	0.00	14.73	0.88	120.43
2005-06	30.87	13.61	27.28	12.49	9.96	11.02	2.41	0.00	10.54	1.28	147.10
2010-11	18.85	14.40	44.44	10.52	26.02	20.53	10.28	20.71	11.36	3.52	217.26
2011-12	17.65	16.11	40.85	12.87	24.33	16.67	16.96	18.93	12.32	3.64	217.59
2012-13	19.11	24.76	34.75	15.14	18.24	17.55	9.46	29.44	12.35	4.17	222.58
2013-14	20.87	21.12	39.85	15.34	27.29	15.02	18.55	27.75	13.06	5.22	242.60
2014-15	19.38	23.41	42.14	21.28	22.02	15.51	20.68	23.08	12.79	6.63	241.73
2015-16	14.11	25.17	33.10	25.80	18.27	11.64	24.89	17.51	13.06	7.15	225.67
2016-17	16.53	26.90	33.14	33.41	34.53	13.79	9.53	26.63	15.25	7.05	259.00
2017-18	23.22	23.55	38.54	35.37	30.51	17.94	25.92	25.56	15.98	11.35	287.53
CAGR	**5.31****	**1.92****	**8.98****	**9.45****	**2.55****	**2.13****	**10.96****	**-1.38**^{NS}	**0.58****	**5.0****	**3.13****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

AP: Andhra Pradesh, BR: Bihar, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TN: Tamil Nadu, TS: Telangana State, UP: Uttar Pradesh, WB: West Bengal.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

4.1.9 Status of maize productivity in major producing states of India

The Table 4.1.9 presents the productivity of maize in quintals per hectare for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the productivity of maize has showed a significant CAGR of around 2.08 per cent for the study period from 1960-61 to 2017-18 indicating a consistent improvement in maize yield over the years. Andhra Pradesh state with a CAGR of 3.89 per cent ranked first in growth of maize productivity followed by West Bengal and Bihar. Uttar Pradesh has shown a growth of 1.89 per cent while Maharashtra has shown a similar CAGR of 1.84 per cent. Madhya Pradesh and Karnataka have shown quite similar CAGR of 1.07 and 1.18 per cent respectively. Tamil Nadu state has shown a CAGR of 2.97 per cent. The CAGR of Rajasthan was found to be 1.40 percent .The CAGR for all the major producing states were found to be significant at 1 per cent level except the Telangana state with a negative CAGR of -3.57 which is significant at 5 percent level.

4.1.10 Area under jower cultivation in major producing states of India

Table 4.1.10 presents the area in lakh hectares under the cultivation of jower in major producing states of India for the period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the area under the cultivation of jower crop has shown a CAGR of -2.14 per cent as the area has significantly decreased over the years for the period from 1960-61 to 2017-18. The highest CAGR of -1.14 per cent for the area under jower cultivation was shown by Maharashtra state which was significant followed by Rajasthan which showed a significant growth of -1.30 per cent while the lowest CAGR of -5.48 per cent was shown by the state of Andhra Pradesh, which was significant. Karnataka, Tamil Nadu, Uttar Pradesh, Madhya Pradesh and Gujarat states have showed a CAGR of -1.56 per cent, -2.27 per cent, -3.21 per cent, -4.08 per cent and -5.35 per cent respectively which were significant for the period from 1960-61 to 2017-18. All the major producing states have shown a negative growth indicating the consistent decrease of the area under jower cultivation, which was significant at the 1 percent level, for the period from 1960-61 to 2017-18.

4.1.11 Status of production of jower in major producing states of India

Table 4.1.11 presents the production of jower in lakh tonnes for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

Table 4.1.9: Productivity of maize in major producing states of India

(In Quintals/Hectare)

Year	AP	BR	KA	MP	MH	RJ	TN	TS	UP	WB	All India
1960-61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1965-66	7.92	11.11	7.27	11.66	9.62	7.77	10.99	0.00	6.79	7.35	9.81
1970-71	13.44	8.34	32.26	10.62	9.98	12.26	11.01	0.00	11.91	9.43	12.79
1975-76	16.36	10.04	30.02	10.51	14.49	11.40	11.40	0.00	7.27	11.50	12.03
1980-81	22.63	9.85	25.84	9.16	17.75	8.72	10.71	0.00	7.31	10.57	11.59
1985-86	14.33	13.10	21.87	8.44	13.36	6.61	18.58	0.00	12.18	18.37	11.46
1990-91	20.87	15.61	25.25	14.10	12.44	13.25	15.93	0.00	13.20	12.63	15.18
1995-96	26.32	19.08	31.29	13.42	14.55	8.91	16.00	0.00	13.74	23.76	15.95
2000-01	29.94	24.13	31.93	14.49	9.20	10.47	17.17	0.00	16.22	25.01	18.22
2005-06	40.73	20.98	29.15	14.50	21.06	10.98	11.89	0.00	12.95	25.33	19.38
2010-11	80.90	22.30	34.50	12.66	29.20	17.94	44.58	40.53	15.01	39.77	25.40
2011-12	64.64	23.86	30.28	14.92	27.62	15.94	60.42	32.04	14.64	37.22	24.78
2012-13	61.84	36.11	26.29	17.90	22.19	17.80	32.52	44.40	16.77	39.47	25.66
2013-14	62.18	28.84	28.94	17.67	27.27	16.21	53.72	41.40	17.03	40.59	26.76
2014-15	63.96	33.13	31.52	18.80	20.45	17.40	64.23	33.35	17.84	43.50	26.32
2015-16	60.56	35.71	27.13	23.50	17.12	13.34	70.10	30.56	18.55	46.54	25.63
2016-17	66.12	37.32	24.19	26.02	30.09	15.01	30.26	33.21	20.64	43.67	26.89
2017-18	69.12	34.76	29.48	26.15	28.68	20.63	79.86	40.57	22.08	48.05	30.65
CAGR	**3.89****	**2.55****	**1.07****	**1.18****	**1.84****	**1.40****	**2.97****	**-3.57***	**1.89****	**3.59****	**2.08****

Note: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant

AP: Andhra Pradesh, BR: Bihar, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TN: Tamil Nadu, TS: Telangana State, UP: Uttar Pradesh, WB: West Bengal.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

Table 4.1.10: Area under jower cultivation in major producing states of India

(In Lakh Hectares)

Year	AP	GJ	KA	MP	MH	RJ	TN	UP	A. India
1960-61	26.92	13.15	29.69	21.12	62.84	10.28	7.74	8.94	184.12
1965-66	24.53	12.92	28.78	20.68	60.57	10.27	7.59	8.58	176.79
1970-71	25.67	13.34	25.94	21.78	57.84	11.79	7.49	7.34	173.74
1975-76	23.95	10.94	20.16	19.81	61.52	7.13	8.17	7.10	160.92
1980-81	20.54	9.06	16.48	23.52	64.38	10.02	5.37	6.78	158.09
1985-86	17.88	8.94	23.18	19.60	66.26	9.83	7.29	6.30	160.97
1990-91	11.90	8.53	21.55	16.48	63.31	9.31	5.41	5.27	143.57
1995-96	8.88	3.25	19.76	9.94	55.57	5.94	3.83	4.41	113.26
2000-01	6.77	1.63	17.82	6.38	50.94	6.74	3.31	3.47	98.56
2005-06	4.44	1.30	15.20	5.77	47.50	5.89	3.16	2.27	86.67
2010-11	0.88	1.25	12.43	4.32	40.60	7.27	2.44	2.01	73.82
2011-12	1.48	1.24	11.42	3.95	32.79	5.54	1.98	1.92	62.45
2012-13	1.65	0.80	12.63	2.86	31.62	6.80	1.94	1.84	62.14
2013-14	1.18	1.28	11.39	2.55	28.62	5.80	3.47	1.65	57.93
2014-15	1.42	1.45	10.47	2.20	32.88	6.61	3.48	1.64	61.61
2015-16	1.74	1.03	11.04	2.05	32.18	6.31	3.39	1.55	60.77
2016-17	0.97	1.06	9.48	2.20	30.51	5.79	2.68	1.83	56.24
2017-18	1.40	0.91	10.88	2.70	22.31	5.16	3.86	1.69	50.24
CAGR	**-5.48****	**-5.35****	**-1.56****	**-4.08****	**-1.14****	**-1.30****	**-2.27****	**-3.21****	**-2.14****

***Note**: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant*

AP: Andhra Pradesh, BR: Bihar, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TN: Tamil Nadu, TS: Telangana State, UP: Uttar Pradesh, WB: West Bengal.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

Table 4.1.11: Jower production of in major producing States of India

(In Lakh Tonnes)

Year	AP	GJ	KA	MP	MH	RJ	TN	UP	A. India
1960-61	13.34	2.22	11.54	14.83	42.24	2.94	5.46	4.95	98.14
1965-66	10.16	3.38	13.10	13.16	22.95	2.92	5.13	4.51	75.81
1970-71	9.67	4.97	20.24	13.36	15.91	5.73	5.47	4.86	81.05
1975-76	10.20	5.54	16.95	13.49	34.55	1.90	7.16	4.62	95.04
1980-81	10.82	5.83	12.69	18.14	44.28	3.38	4.26	4.06	104.31
1985-86	11.62	3.55	14.74	17.73	39.23	3.75	6.42	4.20	101.97
1990-91	8.51	3.79	13.53	14.90	59.48	5.18	5.49	4.93	116.81
1995-96	6.49	2.33	17.18	8.44	49.40	1.39	3.30	4.18	93.27
2000-01	6.34	1.69	13.72	5.80	39.10	2.54	2.75	3.09	75.57
2005-06	5.88	1.48	16.65	6.28	39.04	1.70	2.31	2.42	76.30
2010-11	1.56	1.39	14.67	6.16	34.52	5.09	2.47	2.07	70.03
2011-12	3.07	1.39	11.66	6.15	26.93	4.10	2.53	2.13	59.79
2012-13	3.46	1.07	13.15	5.75	19.35	4.20	1.65	2.48	52.82
2013-14	2.66	1.75	13.17	3.73	22.67	3.57	4.50	1.73	55.42
2014-15	2.86	1.96	11.74	3.77	21.09	5.05	5.13	1.63	54.45
2015-16	3.57	1.38	9.55	4.00	13.52	3.44	4.68	1.05	42.38
2016-17	1.98	1.50	8.46	3.79	21.70	3.50	1.54	1.83	45.68
2017-18	3.00	1.25	11.40	5.70	16.07	3.01	4.31	2.15	48.03
CAGR	**-2.99****	**-2.40****	**-0.36****	**-2.51****	**-0.13^{NS}**	**-0.23^{NS}**	**-1.65****	**-1.88****	**-0.95****

***Note**: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant*

AP: Andhra Pradesh, GJ: Gujarat, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TN: Tamil Nadu, UP: Uttar Pradesh.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

At the national level, the production of jower has shown a significant and negative CAGR of around -0.95 per cent for the study period from 1960-61 to 2017-18 indicating a consistent reduction in jower production over the years. Karnataka state has shown negative growth of - 0.36 per cent. The least negative CAGR of -0.13 was shown by Maharashtra which was non-significant followed by Rajasthan with a non-significant CAGR of -0.23 per cent. The states which showed CAGR significant at the 1 per cent level were Karnataka with a growth rate of -0.36 per cent, Tamil Nadu with a growth rate of -1.65 per cent, Uttar Pradesh with a growth rate of -1.88 per cent, Gujarat with a growth rate of -2.40 per cent, Madhya Pradesh with a growth rate of -2.51 per cent, and Andhra Pradesh with the highest negative growth rate of -2.99 per cent indicating a major reduction in the production of maize in the state for the study period.

4.1.12 Status of jower productivity in major producing states of India

Table 4.1.12 presents the productivity of jower in quintals per hectare for the major producing states of India for the study period from 1960-61 to 2017-18. Compound annual growth rates for the same has been presented in the table.

At the national level, the productivity of jower has shown a significant CAGR of around 1.22 per cent for the study period from 1960-61 to 2017-18 indicating a gradual improvement in the yield of jower over the years. The state with the highest CAGR of 3.11 per cent was Gujarat followed by Andhra Pradesh with a CAGR of 2.69 per cent, Madhya Pradesh with a CAGR of 1.63 per cent, Uttar Pradesh with a CAGR of 1.38 per cent, Karnataka with a CAGR of 1.22 per cent, Rajasthan with a CAGR of 1.08 per cent, and Maharashtra with CAGR of 1.04 per cent. Tamil Nadu state has shown the lowest CAGR of 0.66 per cent for the study period. The CAGR of all the major producing states were found to be significant at the 1 per cent level for the study period from 1960-61 to 2017-18.

Table 4.1.12: Productivity of jower in major producing states of India

(In Quintals /Hectare)

Year	AP	GJ	KA	MP	MH	RJ	TN	UP	All India
1960-61	4.95	1.69	3.88	7.01	6.72	2.86	7.06	5.53	5.33
1965-66	4.14	2.62	4.55	6.36	3.79	2.84	6.75	5.25	4.29
1970-71	3.77	3.73	7.80	6.14	2.75	4.86	7.30	6.62	4.66
1975-76	4.26	5.06	8.41	6.81	5.62	2.66	8.76	6.51	5.91
1980-81	5.27	6.44	7.70	7.72	6.88	3.37	7.93	5.99	6.60
1985-86	6.50	3.97	6.36	9.05	5.92	3.81	8.80	6.66	6.33
1990-91	7.15	4.44	6.28	9.04	9.39	5.57	10.14	9.36	8.14
1995-96	7.31	7.19	8.69	8.49	8.89	2.35	8.60	9.48	8.23
2000-01	9.14	6.01	8.68	7.22	7.83	2.00	9.24	9.48	7.64
2005-06	13.24	11.38	10.95	10.88	8.24	2.88	7.32	10.65	8.80
2010-11	17.84	11.12	11.80	14.26	8.50	7.00	10.14	10.30	9.49
2011-12	20.71	11.21	10.21	15.58	8.21	7.41	12.77	11.09	9.57
2012-13	20.98	13.38	10.41	20.11	6.12	6.18	8.51	13.48	8.50
2013-14	22.55	13.67	11.56	14.66	7.92	6.15	12.95	10.49	9.57
2014-15	20.15	13.50	11.21	17.14	6.41	7.63	14.75	9.94	8.84
2015-16	20.52	13.40	8.65	19.51	4.20	5.45	13.80	6.77	6.97
2016-17	20.41	14.15	8.92	17.21	7.11	6.03	5.73	10.00	8.12
2017-18	21.46	13.74	10.48	21.12	7.20	5.83	11.17	12.70	9.56
CAGR	**2.69****	**3.11****	**1.22****	**1.63****	**1.04****	**1.08****	**0.66****	**1.38****	**1.22****

***Note**: ** Significant at 1 per cent level, * Significant at 5 per cent level, NS=Non-significant*

AP: Andhra Pradesh, GJ: Gujarat, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TN: Tamil Nadu, UP: Uttar Pradesh.

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

Section II: Quantum of cereals procured and the availability of storage facilities in India

This section deals with the quantum of cereals procured and the share of different states in the total procurement of cereals (rice, wheat and coarse grains) in India. The data on procurement of rice, wheat and coarse grains for the period from 2000-01 to 2018-19, were collected for the major states and per cent share of different states were computed and presented in the subsections mentioned below. The procurement as a percentage of production for the major producing states and the per cent shares of agencies in total procurement have also been presented in this section

4.2.1 Quantum of rice procured in India

The Table 4.2.1 presents the quantum of rice procured in lakh tonnes for the major procuring states of India for the period from 2000-01 to 2018-19.

At all India level, total rice procurement has more than doubled over the years from 212.80 lakh tonnes in 2000-01 to 443.9 lakh tonnes in 2018-19. The perusal of the table 4.2.1 revealed that the quantity of rice procured in Odisha was only 9.16 lakh tonnes in 2000-01 which increased to more than four times i.e., 44.48 lakh tonnes in the year 2018-19.The quantity of rice procured in Punjab state increased to 113.34 lakh tonnes in 2018-19 from 69.64 lakh tonnes in 2000-01. In the state of Haryana, rice procured during 2000-01 was 14.84 lakh tones which increased to 39.42b lakh tones in 2018-19. The procurement of rice in Uttar Pradesh showed an increase of more than 2 times, in Madhya Pradesh it showed an increase of around 7 times while in West Bengal it showed an increase of more than 4 times in the year 2018-19 than the procurement quantity in 2000-01.The quantum of rice procured in Bihar increased from 0.19 lakh tonnes in 2000-01 to 9.49 lakh tonnes in 2018-19.The quantity of rice produced in Andhra Pradesh and Tamil Nadu during 2000-01 was 71.74 and 16.94 lakh tonnes, respectively, which decreased to 48.06 and 10.11 lakh tonnes respectively in 2018-19, as can be seen clearly in the Fig. 4.2.1.

The quantity of rice procurement for different sates during the two periods 2000-01 and 2018-19 depicted in the Fig. 4.2.1. It can be clearly seen that the rice procurement decreased in the states of Andhra Pradesh and Tamil Nadu (TN) while it has increased over time in all the other states.

Table 4.2.1: State-wise procurement of rice in India

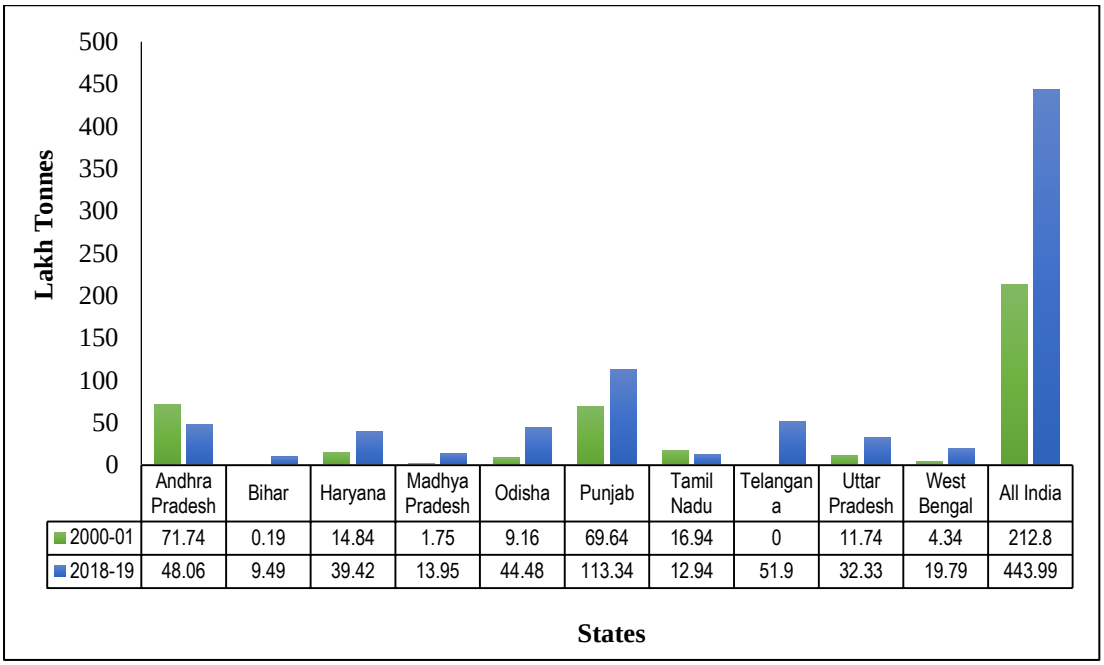
(In Lakh Tonnes)

Year	AP	BR	HR	MP	OD	PB	TN	TS	UP	WB	All India
2000-01	71.74	0.19	14.84	1.75	9.16	69.64	16.94	NA	11.74	4.34	212.80
2005-06	49.71	5.24	20.54	1.36	17.85	88.55	9.26	NA	31.51	12.75	276.56
2010-11	96.09	8.83	16.87	5.16	24.65	86.34	15.43	NA	25.54	13.10	341.98
2011-12	75.42	15.34	20.70	6.35	28.66	77.31	15.96	NA	33.57	20.41	350.41
2012-13	64.86	13.03	26.09	8.97	36.14	85.57	4.81	NA	22.85	17.65	340.36
2013-14	37.37	9.42	24.06	10.45	28.01	81.06	6.84	43.53	11.27	13.59	318.45
2014-15	35.96	16.14	20.15	8.07	33.57	77.86	10.51	35.04	16.98	20.32	320.40
2015-16	43.36	12.25	28.61	8.49	33.69	93.50	11.92	15.79	29.10	15.68	342.18
2016-17	37.24	12.34	35.83	13.14	36.30	110.52	1.44	35.96	23.54	19.23	381.06
2017-18	40.00	7.93	39.92	10.96	32.87	118.33	10.11	36.18	28.75	16.73	381.85
2018-19	48.06	9.49	39.42	13.95	44.48	113.34	12.94	51.90	32.33	19.79	443.99

***Note**: NA-Not Available*

AP: Andhra Pradesh, BR: Bihar, HR: Haryana, MP: Madhya Pradesh, OD: Odisha PB: Punjab, TN: Tamil Nadu, TN: Telangana State, UP: Uttar Pradesh, WB: West Bengal.

***Source**: Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*



	Andhra Pradesh	Bihar	Haryana	Madhya Pradesh	Odisha	Punjab	Tamil Nadu	Telangana	Uttar Pradesh	West Bengal	All India
2000-01	71.74	0.19	14.84	1.75	9.16	69.64	16.94	0	11.74	4.34	212.8
2018-19	48.06	9.49	39.42	13.95	44.48	113.34	12.94	51.9	32.33	19.79	443.99

Fig 4.2.1: Quantum of rice procured in different states of India, 2000-01 and 2018-19

4.2.2 Procurement of rice as a percentage of production in major producing states of India

Table 4.2.2 presents the procurement of rice as percentage of production in the major wheat-producing states for the period from 2000-01 to 2017-18.

Table 4.2.2: Procurement of rice as a percentage of production in major producing states of India (%)

Year	Andhra Pradesh	Punjab	Uttar Pradesh	West Bengal	All India
2000-01	57.59	76.08	10.05	3.49	23.73
2005-06	42.47	86.87	28.3	8.79	30.13
2010-11	66.65	79.67	21.3	10.04	35.63
2011-12	58.49	73.34	23.94	13.97	33.28
2012-13	56.35	75.23	15.85	11.75	32.34
2013-14	53.62	71.94	7.70	8.84	29.86
2014-15	49.71	70.10	13.95	13.84	30.37
2015-16	57.90	79.08	23.28	9.83	32.77
2016-17	49.97	95.39	17.12	12.57	34.74
2017-18	48.98	88.43	21.66	10.51	33.86

***Source**: Ministry of Agriculture and Farmers Welfare, Govt. of India.*

The procurement of rice as a percentage of production increased over the years at the national level from 23.73 per cent in 2000-01 to 33.86 per cent in 2018-19.The procurement of rice as a percentage of production was highest in Punjab which stood at 88.43 per cent

during 2018-19. In all the states except Andhra Pradesh, procurement of rice as percentage of production increased over the years. In Andhra Pradesh it has increased from 57.72 per cent in to 66.65 per cent in 2010-11 but, later decreased to 48.9 per cent in 2018-19, which can be clearly seen in the Fig. 4.2.2.

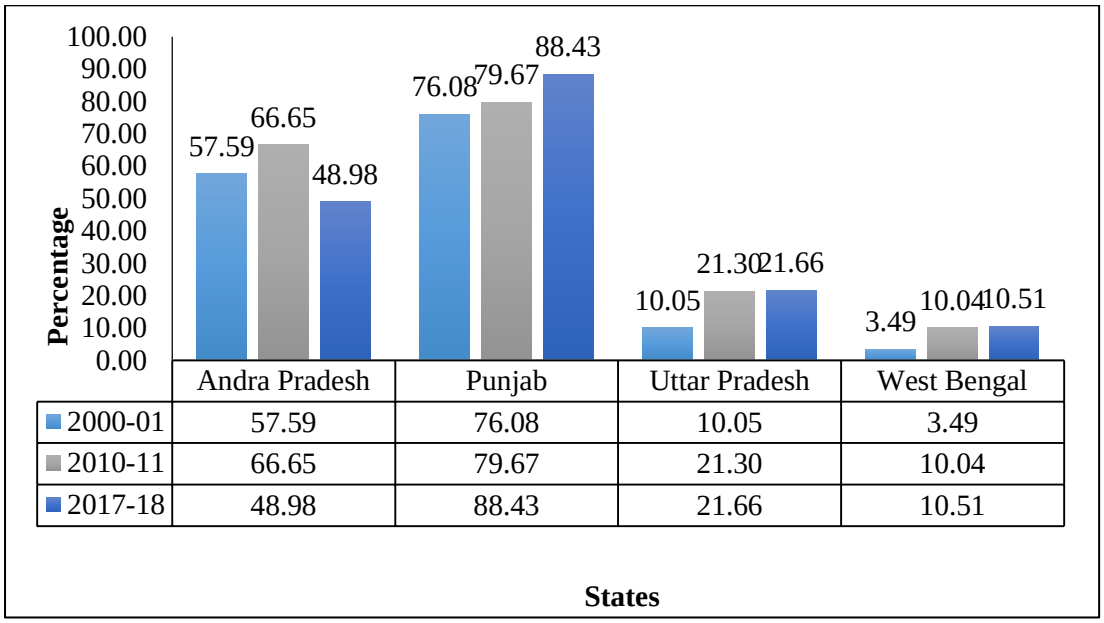


Fig 4.2.2: Procurement of rice as percentage of production in major producing states of India

4.2.3 State-wise share of rice procurement in India

The Table 4.2.3 presents the state-wise share in total rice procurement in India for the period from 2000-01 to 2018-19.

Andhra Pradesh state has the highest share of 33.71 per cent in rice procurement followed by Punjab with a share of 32.73 per cent during 2000-01. For the period 2018-19, the scenario has changed, the highest share in total rice procurement was held by Punjab state with 25.53 per cent procurement followed by Telangana and Andhra Pradesh with the share of 11.69 per cent and 10.82 per cent respectively.

The share of Haryana state has increased from 6.97 per cent in 2000-01 to 8.88 per cent in 2018-19 whereas Telangana state contributed a share of 11.69 per cent during the year 2018-19.

The share of different states in the total rice procurement for the year 2000-01 can clearly be seen from the Fig. 4.2.3(a). Andhra Pradesh showed the highest share of 33.71 per cent followed by Punjab with a share of 32 .73 per cent, Tamil Nadu with a share of 7.96 per cent, Haryana with a share of 6.97 per cent, Uttar Pradesh with a share of 5.52 per cent. Other states were having a share less than 5 per cent during the year.

Table 4.2.3: State-wise share of rice procurement In India (%)

Years	AP	BR	HR	MP	OD	PB	TN	TS	UP	WB	Others
2000-01	33.71	0.09	6.97	0.82	4.30	32.73	7.96	0.00	5.52	2.04	5.86
2005-06	17.97	1.89	7.43	0.49	6.45	32.02	3.35	0.00	11.39	4.61	14.39
2010-11	28.10	2.58	4.93	1.51	7.21	25.25	4.51	0.00	7.47	3.83	14.61
2011-12	21.52	4.38	5.91	1.81	8.18	22.06	4.55	0.00	9.58	5.82	16.18
2012-13	19.06	3.83	7.67	2.64	10.62	25.14	1.41	0.00	6.71	5.19	17.74
2013-14	11.73	2.96	7.56	3.28	8.80	25.45	2.15	13.67	3.54	4.27	16.60
2014-15	11.22	5.04	6.29	2.52	10.48	24.30	3.28	10.94	5.30	6.34	14.29
2015-16	12.67	3.58	8.36	2.48	9.85	27.32	3.48	4.61	8.50	4.58	14.55
2016-17	9.77	3.24	9.40	3.45	9.53	29.00	0.38	9.44	6.18	5.05	14.57
2017-18	10.48	2.08	10.45	2.87	8.61	30.99	2.65	9.47	7.53	4.38	10.49
2018-19	10.82	2.14	8.88	3.14	10.02	25.53	2.91	11.69	7.28	4.46	13.13

***Note**: AP: Andhra Pradesh, BR: Bihar, HR: Haryana, MP: Madhya Pradesh, OD: Odisha PB: Punjab, TN: Tamil Nadu, TN: Telangana State, UP: Uttar Pradesh, WB: West Bengal.*

***Source:** Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*

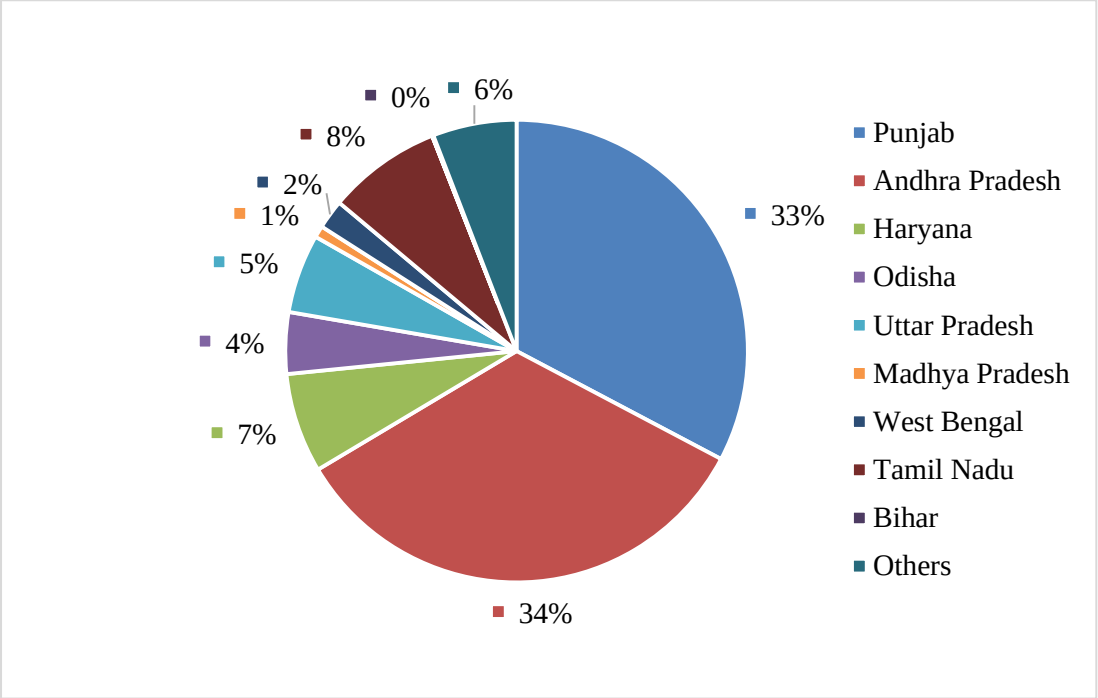


Fig 4.2.3 (a): State-wise share of rice procurement in India for the year 2000-01.

Fig. 4.2.3(b) reflected the state-wise share in total rice procurement for the year 2010-11.The highest share in total rice procurement was still held by Andhra Pradesh with a share of 28.1 per cent followed by Punjab with a share of 25.25 per cent. Uttar Pradesh with a share of 7.47 per cent stands at third position while Odisha state stands at fourth position with an increased share of 7.21 per cent. Share of Haryana state has gone below 5 percent (4.93 per cent) while other states altogether have a share of 14.6 per cent.

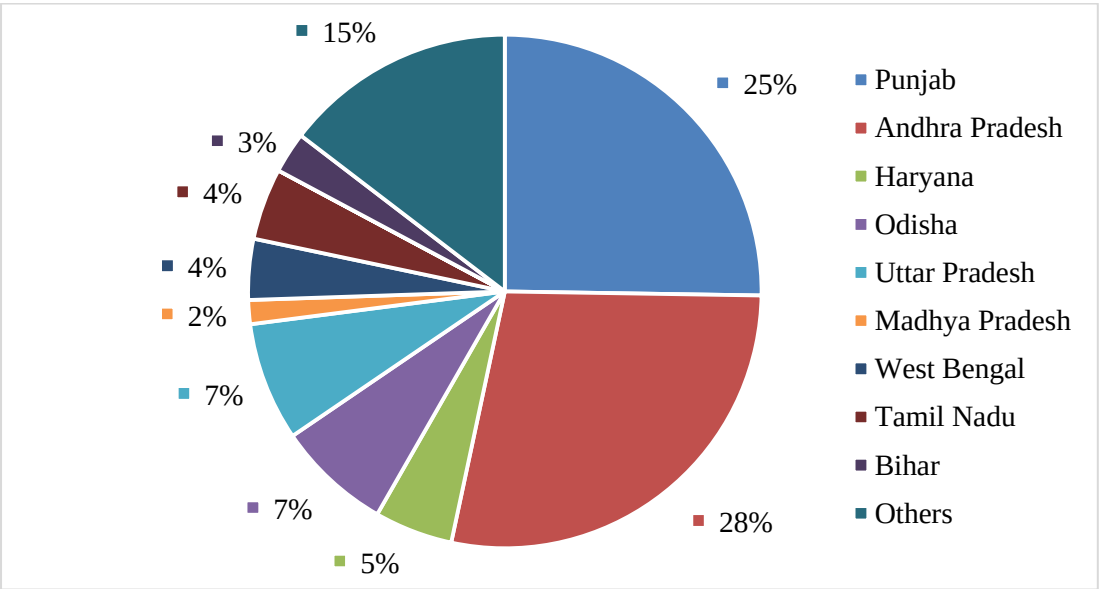


Fig 4.2.3(b): State-wise share of rice procurement India, 2010-11

The perusal of the Fig. 4.2.3(c) revealed that the state-wise share in total rice procurement for the year 2018-19. Punjab occupied the first position with the highest share of 25.53 per cent followed by Telangana with a share of 11.69 per cent. The share of Andhra Pradesh further decreased to 10.82 per cent. The Odisha state increased its share to 10.2 percent which was almost similar to that of Andhra Pradesh. Share of Haryana improved to 8.88 percent while the share of Uttar Pradesh stood at 7.28 per cent. The share of other states altogether was around 13 per cent with each state having a share below 5 per cent for the year. The decline in the share of Andhra Pradesh can mostly be attributed to the division of state which took place in 2013-14 and partly to the decreased area under rice cultivation in the state.

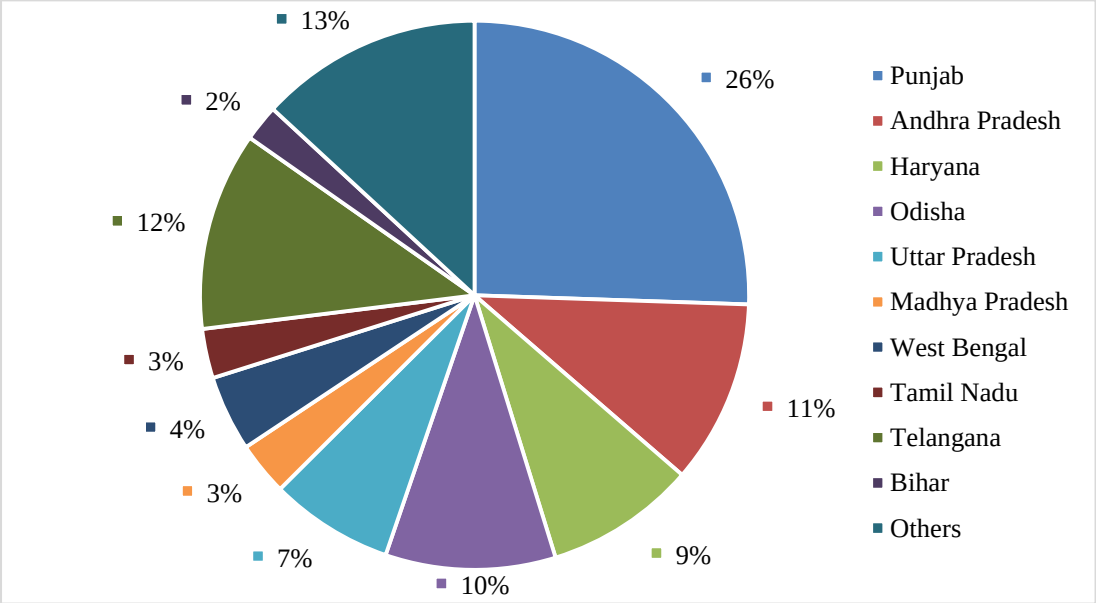


Fig 4.2.3(c): State-wise share of rice procurement in India, 2018-19.

4.2.4: Quantum of wheat procured in the states of India

The Table 4.2.4 presents the quantum of wheat procured in lakh tonnes for the major procurement states of India for the period of 2000-01 to 2018-19.

At all India level, quantum of wheat procured has doubled from 163.55 lakh tonnes in 2000-01 to 357.95 tonnes in 2018-19. Quantum of wheat procured has increased sharply from 3.51 lakh tonnes in 2000-01 to 73.13 lakh tonnes in 2018-19 in Madhya Pradesh. The quantity of wheat procured in Haryana state has almost doubled from 44.97 lakh tonnes in 2000-01 to 87.84 lakh tonnes in 2018-19. Rajasthan has almost tripled its quantity of wheat procured from 5.39 lakh tonnes in 2000-01 to 12.45 lakh tonnes in 2018-19. Wheat procurement in Punjab increased from 94.23 lakh tonnes in 2000-01 to 106.49 lakh tonnes in 2018-19. Uttar Pradesh state has increased its quantity of wheat procured from 15.45 lakh tonnes in 2000-10 to 59.54 lakh tonnes in 2018-19.

Table 4.2.4: State-wise procurement of wheat in India

(In Lakh Tonnes)

Year	Haryana	Madhya Pradesh	Punjab	Rajasthan	Uttar Pradesh	All India
2000-01	44.97	3.51	94.23	5.39	15.45	163.55
2005-06	45.29	4.84	90.10	1.59	5.60	147.87
2010-11	63.48	35.39	102.09	4.76	16.46	225.14
2011-12	68.93	49.65	109.58	13.03	34.61	283.35
2012-13	86.56	84.93	128.35	19.64	50.63	381.48
2013-14	58.73	63.55	108.98	12.68	6.83	250.92
2014-15	64.95	70.94	116.41	21.59	6.28	280.23
2015-16	67.78	73.09	103.44	13.00	22.67	280.88
2016-17	67.52	39.92	106.49	7.62	7.97	229.62
2017-18	74.32	67.25	117.06	12.45	36.99	308.25
2018-19	87.84	73.13	126.92	15.32	52.94	357.95

***Source**: Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*

Fig. 4.2.4 presented the quantity of wheat procurement for different sates during the two period 2000-01 and 2018-19.It can be clearly seen that the wheat procurement in Madhya Pradesh rapidly increased while compared to other states. Though Uttar Pradesh is the leading producer of wheat, procurement has not increased as sharply as it has in Madhya Pradesh. Quantum of wheat procured in Haryana, Rajasthan and Uttar Pradesh has increased more than two folds except Punjab.

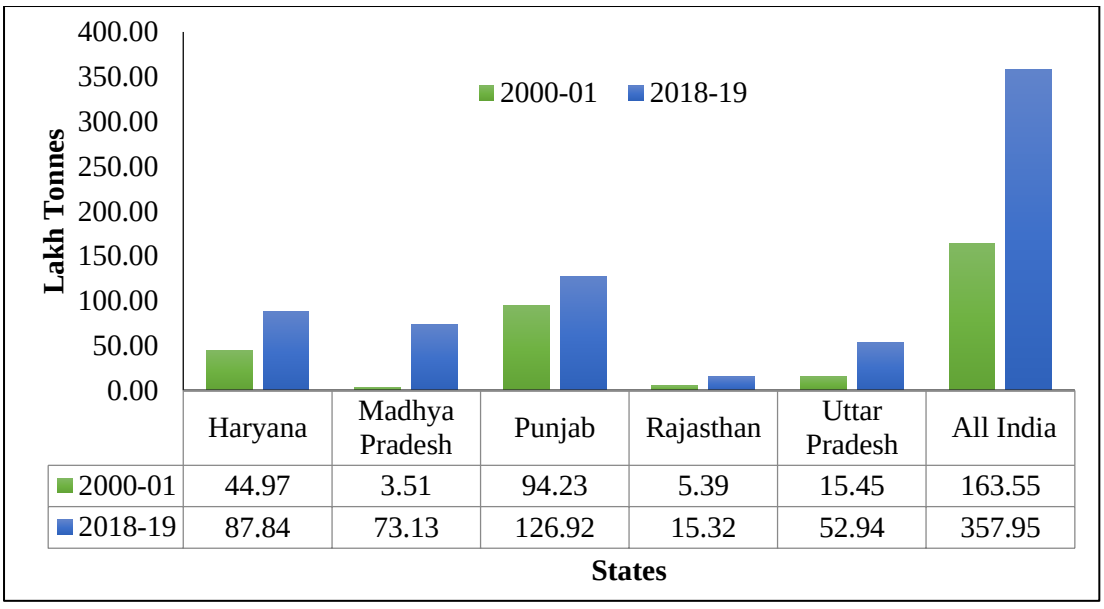


Fig. 4.2.4: Quantum of wheat procurement in different states of India, 2000-01 and 2018-19

4.2.5 Procurement of wheat as a percentage of production in major producing states of India

The Table 4.2.5 presents the procurement of wheat as a percentage of production for the major wheat producing states for the period from 2000-01 to 2017-18.

Table 4.2.5: Procurement of wheat as a percentage of production in major producing states of India (%)

Year	Haryana	Madhya Pradesh	Punjab	Uttar Pradesh	All India
2000-01	46.51	7.21	60.59	6.14	23.47
2005-06	51.12	8.12	62.18	2.33	21.32
2010-11	54.58	46.40	61.98	5.49	25.92
2011-12	54.34	43.03	63.41	11.43	29.86
2012-13	77.86	64.67	77.36	16.71	40.80
2013-14	49.77	49.12	61.85	2.28	26.18
2014-15	62.73	41.48	77.35	2.80	32.39
2015-16	59.71	41.32	64.34	8.92	30.44
2016-17	58.48	22.25	64.77	2.65	23.31
2017-18	69.04	42.27	65.65	11.60	30.87

***Source**: Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*

The procurement of wheat as percentage of production has increased over the years at the national level from 23.47 per cent in 2000-01 to 30.87 per cent in 2018-19. It has increased in all the states. The procurement of wheat as a percentage of production found to be the highest in Punjab with a share of 65.6 per cent for the year 2017-18. The procurement of wheat as a percentage of production increased in Madhya Pradesh sharply in the recent years which can be clearly noted in the Fig. 4.2.5.

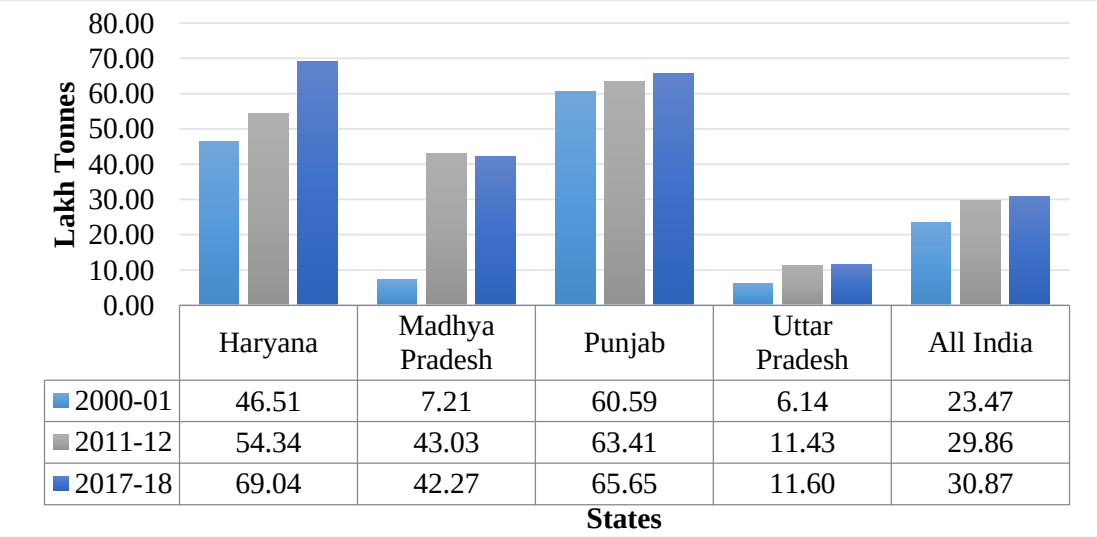


Fig 4.2.5: Procurement of wheat as percentage of production in major producing states of India

4.2.6: State-wise share of wheat procurement in India

The Table 4.2.6 presents the state-wise share in the procurement of wheat in India for the period from 2000-01 to 2018-19.

For the year 2000-01, Punjab state occupied the highest share of 57.62 per cent in wheat procurement followed by Haryana with a share of 27.50 per cent and Madhya Pradesh has the share of only 2.15 per cent. For the year 2018-19, the scenario has changed, the share of Madhya Pradesh has increased to 20.43 per cent while the share of Punjab and Haryana has decreased to 35.46 and 24.54 per cent respectively. The share of Uttar Pradesh and Rajasthan has increased to 14.79 and 4.28 per cent respectively.

Table 4.2.6: State-wise share in procurement of wheat in India (%)

Year	Haryana	Madhya Pradesh	Punjab	Rajasthan	Uttar Pradesh	Others
2000-01	27.50	2.15	57.62	3.30	9.45	0.00
2005-06	30.63	3.27	60.93	1.08	3.79	0.30
2010-11	28.20	15.72	45.35	2.11	7.31	1.31
2011-12	24.33	17.52	38.67	4.60	12.21	2.66
2012-13	22.69	22.26	33.65	5.15	13.27	2.98
2013-14	23.41	25.33	43.43	5.05	2.72	0.06
2014-15	23.18	25.31	41.54	7.70	2.24	0.02
2015-16	24.13	26.02	36.83	4.63	8.07	0.32
2016-17	29.41	17.39	46.38	3.32	3.47	0.04
2017-18	24.11	21.82	37.98	4.04	12.00	0.06
2018-19	24.54	20.43	35.46	4.28	14.79	0.50

Source: *Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*

Fig. 4.2.6(a) revealed the state-wise share in wheat procurement for the year 2000-01. Punjab state held the highest share of 57.62 per cent followed by Haryana with a share of 27.5 per cent. Uttar Pradesh and Madhya Pradesh has a share less than 5 per cent i.e., of 3.3 per cent and 2.15 per cent respectively. Other states were not having any share during the year. It is important to notice here that though Uttar Pradesh is the leading producer of wheat and Madhya Pradesh being high in production compared to that of Haryana, their contribution to the procurement was below 5 per cent.

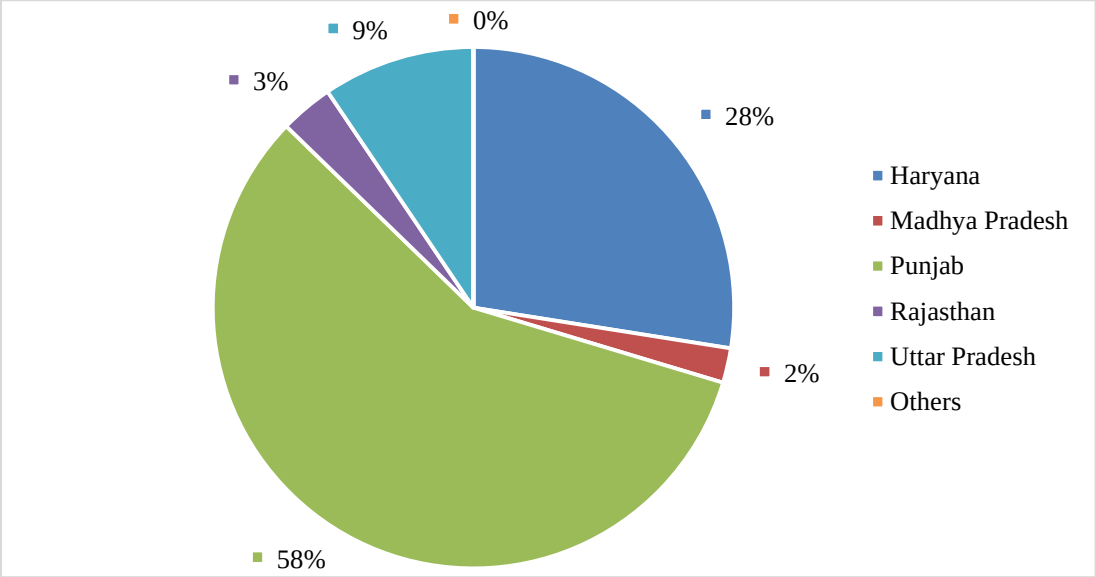


Fig 4.2.6(a): State-wise share of wheat procurement in India, 2000-01.

Fig. 4.2.4(b) presented the state-wise share in wheat procurement for the year 2010-11. Punjab state continued to hold the highest share of 45.35 per cent followed by Haryana with a share of 28.2 per cent. The share of Madhya Pradesh sharply increased to 15.72 per cent whereas Uttar Pradesh's share increased to 7.31 per cent. Rajasthan had a share less than 5 per cent i.e., 2.11 per cent. Other states altogether had a share of 1.31 per cent.

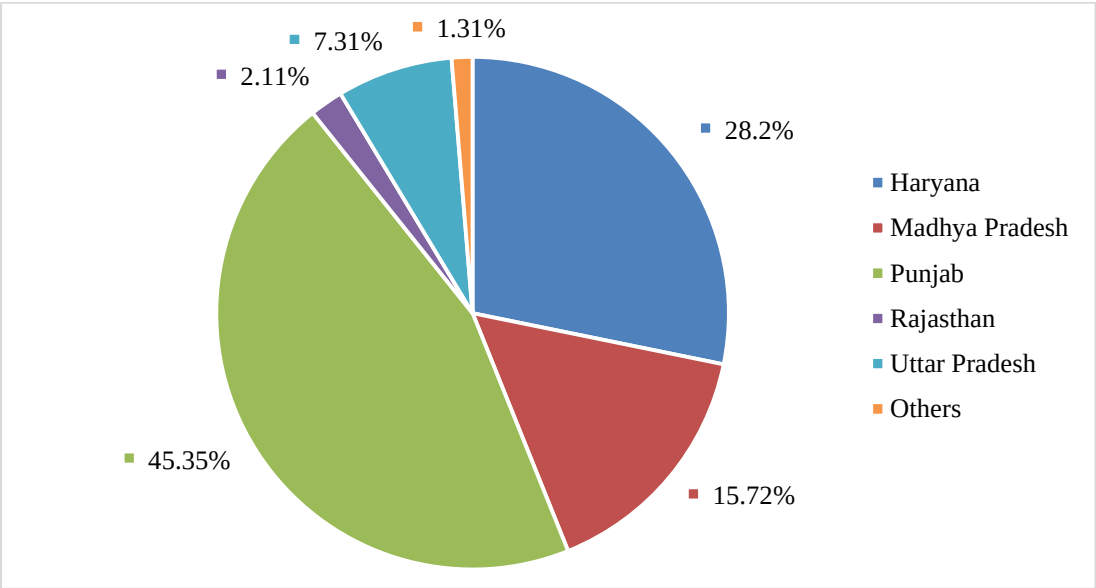


Fig 4.2.6 (b): State-wise share of wheat procurement in India, 2010-11.

Fig. 4.2.6(c) revealed the state-wise share in wheat procurement for the year 2018-19. Punjab state consistently maintained the highest share in wheat procurement, which stood at 35.35 per cent for the year 2018-19 followed by Haryana with a share of 24.54 per cent. The share of Madhya Pradesh further increased to 20.43 per cent .Uttar Pradesh has increased its

share to 14.79 per cent whereas Rajasthan held a share less than 5 per cent i.e., of 4.28 per cent. Other states altogether had a share less than 5 per cent i.e., 0.50 per cent for the year.

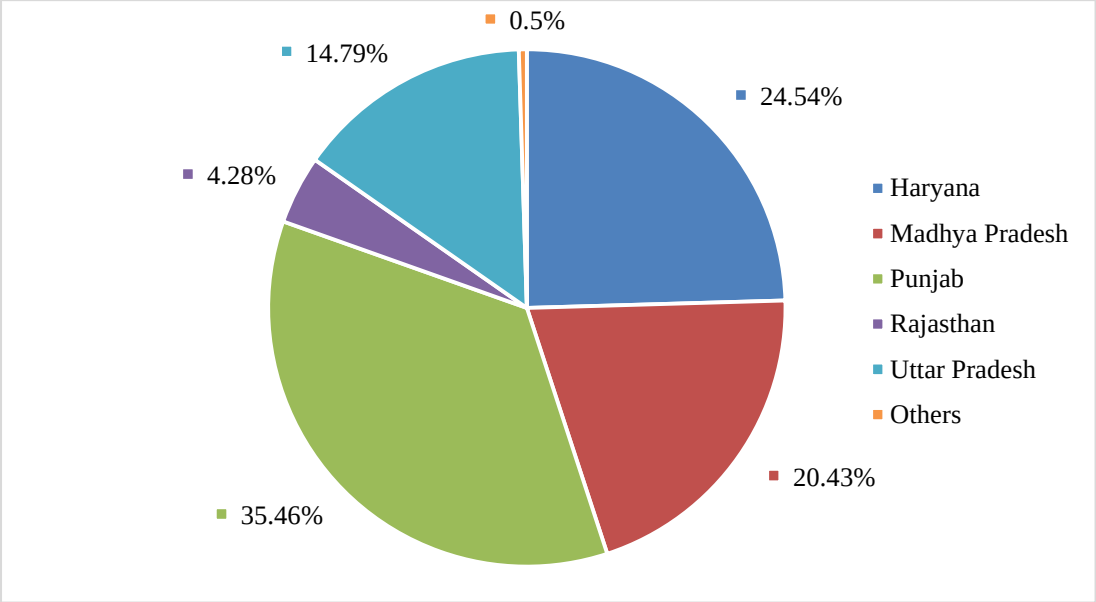


Fig 4.2.6 (c): State-wise share of wheat procurement in India, 2018-19.

4.2.7 Quantum of coarse grains procured in India

The table 4.2.7 represented the quantum of coarse grains procured in lakh tonnes for the major procurement states of India for the period from 2001-02 to 2018-19.

Table 4.2.7: State-wise procurement of coarse grains in India (In Lakh Tonnes)

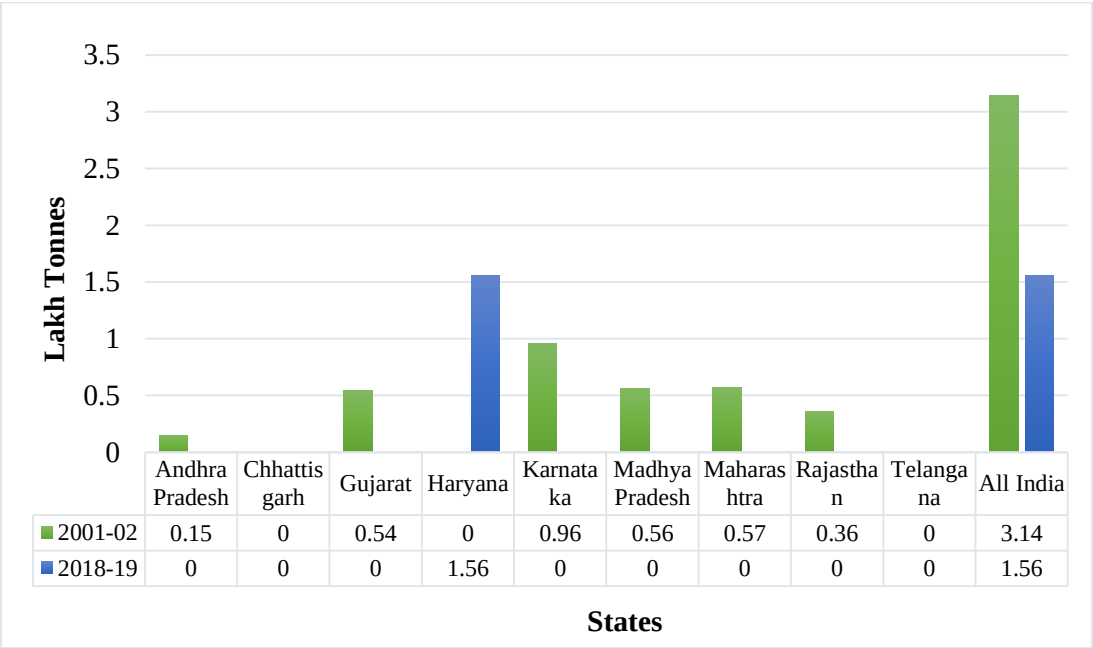
Year	AP	CG	GJ	HR	KA	MP	MH	RJ	TS	All India
2001-02	0.15	0.00	0.54	0.00	0.96	0.56	0.57	0.36	0.00	3.14
2005-06	5.94	0.09	0.00	0.05	4.43	0.03	0.97	0.00	0.00	11.51
2010-11	0.00	0.03	0.00	0.73	0.40	0.09	0.03	0.00	0.00	1.28
2011-12	0.00	0.01	0.00	0.17	0.01	0.17	0.00	0.00	0.00	0.36
2012-13	0.00	0.00	0.00	0.00	0.00	0.08	0.64	0.00	0.00	0.72
2013-14	0.28	0.03	0.00	0.00	7.28	0.87	0.96	0.00	2.89	12.31
2014-15	0.05	0.00	0.00	0.00	1.43	3.03	0.07	0.00	0.06	4.64
2015-16	0.00	0.00	0.00	0.05	2.10	0.28	0.17	0.00	0.00	2.60
2016-17	0.00	0.00	0.00	0.06	0.00	0.50	0.16	0.00	0.00	0.72
2017-18	0.00	0.00	0.00	0.31	0.00	0.04	0.50	0.00	0.00	0.85
2018-19	0.00	0.00	0.00	1.56	0.00	0.00	0.00	0.00	0.00	1.56

Note: *AP: Andhra Pradesh, CG: Chhattisgarh GJ: Gujarat, HR: Haryana, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TS: Telangana State.*

Source*: Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*

At all India level, quantum of coarse grains procurement decreased to around half the quantity procured in 2000-01 i.e., from 3.14 lakh tonnes in 2001-02 to 1.56 tonnes in 2018-19. Maharashtra, Madhya Pradesh and Karnataka were the major sates of coarse grains procurement but have shown a declining trend in recent years. The quantum of coarse grains procured in Haryana state increased in the recent years. For the year 2018-19, Haryana was the only state where 1.56 lakh tonnes of the coarse grains have been procured.

The Fig. 4.2.7 presented the quantum of coarse grains procured in the states of India for the two periods 2001-02 and 2018-19. Total quantity of coarse grains procured was high during the year 2001-02 where Karnataka, Maharashtra and Madhya Pradesh have largely contributed to the total coarse grains procured. For the year 2018-19, Haryana stood as the only state where coarse grains were procured, which is of the quantity 1.56 lakh tonnes.



	Andhra Pradesh	Chhattisgarh	Gujarat	Haryana	Karnataka	Madhya Pradesh	Maharashtra	Rajasthan	Telangana	All India
2001-02	0.15	0	0.54	0	0.96	0.56	0.57	0.36	0	3.14
2018-19	0	0	0	1.56	0	0	0	0	0	1.56

Fig 4.2.7: Quantum of coarse grains procured in different states of India

4.2.8: State-wise share in procurement of coarse grains in India

The Table 4.2.8 presents the state-wise share in procurement of coarse grains in India for the period from 2001-02 to 2018-19. For the year 2001-02, perusal of the Table 4.2.8 and Fig. 4.2.8 (a) revealed that the Karnataka state has the highest share of 30.57 per cent followed by Maharashtra, Madhya Pradesh and Gujarat with a share of 18.15 per cent, 17.83 per cent, and 17.2 per cent respectively. Rajasthan had a share of 11.46 per cent while Andhra Pradesh had a share less than 5 per cent i.e., 4.78 per cent.

For the year 2010-11, Table 2.4.8 and Fig. 4.2.8(b) revealed that Haryana state held the highest share of 50.07 per cent followed by Karnataka and Madhya Pradesh with a share

of 31.25 per cent and 7.31 per cent respectively. Maharashtra and Chhattisgarh held the share less than 5 per cent, i.e., 2.34 and 2.34 per cent respectively.

For the year 2018-19, Table 4.2.8 showed that Haryana alone had the whole share of 100 per cent in the procurement of coarse grains while no other state contributed for the procurement of coarse grains.

Table 4.2.8: State-Wise share of Procurement of coarse grain in India (%)

Years	AP	CG	GJ	HR	KA	MP	MH	RJ	TS
2001-02	4.78	0.00	17.20	0.00	30.57	17.83	18.15	11.46	0.00
2005-06	51.61	0.78	0.00	0.43	38.49	0.26	8.43	0.00	0.00
2010-11	0.00	2.34	0.00	57.03	31.25	7.03	2.34	0.00	0.00
2011-12	0.00	2.78	0.00	47.22	2.78	47.22	0.00	0.00	0.00
2012-13	0.00	0.00	0.00	0.00	0.00	11.11	88.89	0.00	0.00
2013-14	2.27	0.24	0.00	0.00	59.14	7.07	7.80	0.00	23.48
2014-15	1.08	0.00	0.00	0.00	30.82	65.30	1.51	0.00	1.29
2015-16	0.00	0.00	0.00	1.92	80.77	10.77	6.54	0.00	0.00
2016-17	0.00	0.00	0.00	8.33	0.00	69.44	22.22	0.00	0.00
2017-18	0.00	0.00	0.00	36.47	0.00	4.71	58.82	0.00	0.00
2018-19	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00

Note: *AP: Andhra Pradesh, CG: Chhattisgarh GJ: Gujarat, HR: Haryana, KA: Karnataka, MP: Madhya Pradesh, MH: Maharashtra, RJ: Rajasthan, TS: Telangana State.*

Source: Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.

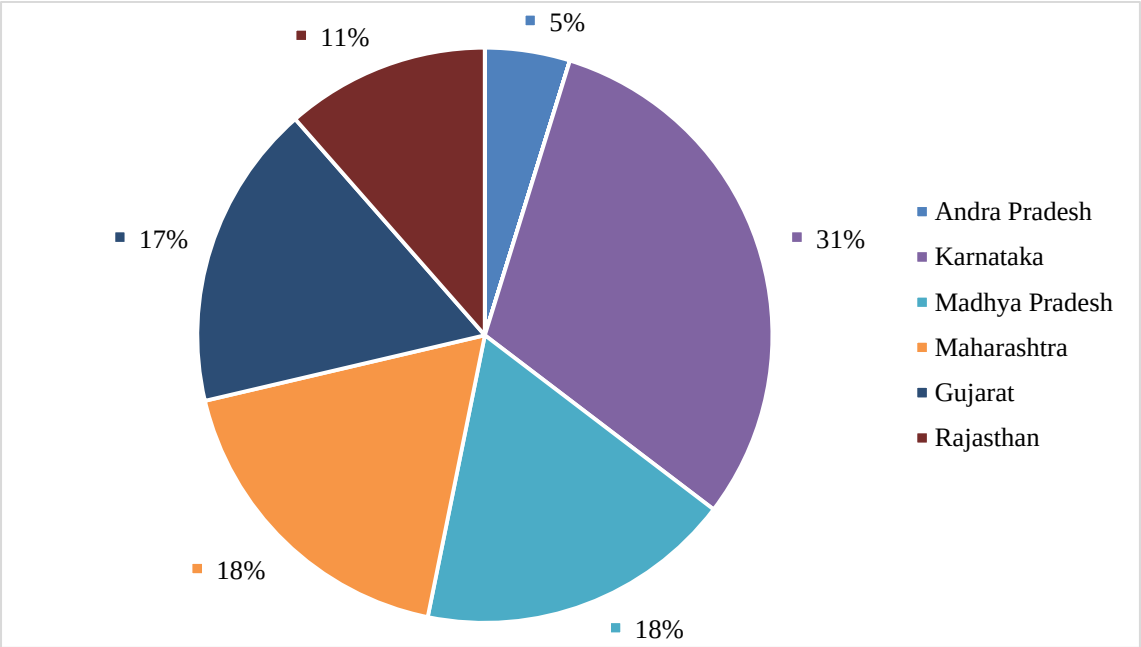


Fig 4.2.8 (a): State-wise share of coarse grains procurement in India, 2001-02.

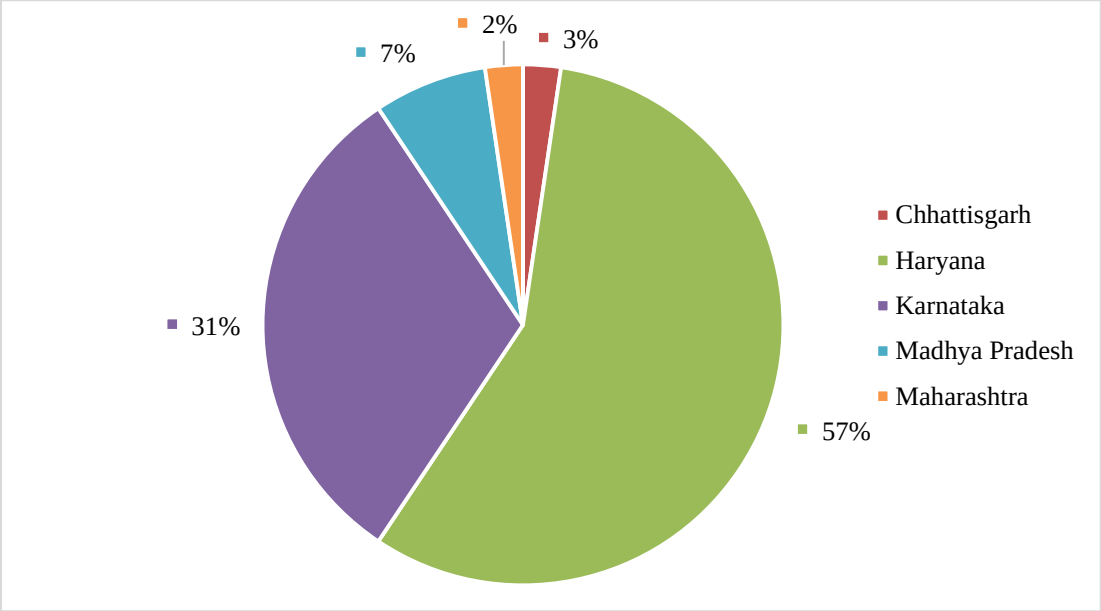


Fig 4.2.8 (b): State-wise share of coarse grains procurement in India, 2010-11.

4.2.9: Agency-wise share in procurement of rice in India.

The Table 4.2.9 presented the agency wise share in procurement of rice for the various states of India. At the national level, the share of state agencies in rice procurement increased from 41.2 per cent in 2000-01 to 98.9 per cent as the share of FCI decreased to 1.0 per cent during the year 2018-19. The perusal of the Table 4.2.9 revealed that the share of state agencies improved to around 98.5 per cent in Punjab during the year 2018-19 which was only 56.2 per cent in the year 2000-01. In Andhra Pradesh, the share of state agencies increased sharply from 3.5 per cent in 2000-01 to 100 per cent in 2015-16. In Telangana also, share of state agencies improved from 56.3 per cent in 2013-14 to 100 per cent in 2015-16. Meanwhile in Odisha also, the share of state agencies reached 100 per cent which was only 1.0 per cent in 2000-01. In West Bengal the share of state agencies hovered around 96 per cent since 2010-11 which was much varying before that. In Uttar Pradesh, the share of state agencies hovered around 30 to 60 per cent until 2015-16 since then, it improved and reached to 98 per cent in 2018-19. In Haryana, for the period from 2010-11 to 2012-13, state agencies had no share as the entire procurement was done by FCI. Since 2013-14, share of state agencies hovered around 99.5 per cent.

In the case of rice procurement, the share of state agencies has greatly improved as can clearly be seen from the Fig 4.2.9. This improvement in the share of state agencies can be attributed to both the states Telangana and Andhra Pradesh becoming DCP states during 2014-15 and 2015-16 respectively where in the procurement done by state agencies rather than FCI. These two states were among the top rice producers contributing largely to the improvement in the share of state agencies in rice procurement.

Table 4.2.9: Agency-wise share in procurement of rice in India. (%)

year	Andhra Pradesh		Haryana		Odisha		Punjab		Telangana		Uttar Pradesh		West Bengal		All India	
	FCI	State Ag.	FCI	State Ag.	FCI	State Ag.	FCI	State Ag.	FCI	State Ag.	FCI	State Ag.	FCI	State Ag.	FCI	State Ag.
2000-01	96.5	3.5	45.51	54.49	99.89	0.11	43.75	56.25	0	0	0	100	0	100	58.72	41.28
2005-06	96.16	3.84	26.19	73.81	68.52	31.48	20.01	79.99	0	0	16.69	83.31	63.45	36.55	40.15	59.85
2010-11	84.9	15.1	100	0	2.07	97.93	4.02	95.98	0	0	62.14	37.86	5.11	94.89	35.02	64.98
2011-12	81.76	18.24	100	0	1.78	98.22	1.59	98.41	0	0	61.32	38.68	24.3	75.7	27.6	72.4
2012-13	72.45	27.55	100	0	0.94	99.06	4.55	95.45	0	0	47.86	52.14	23.46	76.54	20.67	79.33
2013-14	79.29	20.71	0.42	99.58	0.11	99.89	3.85	96.15	43.69	56.31	46.32	53.68	3.83	96.17	18.91	81.09
2014-15	15.35	84.65	0.1	99.9	0.06	99.94	2.48	97.52	30.62	69.38	30.39	69.61	1.87	98.13	7.48	92.52
2015-16	0	100	0	100	0	100	4.67	95.33	0	100	4.71	95.29	3.95	96.05	2.37	97.63
2016-17	0	100	0.61	99.39	0	100	4.64	95.36	0	100	7.56	92.44	6.5	93.5	2.59	97.41
2017-18	0	100	0.47	99.53	0	100	3.07	96.93	0	100	4.49	95.51	5.27	94.73	1.81	98.19
2018-19	0	100	0.33	99.67	0	100	1.49	98.51	0	100	1.42	98.58	4.04	95.96	1.02	98.98

Note: State Ag.: State Agencies, FCI: Food Corporation of India

Source: The Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.

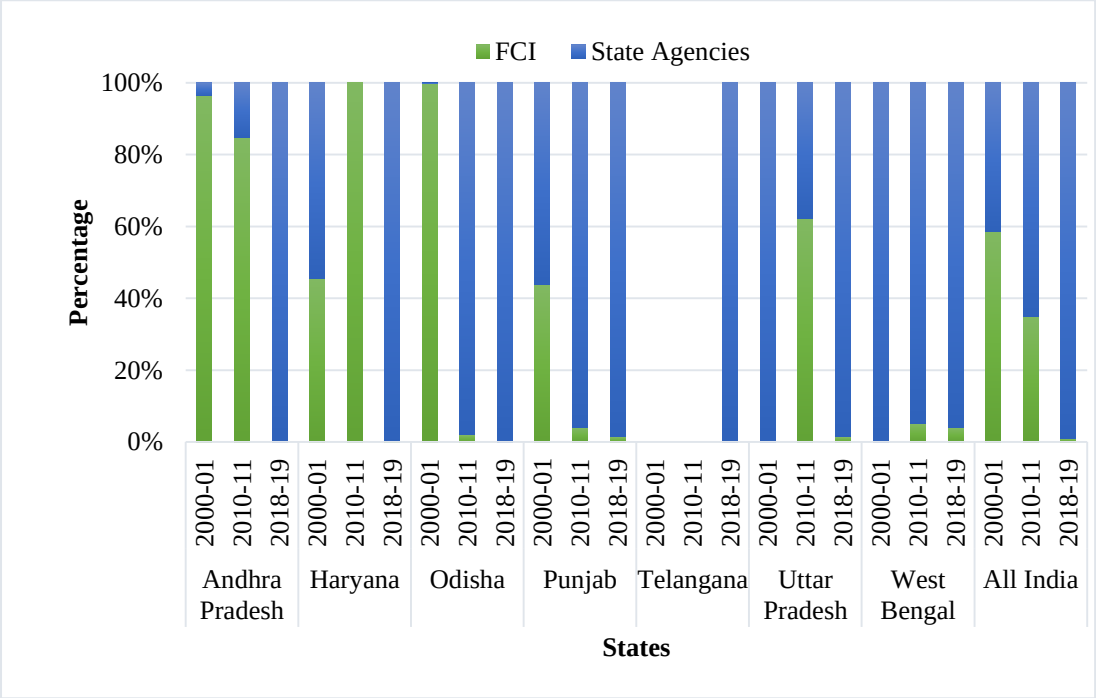


Fig 4.2.9: Agency wise share in procurement of rice in India.

4.2.10 Agency-wise share in procurement of wheat in India

The Table 4.2.10 presented the agency wise share in procurement of rice for the various states of India. At the national level, the share of FCI in wheat procurement declined from 21.08 per cent in 2000-01 to 11.9 per cent in 2018-19 as the share of state agencies increased to 88.1 per cent in 2018-19 as can be seen clearly from the Fig. 4.2.10. FCI's share in wheat procurement has not declined much during the period. The share of FCI in wheat procurement is relatively greater than that of its share in rice procurement. In Haryana, the share of FCI in wheat procurement was 9.16 per cent in 2000-01 which increased to 15 per cent in 2010-11 but again decreased to 12 per cent in the next year. Since then, it hovered around 11 to 12 per cent. The share of FCI in Madhya Pradesh decreased from 3.99 per cent in 2000-01 to nil in 2011-12. Since then, the procurement of wheat done by the state agencies only in that state. In Punjab, share of FCI has continuously decreased from 29.84 per cent in 2000-01 and hovered around 15 to 17 per cent for the period from 2005-06 to 2016-17. It further decreased to 12.4 and 12.0 per cent in 2017-18 and 2018-19 respectively. In Rajasthan, the share of FCI hovered around 75 to 85 per cent in last 4 years. In Uttar Pradesh, share of FCI hovered around 6 to 8 per cent since 2014-15, which was just 1 to 2 per cent in the past. All these states except Madhya Pradesh were non-DCP states where in procurement is done by FCI rather than state agencies.

Table 4.2.10: Agency-wise share in procurement of wheat in India. (%)

State	Haryana		Madhya Pradesh		Punjab		Rajasthan		Uttar Pradesh		All India	
Agency	**FCI**	**State Ag.**	**FCI**	**State Ag.**	**FCI**	**State Ag.**	**FCI**	**State Ag.**	**FCI**	**State Ag.**	**FCI**	**State Ag.**
2000-01	9.16	90.84	3.99	96.01	29.84	70.16	36.55	63.45	0.84	99.16	21.08	78.92
2005-06	13.62	86.38	3.10	96.90	15.85	84.15	74.84	25.16	7.32	92.68	15.01	84.99
2010-11	15.09	84.91	6.78	93.22	16.20	83.80	100.00	0.00	1.52	98.48	15.76	84.24
2011-12	12.00	88.00	0.00	100.00	0.00	0.00	100.00	0.00	2.08	97.92	14.03	85.97
2012-13	10.94	89.06	0.00	100.00	15.08	84.92	100.00	0.00	0.47	99.53	13.09	86.91
2013-14	12.49	87.51	0.00	100.00	17.80	82.20	95.66	4.34	1.46	98.54	15.53	84.47
2014-15	12.30	87.70	0.00	100.00	15.79	84.21	38.91	61.09	8.12	91.88	12.61	87.39
2015-16	0.00	100.00	0.00	100.00	17.87	82.13	73.08	26.92	7.23	92.77	10.63	89.37
2016-17	10.71	89.29	0.00	100.00	16.41	83.59	68.64	31.36	5.77	94.23	13.27	86.73
2017-18	11.61	88.39	0.00	100.00	12.41	87.59	78.47	21.53	8.33	91.67	11.71	88.29
2018-19	11.95	88.05	0.00	100.00	12.06	87.94	85.05	14.95	6.74	93.26	11.90	88.10

Note: State Ag. : State Agencies, FCI: Food Corporation of India *Source: Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India.*

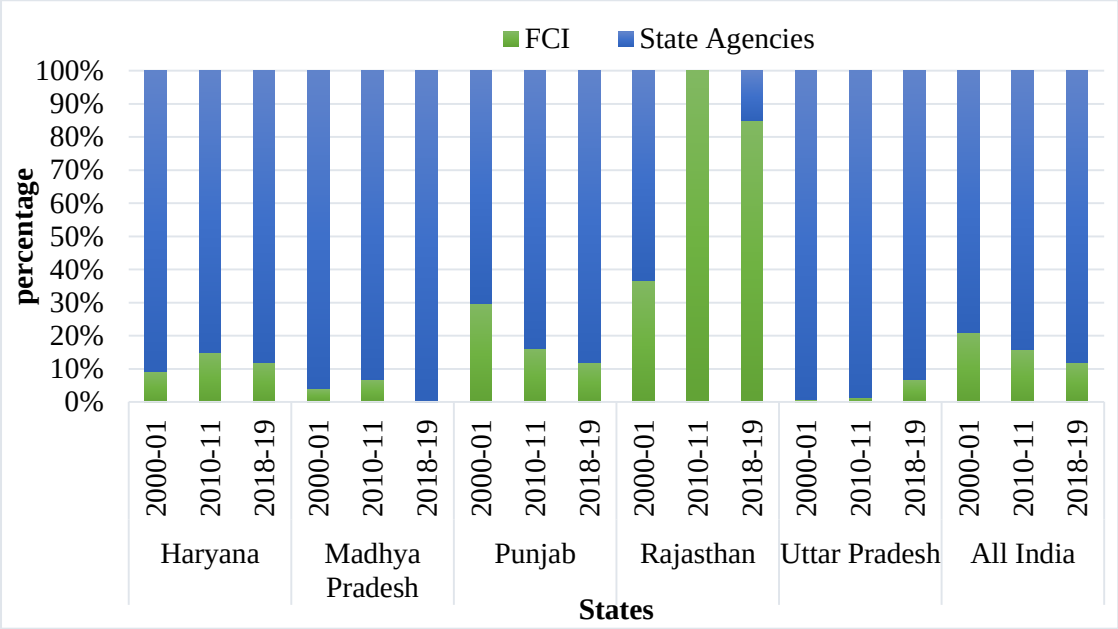


Fig 4.2.10: Agency wise share in procurement of wheat in India.

4.2.11 Storage capacity available in India for central pool stock

The Table 4.2.11 presented the storage capacity available in India from the period 2011 to 2020. The storage capacity of FCI increased to 412.2 lakh tonnes in 2020 (23.38 lakh tonnes more than previous year). During 2011, FCI had the storage capacity of 316.10 lakh tonnes which increased by almost 96 lakh tonnes in 2020.But, the total capacity declined to 755.94 lakh tonnes in 2020, lowest in last five years, which can be attributed to the drop in the storage capacity of other agencies that FCI temporarily contracted with.

Table 4.2.11: Storage capacity available in India for central pool stock (in Lakh Tonnes)

Year	Storage Capacity with FCI	Storage Capacity with other Agencies	Total
2011	316.10	291.32	607.42
2012	336.04	341.35	677.39
2013	377.35	354.28	731.63
2014	368.90	379.18	748.08
2015	356.63	352.59	709.22
2016	357.89	456.95	814.84
2017	352.71	420.22	772.93
2018	362.50	480.53	843.03
2019	388.65	467.03	855.68
2020	412.03	343.91	755.94

Note: As on 1st April.

Source: Food Corporation of India.

4.2.12 Break-up of storage capacity available with FCI.

The Table 4.2.12 presented the break-up of total storage capacity available with FCI which includes both the capacity owned and hired by FCI. The perceptual of the table reveals that the increase in the storage capacity of FCI was mainly due to increase in hired Capacity. The hired capacity almost doubled from 108.7 lakh tonnes in 2005 to 202.31 lakh tonnes in 2020 while the owned capacity hovered around 150 to 156 lakh tonnes during the period. The huge contribution of hired capacity to the increase of total capacity with FCI can be clearly seen in the Fig. 4.2.12.

Table 4.2.12: Break up of storage capacity available with FCI (In Lakh Tonnes)

Year	Owned	Hired	Total
2005	151.57	108.74	260.31
2006	151.42	104.14	255.56
2007	152.33	99.74	252.07
2008	151.54	87.40	238.94
2009	151.40	101.39	252.79
2010	154.77	133.59	288.36
2011	156.07	160.03	316.10
2012	156.40	179.64	336.04
2013	156.33	221.02	377.35
2014	156.41	212.49	368.90
2015	153.18	203.45	356.63
2016	154.07	203.80	357.87
2017	154.21	198.50	352.71
2018	154.44	202.31	356.75

Note: As on 31st March

Source: Fertilizer Statistics 2003-04, The Fertilizer Association of India. (16851)

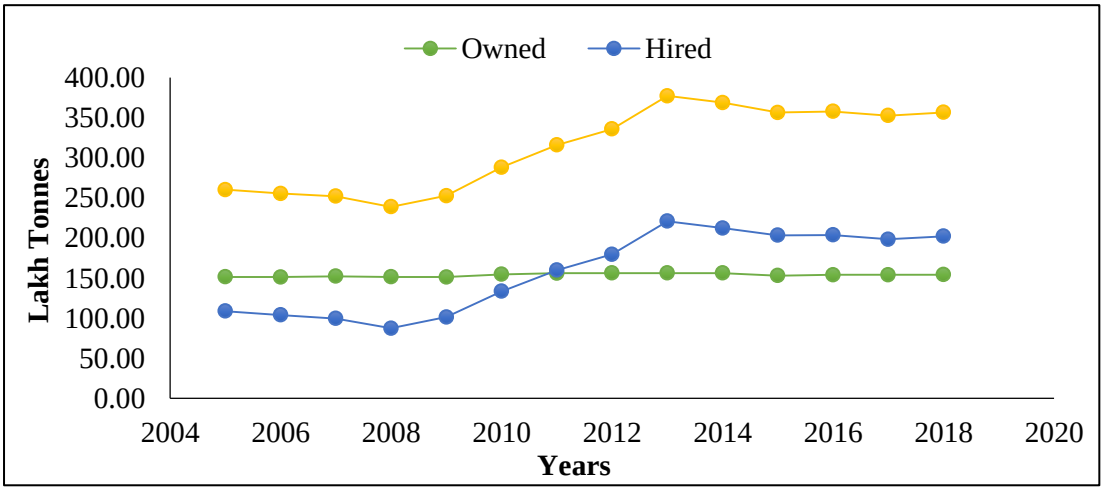


Fig 4.2.12: Break up of storage capacity available with FCI. 2005-06 to 2017-18.

Section III: Problems encountered in procurement, storage and handling of cereals by the agencies

This section deals with the problems encountered in procurement, storage and handling of cereals by the procurement agencies. The problems were sought from both individual and institutional point of view.

4.3.1 Demographic profile of the respondents

A brief description of the survey respondents consisting of gender, agency/institution, years of experience, respondent's designation was outlined in the table 4.3.1.The number and percentage were used to express the responses received. Among the respondents, 74 per cent were male and 26 per cent were female. About 77 per cent of the respondents were employees of Food Corporation of India, chief agency involved in procurement and storage operations in the country. Around 17 per cent were employees of Central Ware House Corporation and 6 per cent were employees of State Warehouse Corporation. Around 80 per cent of workers had

Table 4.3.1: Demographic profile of the respondents

S. No.	Category	Profile	Number (n)	Percentage *(%)*
1	**Gender**	Male	26	74
		Female	9	26
		Total	**35**	**100**
2	**Agency/ Institution**	FCI	27	77
		CWC	6	17
		SWC	2	6
		Total	**35**	**100**
3	**Years of experience**	>1 Years	4	11
		1 - 5 years	28	80
		>5 years	3	9
		Total	**35**	**100**
4	**Designation**	Manager (Quality Control)	20	57
		Manager (other)*	5	14
		Technical Assistant	10	29
		Total	**35**	**100**

Note: FCI: Food Corporation of India, CWC: Central Warehousing Corporation,
SWC: State Warehousing Corporation

* IT, Accounts, Finance etc.

job experience of 1 to 5 years, suggesting that the majority of respondents had better experience in the procurement, storage and handling of food grain. Respondents with less than one year of work experience were 11 per cent, while 9 per cent of respondents had more than five years of work experience. Around 57 per cent of the respondents were quality control managers, operating primarily in the field of procurement and storage operations. Technical assistants constituted for about 29 per cent and 14 per cents were managers operating in other areas like accounts, finance, IT etc., who were secondarily involved in storage and procurement of food grains.

4.3.2 Problems encountered during procurement, storage and handling of food grains from individual point of view

The views of the respondents on the issues that came upon during the process of procurement, storage and handling of grains in agencies with which they were working on regular basis were presented in the Table 4.3.2.

Among other issues, the low quality of grains brought by the farmers to the procurement centers was found to be the major problem during the grain procurement process. Many a times the grains brought by the farmers fail to satisfy the quality standards/ uniform specifications provided by the Government of India. The grains brought to the centers often contained high moisture than specified level, or the grains were broken/damaged, or unclean containing admixtures of deleterious materials like small stones and granules etc., leading to the deterioration of the grain quality. About 45.71 per cent of respondents agreed with the low quality of grains being the main problem while 42.86 per cent opinioned that the major problems in procurement were operational issues. Procuring large volumes of grains in short period, Quality analysis of large number of arrivals in short span of time and handling the untimely arrival of the farmers were the operations issues often faced during procurement. Lack of transport vehicles and labour scarcity in the peak times of procurement, lack of well-structured procurement centers were among the problems faced during procurement other than quality and operational issues specified by the respondents. Wastage of grains during procurement was found to be less than 0.5 per cent which was low or negligible as stated by 88.6 per cent of respondents.

The procured food grains were stored for some period to maintain the required operational and buffer stocks for the central pool. Scientific storage methods were used for the safe storage of the grains. The quality and quantity deterioration of food grains caused by the biotic factors like insects, pests, rodents and birds was the major problem in storage and handling of food grains as stated by about 65.7 per cent of the respondents. Abiotic factors like moisture and temperature also pose some problems in maintaining the quality of stored

grains. Around 17 per cent of the respondents have detailed about some issues, other than biotic and abiotic factors, which posed difficulties in safe storage of grains. While storing, the grain bags were stacked in about 20 to 24 layers in general. The bags were hooked to lifters while stacking which often resulted in loosening of threads of bag leading to spillage of grains around the stacks. This in turn create imbalance in the stacks kept leading to the fall of stacks. The fallen stakes need to be restacked every time which accounts for extra handling costs. Often during high procurement seasons, when the grains procured are in execs to the available storage capacity, the bags were stacked in the space between two stacks (Alley way) which otherwise left empty for the required aeration. This problem of occupancy has often posed much trouble in maintaining the quality of grains when stored for long. Encrustation of the grains was another problem, prevalently seen in rice, when stacks were kept for long time and in more layers. The grains in the bottom layer get pressed when more number of layers was kept. This reduces the quality of grains in bottom layer making it appear choky (damaged and powdery). These problems were found to be relatively manageable when compared to problems caused by biotic and abiotic factors.

Majorly, covered go-downs were used to store the grains followed by CAP (covered and plinth). About 86 per cent of respondents agreed upon the fact. Around 69 per cent of respondents were satisfied with the available storage capacity while the remaining 31 per cent were not. About 66 per cent of the respondents suggested for the establishment of new structure as a measure to improve storage capacity while only 28 per cent of respondents suggested to go for privatizing/ Out- sourcing of go-downs. Among other measures suggested, (PEG, 2008) Private Entrepreneurs Guarantee scheme was one where in the storage capacity was constructed through private entrepreneurs at the locations identified by FCI to meet the required storage capacities.

In storage, in order to control the possible damage due to biotic and abiotic factors, chemical-control measures were mainly used. About 69 per cent of the respondents are satisfied with chemical measures used while 31 per cent were not satisfied. Among other alternative and/or supplementary measures used, UV-light trap, a mechanical control measure, was more pronounced which were effective in controlling insects and moths. The lights used in the trap, can last for about 6 to 8 hours once charged. Traps were usually kept in 3 to 4 numbers per compartment of the godown to trap the insect files. These were already being used in southern states of India and they were suggested as alternative measure to be adapted everywhere.

When the grains were stored for a long time in covered go-downs, between rice and wheat, rice was more likely to get damaged as the moisture loss was comparatively faster in

rice. Around 54 per cent of the respondents agreed up on it. But, when kept in open storage, wheat can be more prone to damage as it can get infested with weevils easily. And the per cent grains wasted during the storage was found to be less than 0.5 per cent as 66 per cent of respondents stated the same.

Table 4.3.2: Problems in procurement and storage of food grains from individual point of view

S. No.	Particulars	Number (n)	Percentage (%)
Major problems in procurement of food grains			
1	Quality of grains	16	45.71
2	Operational issues	15	42.86
3	Other	04	11.43
	Total	**35**	**100.00**
Per cent grain wastage during procurement			
1	**<0.5%**	31	88.57
2	**0.5-1%**	02	5.71
3	**>1%**	02	5.71
	Total	35	100.00
Major problems in storage of food grains			
1	Biotic factors	23	65.71
2	Abiotic factors	06	17.14
3	Other	06	17.14
	Total	**35**	**100.00**
Type of storage structure used			
1	Godown	30	85.71
2	Cover and Plinth(CAP)	05	14.29
3	Plinth	00	0.00
	Total	**35**	**100.00**
Type of storage structure used			
1	Satisfied	24	68.57
2	Not-satisfied	11	31.43
	Total	**35**	**100.00**

S. No.	Particulars	Number (n)	Percentage (%)
To improve storage capacity			
1	Establish new structure	22	62.86
2	Out-sourcing/privatizing	10	28.57
3	Other	03	8.57
	Total	**35**	**100.00**
Chemical-control measures used			
1	Yes	34	97.14
2	No	01	2.86
	Total	**35**	**100.00**
Control measures used			
1	Satisfactory	24	68.57
2	Not-satisfactory	11	31.43
	Total	**35**	**100.00**
Per cent grain wasted during storage			
1	<0.5%	23	65.7
2	0.5-1%	11	31.4
3	>1%	1	2.9
	Total	**35**	**100.0**
Relative damage proportion of major grains stored			
1	Wheat	16	45.7
2	Rice	19	54.3
	Total	**35**	**100.0**

4.3.3 Problems in procurement and storage of food grains from institutional point of view

The Table 4.3.3 presented the problems encountered by the agencies/institutes in procurement, storage and handling of grains from institutional point of view. Respondents were asked about the various constraints that the organization, as an institute, was faced with in order to obtain a perspective on the current status.

The problems were classified mainly into the four categories; financial problems, technical problems, infrastructural problems and general problems .Under each category,

three important constraints were identified and listed. The respondents were asked to rate each constraint according to their perception on a 5 point scale where a weight of 1 was assigned to strongly disagree and 5 was assigned to strongly agree. Relative importance index was calculated for each constraint and they were ranked accordingly. The following response was received from the survey.

Financial Problems: Among the financial constraints listed, large capital requirement was ranked first with the highest RII of 0.663. This suggested that the requirement of large capital to run the system of food security was the most important financial problem required to be addressed. High maintenance cost with the RII of 0.600 was ranked second which required to be given next priority while addressing the financial problems. Costly protective materials-materials used to protect the grains like tonnage materials, GRF rods, Bamboo mats, wooden planks, CLTF covers etc. - was ranked third, which had the RII of 0.594.

Technical problems: Among the technical constraints listed, inadequate manpower/labor was ranked first, with the highest RII of 0.663. This indicated that there was a shortage in labor availability, especially in peak seasons, which needed to be addressed first. The labour scarcity was relatively high in southern states. Inadequate technical supervision/staff was ranked second, with the RII of 0.594. Lack of skill among storage operators was the constraint that ranked third among technical issues needed to be addressed.

Infrastructural problems: Lack of advanced storage structure stood first among the infrastructural constraints required to be solved with a RII of 0.760. The pressing need to establish more number of advanced storage structure like silos was felt. Lack of adequate quality control laboratory, with RII of 0.617, and lack of covered storage structures, with RII of 0.543 were ranked second and third respectively among the infrastructural problems.

General Problems: Risk of damage due to biotic factors was the constraint with the highest RII of 0.691. This indicated that the problem of wastage of grains due to biotic factors was more prevalent than other two constraints. Risk of damage due to abiotic factors was ranked second by the respondents, which had the RII of 0.64, followed by the quality deterioration due to prolonged storage. This indicated that the problem of damage due to prolonged storage was less prevalent as the grains were not kept for too long periods.

The inadequacy of manpower was much pronounced by the respondents as procurement and storage operations were strenuous and sufficient manpower/labor was required to carry out the operations with full efficiency. Many of the respondents when asked for suggestions, proposed to carry out more research on scientific storing methods to avoid quality issues which was the major hurdle in ensuring food security of the nation.

Among the respondents, 47 Per cent agreed that the bureaucracy and red tape in workplace has been affecting the process of procurement, storage and handling of food grains. By this, it can be conclude that, though 52 per cent have not agreed upon the fact, to some extent, bureaucracy was prevalent in work place which hindered the quality control and other operations.

Table 4.3.3: Problems in procurement and storage of food grains from institutional point of view

S. No.	Particulars	RII*	Rank
I	**Financial Problems**		
1	Costly protective materials	0.594	3
2	Large capital requirement	**0.663**	**1**
3	High maintenance cost	0.600	2
II	**Technical Problems**		
1	Inadequate technical supervision (Staff)	0.594	2
2	Inadequate manpower (labour)	**0.663**	**1**
3	Lack of skill among storage operators	0.543	3
III	**Infrastructure Problems**		
1	Lack of adequate quality control laboratory	0.617	2
2	Lack of covered storage structures	0.543	3
3	Lack of advanced storage structures	**0.760**	**1**
IV	**General Problems**		
1	Risk of damage due to abiotic factors	0.674	2
2	Risk of damage due to biotic factors	**0.691**	**1**
3	Quality deterioration due to prolonged storage	0.566	3

Note: *Relative Importance Index

Protective materials: GRF rods, CLTF covers, storage chemicals etc.

Conclusion

The following conclusions were drown from the study:

- The area, production and productivity scenario of major cereals has revealed that the cereals like rice, wheat and maize have shown significant and positive growth in the area, production and productivity over the study period.
- In case of the jower crop, a significant decline in the area and production over the study period has been noticed, which elucidates the poor status of jower cultivation in India.

- The procurement of rice in India:
  - The procurement scenario of rice, at the national level, has shown that the total quantity of rice procurement has more than doubled and that procurement of rice as a percentage of production has also increased during the study period.
  - Among the major rice-producing states, Andhra Pradesh has shown a decline in the quantum of rice procured as the procurement as a percentage of production has declined in the recent years.
  - Punjab state has shown the highest share in total rice procurement followed by Telangana and Andhra Pradesh for the year 2018-19
  - The share of state agencies in rice procurement, at the national level, increased to above 98 per cent over the study period.
- Procurement of wheat in India:
  - The procurement scenario of wheat, at the national level, has shown that the total quantity of wheat procured has more than doubled and the procurement of wheat as a percentage of production has increased considerably over the study period.
  - Among the major wheat-producing states, Madhya Pradesh has shown a sharp increase in the quantum of wheat procured as the procurement as a percentage of production has also increased sharply in the recent years.
  - Punjab state has shown the highest share in total wheat procurement followed by Haryana and Madhya Pradesh for the year 2018-19
  - The increase in the share of state agencies, at the national level, was relatively lesser in case of wheat procurement over the study period when compared to that of rice procurement.
- The procurement of coarse grains in India:
  - The total quantity of coarse grain procured has declined to around half the quantity over the study period. The procurement has declined in the coarse grain procuring states like Madhya Pradesh, Maharashtra and Karnataka except Haryana where procurement has increased in the recent years.
  - Entire procurement of coarse grains is done by state agencies in consultation with FCI.
- Storage facilities available in India:
  - Storage capacity with the FCI has increased to 412.2 lakh tonnes in 2020, an all-time high in the decade, which was mainly due to increase in the hired capacity.

- The total storage capacity has declined to 755.94 lakh tonnes, lowest in the last five years, which was mainly due to the decline in the capacity of other agencies that FCI has contracted with.

- Problems faced during the procurement, storage, and handling of cereals by the procurement agencies:
  - The low quality of grains brought by farmers to the procurement centers was the main problem during procurement of grains.
  - The key problem in storage and handling of food grains was quality and quantity deterioration due to the biotic factors like insects, pests, rodents and birds.
  - The wastage of grains during procurement and storage was found to be less than 0.5 per cent which can be considered as low or negligible.
  - The covered godowns were largely used to store the grains and the available storage capacity was found to be satisfactory.
  - The chemical control measures were mainly used to protect the stored grains and were found to be satisfactory in protecting the stored grains. Between rice and wheat, when stored, the rice was relatively more prone to damages.
- Problems faced by the procurement agencies as an institute:
  - The most important financial issue that needed to be solved was the requirement of large capital to operate the agencies. The labour scarcity, particularly in peak periods of procurement, was the main technical issue with the agencies while the lack of advanced storage structures like silos was the main infrastructural issue faced by the agencies as an institute that required to be addressed.

Policy measures:

- The poor status of jower production calls for concerned efforts from the government to encourage farmers to grow jower crop.
- Andhra Pradesh needs special attention from the government to increase the production of rice and improve the share of procurement to total production in the state.
- The production of so called ‘nutri cereals’ needs to be increased through further research on developing HVYs , giving incentives to farmers to grow more, concerned efforts from extension services to create awareness on nutritional quality of coarse cereals, which would aid in improving the nutritional security in the country.
- The storage capacity with FCI needs to be enhanced rather than depending on other agencies that FCI usually contracts with.

- Among the farmers, awareness regarding the importance of maintaining the quality standards of grains, prescribed by GOI, needs to be created which would help in procurement and safe storage of grains
- There is a pressing need for further research on developing scientific and improved measures to protect and ensure the safe storage of grains.
- The establishment of advanced storage structures, ensuring labour availability, especially in peak periods would greatly aid in improving the efficiency of the institution.

CHAPTER V

SUMMARY

India being an agrarian country, agriculture in the county has made significant progress from being a major importer of food grains to a stable, self-sufficient, and food secure nation. In the pre-green revolution period, the increase in the production of food grains was mainly due to the expansion of area under the cultivation of crops. Ever since the green revolution took place, the increased production has been sustained by the use of high yielding varieties, improved irrigation facilities, increased use of new technologies and well-built infrastructure and extension services. As a result, the production of food grains increased tremendously enabling the country not only to attain self-sufficiency but also to export food grains to other counties. Today, India ranks first in the production of total pulses, millets and jute, second in the production of wheat, rice, groundnut, sugarcane, cotton, tea, and third in the production of total cereals. Total production of food grains reached 284.95 million tonnes while the total production of rice, wheat, coarse grains and pulses stood at 116.42, 102.19, 42.95, and 23.40 million tonnes respectively.

Attaining food sufficiency may not always reflect food and nutritional security of the country. Food security can only exist when all people have access to sufficient and nutritious food to meet their dietary needs. To improve the same, the Government has implemented many schemes and policies like the Public Distribution System and the National Food Security Act. The Food Corporation of India attempts to ensure support price for farmers to encourage them to grow more and also to ensure the availability of food grains to weaker sections of society through its procurement and distribution operations.

On the background of the above facts, the present study has been conducted titled "The Production and Procurement Scenario of cereals in Major Producing States of India" with the objectives:

- To study the production status of cereals in major producing states of India.
- To analyze the quantum of cereals procurement and availability of storage facilities in the country.
- To bring out problems encountered in procurement, storage and handling of cereals by procurement agencies.

To achieve the stated objective, the required data was collected from various reliable sources and an e-survey was also carried out. The analysis of data was carried out using the methodology indicated in chapter 3 and the results of the analysis are presented in chapter 4.

This section deals with the summary of the study. The findings of the study are summarized as below:

At the national level, area, production, and productivity of rice has shown positive and significant growth of (0.41), (2.31) and (1.89) per cent respectively over the study period from 1960-61 to 2017-18. The major rice-producing states likes Andhra Pradesh, Punjab, Uttar Pradesh and West Bengal have shown significant growth rates for the area, production and productivity of rice except Andhra Pradesh, which has shown a negative growth in area which was significant. Among them, the highest growth in both area and production of rice was shown by Punjab while the highest growth in productivity was shown by Uttar Pradesh.

In the case of wheat, at the national level, the area, production, and productivity has shown positive and significant growth of (1.42), (3.95) and (2.44) per cent respectively over the study period from 1960-61 to 2017-18. Among the major wheat-producing states likes Haryana, Madhya Pradesh Punjab and Uttar Pradesh, the growth rates of area, production, and productivity was positive and significant. Among them, the highest growth in both area and production of wheat was shown by Haryana while the highest growth in productivity was showed by Madhya Pradesh.

At the national level, the area, production, and productivity of maize showed positive and significant growth of (1.02), (3.13) and (2.08) per cent respectively over the study period from 1960-61 to 2017-18. The major maize-producing states like Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh and West Bengal have shown positive and significant growth in the area, production, and productivity of maize. Tamil Nadu has shown the highest growth in both area and production while Andhra Pradesh has shown the highest growth in productivity of maize.

In the case of jower, at the national level, area and production of jower showed a significant and negative growth of (-2.14) and (-0.95) per cent respectively whereas the growth rate of jower productivity was (1.22) per cent over the study period from 1960-61 to 2017-18. Among the major jower-producing states like Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu and Uttar Pradesh, the growth rate of area and production was found to be significant and negative except growth in productivity which was positive and significant growth. This indicated the poor status of jower production in India. Andhra Pradesh has shown the highest negative growth in both area and production. The highest positive growth in productivity of jower was shown by Gujarat state.

The total quantity of rice procured has more than doubled over the years from 212.80 lakh tonnes in 2000-01 to 443.99 lakh tonnes in 2018-19. Among the rice procuring states, Andhra Pradesh and Tamil Nadu showed a decrease in procurement over the time period from

2000-01 to 2018-19. The procurement of rice as a percentage of production, at the national level slightly increased over the period from 23.7 per cent in 2000-01 to 33.86 per cent in 2018-19 .It increased in all the major rice-producing states except Andhra Pradesh where it has declined in the recent years.

The share of Andhra Pradesh and Punjab in the total procurement of rice declined to 10.8 and 25.5 per cent in 2018-19 from 33.7 and 32.7 per cent in 2000-01 respectively. Punjab state has shown the highest share in total rice procurement followed by Telangana and Andhra Pradesh for the year 2018-19.The share of state agencies in total rice procurement had grown to 98.9 per cent in 2018-19 from 41.28 per cent in 2000-01 over the study period. In the major rice procuring states like Andhra Pradesh, Haryana, Odisha, Punjab, Telangana, Uttar Pradesh and West Bengal the share of state agencies in procurement of rice had grown to above 95 per cent while the share of FCI declined over the period.

The total quantity of wheat procured has more than doubled over the years from 163.55 lakh tonnes in 2000-01 to 357.95 lakh tonnes in 2018-19. Wheat procurement increased in all the major wheat procuring states like Haryana Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh. The quantity of wheat procured in Madhya Pradesh increased sharply. The procurement of wheat as a percentage of production at the national level has increased considerably over the years. Among the major procuring states, it was found to be highest in Punjab while in Madhya Pradesh, it has increased sharply in the recent years. The share of Punjab and Haryana in the total wheat procurement declined to 35.46 and 24.54 per cent in 2018-19 from 57.62 and 27.5 per cent in 2000-01 to respectively. This can be mainly attributed to the rise in the shares of other states. The share of Madhya Pradesh increased sharply from 2.15 per cent in 2000-01to 20.43 per cent in 2018-19.

The share of state agencies in the wheat procurement increased from 78.9 per cent in 2000-01 to 88.1 per cent 20181-19. The FCI remained dominant in wheat procurement except in the state of Madhya Pradesh where the share of the FCI declined over the years as the state was made DCP state in 2000-01.

The total quantity of coarse grain procured declined to around half the quantity over the years from 3.14 lakh tonnes in 20000-01 to 1.56 lakh tonnes in 2018-19.The procurement has declined in all the coarse grain procuring states like Madhya Pradesh, Maharashtra and Karnataka except Haryana where procurement has increased over the study period from 2000-01 to 2018-19. The share of Madhya Pradesh, Maharashtra and Karnataka declined over the time period while that of Haryana improved in the recent years contributing 100 per cent to the total coarse grain procurement in 2018-19.

Storage capacity of the FCI increased to 412.2 lakh tonnes in 2020, all time high in the decade but, the total capacity has declined to 755.94 lakh tonnes, lowest among the last five years. It was mainly due to decline in storage capacity of other agencies that FCI contracted with. The increase in the storage capacity with the FCI was mainly due to increase in the hired capacity.

The low quality of grains brought by farmers to the procurement centers was the main problem during procurement along with operational issues viz, untimely arrival of farmers, large quantities to be procured in stipulated period and quality analysis of all the lots brought in within a short period of time. The key problem in storage and handling of food grains was quality and quantity deterioration due to the biotic factors like insects, pests, rodents and birds. The wastage of grains during procurement and storage was found to be less than 0.5 per cent which can be considered as low or negligible.

The covered godowns were largely used to store the grains and the available storage capacity was found to be satisfactory. The chemical control measures were mainly used to protect the stored grains and were found to be satisfactory in protecting the stored grains. Between rice and wheat, when stored, the rice was relatively more prone to damages.

The most important financial issue that needed to be solved was the requirement of large capital to operate the FCI. The labour scarcity, particularly in peak periods of procurement, was the main technical problem, the lack of advanced storage structures like silos was the main infrastructural issue and the risk of damage due to biotic factors like pests and rodents was the major problem that needed to be addressed. Among the respondents, 47 Per cent accepted that the bureaucracy and red tape in workplace had an effect on the process of procurement, storage and handling of food grains. By this, it can be concluded that, though 52 per cent did not accept the fact, to some extent, bureaucracy was prevalent in work place which hindered the quality control and other operations.

The study identified some policy measures such as; increasing the production of jower crop and coarse grains by giving incentives to farmers, enhancing the storage capacity of FCI by building advanced storage structures at key locations, developing improved scientific methods to ensure the safe storage of grains and creating awareness among the farmers regarding the importance of maintaining grain quality standards as prescribed by GOI, which would help in procurement and safe storage of grains and improve nutritional security in the country

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