

## Dynamics of maize Development in Bihar: An overview of emerging issues and challenges

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### Background

The production of food grains in India has registered a majestic rate of growth over the last five decades, following the introduction of the Green Revolution and the adoption of new seed-fertilizer-based technology. The Green Revolution demonstrated that the convergence of scientific knowledge and research in agriculture, industrial support for delivering technology and inputs such as seeds, fertilizers, and irrigation, along with the gradual adoption by farmers, could spur production, employment, and economic development at a faster rate. However, the initial benefits of this new technology were mostly confined to two crops: rice and wheat, whose productivity began to increase at a steady rate after 2000.

Maize started gaining commercial importance in the mid 1970s, having traditionally been grown during the kharif season. It was the main staple food for small and marginal agricultural laborers and other vulnerable sections of society. The challenge of producing more food grains became pressing due to the shortage of per capita food grains and the ever-growing population. By 2050, it is projected that the minimum requirement for food grains will be 480 million tons, while per capita land availability is expected to decline from 0.50 hectares in 1950-51 to 0.04 hectares by 2021, and even further by 2050.

Indiscriminate use of resources and climate change have degraded the quality of land, water, biodiversity, and the atmosphere, raising concerns among policymakers about maintaining the country's food security. This has necessitated the search for new areas and crops to sustain food production. Bihar state extends over 93.60 lakh hectares comprising two highly predominant agricultural regions namely, North Bihar and South Bihar. The North Bihar is famous for maize production since three and more decades. This area comprises about 56 percent of geographical area and about 60.18 per cent net sown area of the state. Maize crop cultivated in all three seasons namely autumn, summer and rabi.

Central America and Mexico are considered the primary centers of maize origin. Its production in India likely began in the early seventeenth century. Maize, known as the "queen of cereals," has been cultivated in the country for more than 4500 years. In Bihar, maize has traditionally been grown during the kharif season. Rabi (winter) maize cultivation began in the mid of 1970s due to the conducive conditions of the winter season, leading to a significant increase in maize yields. This boost was also aided by the introduction of the All India Coordinated Research Project (AICRP) in the early 1960s (or 1957) in Bihar, and genetic improvement efforts started after the involvement of CIMMYT. Due to maize's high adaptability to varied agro climatic conditions and the innovation of new strains, both hybrid and composite maize have been started cultivating successfully year after year. Cooperative research efforts led to the development of numerous maize varieties from the year 1961 to 2022, As a result maize production increases significantly after introduction of varieties including hybrids namely Ganga Safed-2, Suwan Composit, Hi- Starch, Lakshmi Composit, Hemant Composit, Rajendra Hybrid-1, Rajendra Hybrid-2, Dewaki Composit, Rajendra Makka-1, Diara Makka, series of Saktiman Quality protein maize in the state. The varieties were suitable for Kharif, rabi, flood prone, etc. Initially, the research branch was under the Department of Agriculture, Govt. of Bihar, and later came under Rajendra Ag-

ricultural University, Pusa, Samastipur from 1970. It has been engaged in maize research since 1960s. Quality protein maize (QPM) is a genetically improved hybrid maize developed by Rajendra Agricultural University, Bihar, Pusa, by maize group scientists under the leadership of Dr. P.B. Jha. They developed four QPM hybrid varieties (Shaktiman 1-4). Later, another team led by Dr. Ajay Kumar also developed QPM hybrid varieties of Shaktiman . QPM is superior in quality compared to normal maize and other cereals, beneficial for children's health, pregnant women, adults, and elderly persons. It also promotes fast growth in pigs and chicks and increases milk production in cows and buffaloes when fed QPM. In the above background present study was conducted to know the real facts of maize analysis of different aspects with following objectives.

### Objectives

- To study area production and productivity of maize in the state.
- To know the producing capacity of crop in the state.
- To access the technology used in maize production
- To identify the major constraints in the maize production

### Methodology

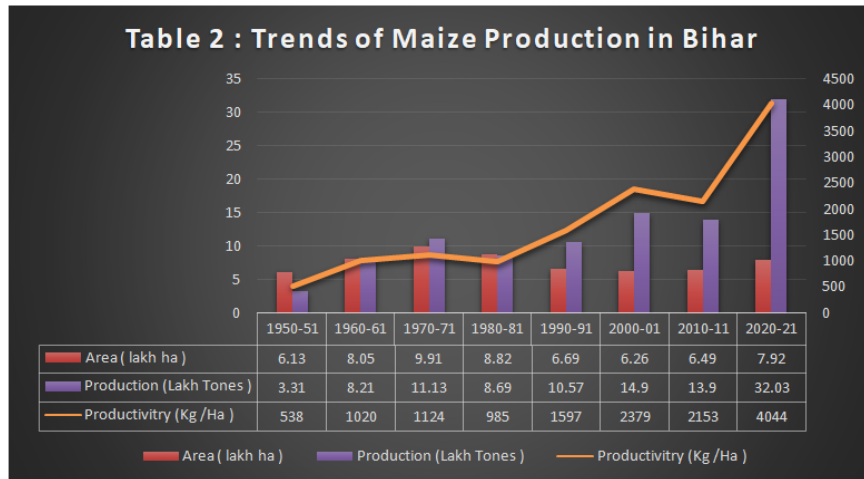
For the purpose of study both secondary as well as primary data was collected to attend the set objectives .The secondary data was collected through various published sources and primary data collected through survey of five villages of Murual block in Muzaffarpur district .In the block five villages surveyed for gathered the required information. The selected villages was namely-Lautan, Rainy, Nemopur, Itaha and Mirapur which comes in the jurisdiction of very old agricultural college famous as Tirhut College of Agriculture, Dholi under Dr. Rajendra Prasad Central Agricultural University , Pusa, Bihar. In each village, ten people were gathered with the help of village Mukhia and two groups of five people each was formed on the basis of their land holdings whether below 1.5 acre and above 1.5 acre. In order to get overall view of maize production and utilization in the villages one key informant of each group were interviewed through a questionnaire prepared with important questions and survey was done during the year 2022- 2023 as a pilot basis. The findings are presented below.

### Maize Status in Bihar

As per the data for the triennium ending 2021-2023, around 1205 million tons of maize are produced annually worldwide. Of this total production, approximately 11.29 percent is consumed as food, about 59.83 percent as feed, around 25.56 percent is used industrially, and the remaining 3.32 percent is for other uses (source: www.agriwatch.com). In India, during the same triennium, about 34.70 million tons of maize are produced annually, ranking the country 7th in the world. Of the total maize produced, about 31.9 million tons (91.93 percent) are consumed domestically, while the remaining 2.8 million tons (8.07 percent) are exported annually (source: Economic Survey, Government of India). India has seen a phenomenal increase in maize production, from 2.08 million tons in 1951-52 to 33.62 million tons in 2021-22. During the same period, the total maize area increased from 3.16 million hectares in 1951-52 to 10.04 million hectares. Bihar is one of the leading maize-producing states in the country. As per 2023-24 data, maize is grown on 7.92 lakh hectares, producing 32.03 lakh tons of maize grains with an average productivity of 4044 kg per hectare. In Bihar, maize is grown in three seasons: Autumn, Rabi, and Summer. Autumn maize is cultivated on about 40.42 percent of the total maize area, followed by Rabi at 32.21 percent, and summer at 27.37 per cent. Of the total maize production in Bihar, the Autumn season contributes 23.18 percent, Rabi 41.00 percent, and Summer 35.82 percent.

### Trends in Maize Production

The graph below is self-explanatory, showing that while the area under maize cultivation has varied slightly, production has significantly increased over the observed period. Productivity has also risen at a notably higher rate compared to previous years. It is evident from the graph that after 1990, the rate of increase in productivity became more pronounced. This was mainly due to the introduction of high-yielding maize varieties, the outcomes of research and development, and government policies.



Source : <http://agricrop.nic.in>

Changes in the acreage of maize crops in the state have been observed in 14 potential maize-growing districts. An effort has been made to assess the changes in area over the last two decades, presented in charts 3A (Increased) and 3B (Declined) during 2001 to 2021.

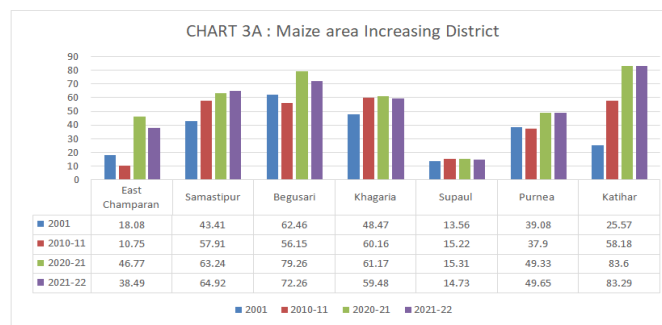
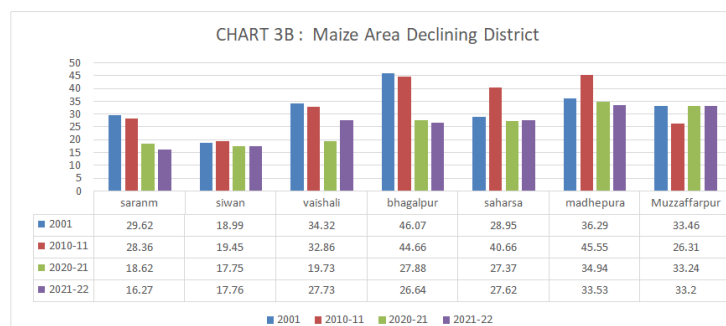


Chart 3A reveals that East Champaran and Katihar districts have shifted more area from other crops to maize compared to other listed districts, likely due to higher productivity. ( Source : Economic Survey of Bihar ,Finance Department GoB )

Economic Survey of Bihar ,Finance Department GoB )



Source :- Economic survey of Bihar & Directorate of Economics and Statistics ,GoB

Chart 3B indicates that Siwan district has only slightly shifted maize-producing areas to other crops compared to the rest of the districts, which have shifted more area to other crops due to various technological and stress-related problems.

### Season wise status of Maize

**Table 4 : Season wise percentage of Maize in Bihar**

Season	Area in per cent	Production in per cent	Yield in per cent
Autum maize	40.42	23.18	57.35
Rabi maize	32.21	41.00	127.29
Summer maize	27.37	35.82	130.88

Source : DES, GoB, Patna

The above table clearly indicates that rabi and summer maize was same but autum maize yield just half. The area of autumn maize was high followed by rabi and summer.

### Maize production in study area

In the studied areas, farmers traditionally grew kharif maize. Rabi maize was introduced between 1975 and 1985, although the exact timing is not clearly recalled by the informants. After the introduction of rabi maize, the area for tobacco and other cash crops decreased, while maize cultivation increased due to its high profitability, as reported by the farmers. In the sampled villages, few farmers grow maize during the kharif season due to various problems such as pigs, parrots, rain, and waterlogging. Some farmers grow deshi and white varieties of maize for their own consumption and feed. Rabi maize cultivation began in their villages in the year onward 1975, with most farmers growing yellow hybrid maize. In the summer season, farmers with assured irrigation cultivate high-yielding varieties for commercial purposes, achieving high yields. The agricultural university particularly TCA, Dholi college was renowned for maize seed distribution up to the year 2000 (20th century). However, after the year 2000 (21st century), the introduction of private companies and university maize out of performance to give higher yield with compared to outside maize seeds. Outside HYVs offer higher productivity per unit compared to the varieties released by the university and farmers stated prefer private seeds. After the state university was upgraded to Dr. Rajendra Prasad Central Agricultural University (RPCAU), Pusa, in 2016, some serious efforts were started taken in this context

### Technology used by the farmers

Farmers primarily use purchased hybrid seeds, including Pioneer, 900M, Krishi Dhan, Bio Seeds, Syngenta Seeds, Kanchan, and Lakshmi. Most farmers reported that Pioneer and Syngenta are the most prominent varieties from private companies, yielding over 110 quintals per hectare in both summer and rabi seasons. Farmers have intercropped maize with potatoes, achieving potato yields of over 225 quintals and maize yields of over 80 quintals. The duration of maize crops varies between 95 and 135 days, depending on the variety, and yield fluctuates across seasons. Intercropping is very popular among farmers. However, many farmers have reported that government seeds do not provide the expected or better yields compared to private sector high-yielding varieties (HYV) seeds. There is very low adoption of mechanized seeding, seed treatment, and manure application among farmers.

### Surplus, Marketing and Processing of Maize

In studied areas most of the farmers particularly in rabi and summer seasons more than 90 per cent maize produce reported as marketable surplus. But in kharif season maize marketable surplus varied from

below 1.5 acre respondents to above 1.5 acre respondents up to 20 to 30 per cent kept for home consumptions. Most farmers report that maize is typically sold to ultimate consumers through village traders or commission agents at the farm level, with a very limited role for retailers. Traders purchase the produce at or above the Minimum Support Price (MSP), which has ranged from Rs 1,800 to Rs 2,300 in recent years. Currently, only 10 to 15 percent of the maize produced is processed at the state level, in 8 to 10 viable processing industries; the rest is traded outside the state. Processing facilities are concentrated in the districts of Khagaria, Bhagalpur, Motihari, Purnea, and Patna. Outside processors like Fritolay, Haldiram, and Kuber have been involved in this activity for some time.

Bihar is a leading maize producer in India, and the demand for maize in various industries could transform the state. However, due to inadequate utilization and surplus production, farmers are forced to sell their maize to traders. Consequently, residents of the state must buy maize-based food, feed, and industrial products prepared outside the state at higher prices. This continuous outflow of maize grains and money has left the state in a disadvantaged position. Promoting maize processing plants to produce value-added products could boost economic development, enhance income levels, and generate employment, particularly benefiting rural communities..

### **Problems in maize production**

Most farmers report several issues, including waterlogging, adverse soil conditions, and delayed sowing. They also face problems with the non-availability of suitable varieties in their area. Additional constraints include the lack of quality seeds, inadequate storage facilities, high irrigation costs, and labor shortages. A significant issue is the lack of confidence in the available maize varieties for value-added products such as starch, oil, baby corn, sweet corn, popcorn, and green cobs. The high Quality Protein Maize generally not popularize in the area but very few farmers in very small piece of land grown in rabi season as per experiment not for commercial purpose. This was mainly due to lack of confidence on its success and give profits. Due to non availability of processing units near by the areas mostly farmers compel to sale their produce at door steps with realization of low prices. In past since 2018 on ward a significant increase in MSP of maize was recorded but it still below the market price as reported by the farmers in market it is sale at more than Rs 2200 per quintal which is much higher than that of Rs 1760 of 2019-20 MSP price.

### **Conclusion**

Despite various efforts by the government over the past eight decades, there remains a significant gap between current maize productivity levels and expectations. The discussion highlights that since 2000, private agencies have largely met seed requirements at very high prices. Consequently, many farmers remain deprived of high-yielding varieties (HYVs) of maize and proper agronomic and plant protection measures. The adverse impacts of climate change have exacerbated maize production problems in the studied areas, threatening food security and livelihoods. To address these issues, a substantial push is needed in the sector through enhanced research and extension technology, provision of quality inputs at reasonable prices, development of value-added maize varieties, improved drainage, storage facilities, insurance, and credit facilities.

### **Suggestions and Policy options**

The results of the study indicates that the state in general and area under study is particular very potential for maize crop. But due to slow research, extension, processing, seed industry it not taken momentum as per expectations. Thus it is suggested that Policy makers, planners, politicians, government agriculture officials, scientists from State and Central Agricultural Universities, and private stakeholders must collaborate to sustain food security, livelihoods, and living standards in Bihar's potential maize-growing districts.

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