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PROSPECTS OF AGRICULTURE IN BIHAR: AN OVERVIEW

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ABSTRACT

*The implications of a sustained growth of agricultural sector is huge for the economy of Bihar. Its role in stimulating growth, employment generation and poverty reduction in the overall economy stems from its substantial forward and backward linkages. Considering that no less than 88.7 percent of the state's population reside in rural areas, agricultural sector holds the key for its overall growth. Two main features characterise agricultural sector in Bihar — First, around 74 percent of the workforce in Bihar depend on agricultural and allied activities for their livelihood (**Census of India, 2011**) and, second, the rich natural resources of the Gangetic plains offer substantial opportunities for high agricultural productivity to enhance the welfare of the rural population. In recent years, similar to other developing economies, Bihar's economic growth seems to be moving away from agriculture indicating a structural change. Still, agricultural sector contributes about 20 percent to the state's GSDP.*

KEYWORDS: *Agro-Climatic Profile, Cropping Pattern, Economic Growth, GSDP.*

INTRODUCTION

However, agricultural sector in Bihar is not bereft of risks and challenges, arising from both climatic and non-climatic factors. Factors such as low crop yield, fragmented land holdings, rainfall irregularities, heterogeneity in landscapes and information asymmetry continue to plague this sector. Despite these challenges, the agricultural economy of Bihar is highly diversified with cereals, pulses, oilseeds, sugarcane, fruits and vegetables as its important crops. Various plans and programmes have been outlined by the state government in the Agriculture Roadmap III (2017-22) towards achieving higher agricultural productivity and boosting rural incomes. Establishing organic corridor along the Ganges has received special impetus in the state's planning to reap the benefits of fertile alluvial soil and abundant water resources. Given that the mineral resources of the state have remained in the present state of Jharkhand after the bifurcation of Bihar in 2000, the expansion of agriculture and allied sectors is central to steering development in the state. For strengthening the viability of agricultural system in Bihar, it would require optimum balance between input use and productivity growth, mediated by climate, price and policy factors. This chapter has been devoted to discuss trends and patterns of different aspects of the agriculture sector in Bihar.

AGRO-CLIMATIC PROFILE OF BIHAR

Located in the eastern part of India, Bihar has an area of 93.6 lakh hectares, accounting for nearly 3 percent of the country's total geographical area. Primarily, the climate is sub-tropical with peak summer temperatures averaging around 40 degree Celsius during March-May and winter months during December-January recording temperatures averaging around 8 degree Celsius. Kharif, Rabi and

Zaid are the three agricultural seasons in Bihar, with main crops being rice, wheat and maize, along with various horticultural crops. The river Ganges divides Bihar into two halves. Northern Bihar receives water from the Himalayan rivers and is largely flood prone. The south of Bihar benefits from the rivers of central India, but it is prone to drought. Table 2.1 briefly describes the features of Bihar's agro-climatic zones — North West Alluvial Plain, North East Alluvial Plain and South Bihar Alluvial Plain. These features determine the soil characteristics, geographical terrain, rainfall and temperature, which together influence its cropping pattern. As evident from Table -1, the alluvial plains of South Bihar are generally characterized by relatively low average rainfall around 1102 mms, with 17 districts falling in this zone. On the other hand, the North Western and North Eastern Zones receive higher rainfall of 1235 and 1382 mms, respectively.

Table 1: Agro-Climate Zones of Bihar

Zones	Soil Type	Mean Rainfall (mms)	Temperature (Degree Celsius)	Major Crops	Districts
North West Alluvial Plain	Medium acidic, heavy textured, sandy loam to clay loam, flood prone	1235	Max: 36.6 Min: 7.7	Rice, Wheat, Maize, Potato, Sugarcane, Mango, Litchi	West Champaran, East Champaran, Siwan, Saran, Sitamarhi, Sheohar, Muzaffarpur, Vaishali, Madhubani, Darbhanga, Samastipur, Gopalganj, Begusarai
North East Alluvial Plain	Light to medium textured, slightly acidic, sandy to silty loam	1382	Max: 33.8 Min: 8.8	Maize, Jute, Pineapple	Purnea, Katihar, Saharsa, Supaul, Madhepura, Khagaria, Araria, Kishanganj
South Bihar Alluvial Plain	Alluvial to sandy loam	1102	Max: 37.1 Min: 7.8	Rice, Wheat, Potato, Gram, Mango, Guava	Sheikhpura, Munger, Jamui, Lakhisarai, Bhagalpur, Banka, Rohtas, Bhojpur, Buxar, Bhabhua, Arwal, Patna, Nalanda, Nawada, Jehanabad, Aurangabad, Gaya

Source: Website of Department of Agriculture, Government of Bihar-www.krishi.bih.nic.in

WATER RESOURCES IN BIHAR

Bihar is endowed with rich ground and surface water resources. Along with the river Ganges, the tributaries of Gandak, Ghaghra, Burhi Gandak, Kosi, Mahananda, Karmanasa, Sone, Punpun, Phalgu, Sakri and Kiul contribute towards availability of water in Bihar for agricultural and nonagricultural purposes. Bihar's agriculture is mainly rainfed, drawing its water resources from south-west monsoons and only around 57 percent of the cultivated area in the state is irrigated.

Erratic rainfall and frequent occurrence of droughts and floods pose stress on crop production cycles and yields. In the Agriculture Road Map-III, the efforts of the state government have been outlined towards facilitating water availability in rainfall deficit regions and addressing the issues of water logging in rainfall surplus regions of Bihar. Along with specific schemes to boost climate-resilience agriculture and access to credit, the availability of irrigated water and setting up of irrigation structures has helped in ensuring agricultural production in the state.

RAINFALL SCENARIO IN BIHAR

Since agricultural operations in Bihar are still substantially dependent on rain water, the variability in rainfall and its month wise distribution are important determinants of the performance of its agricultural sector. The trends in season-wise annual rainfall in Bihar for the period 2001-2017 and the first nine months of 2018 are presented in Table 2.

Table 2: Season-wise Annual Rainfall in Bihar

(Rainfall in mm)

Year	Winter Rain (Jan-Feb)	Hot-Weather Rain (March-May)	Southwest Monsoon (June-Sept)	Northwest Monsoon (Oct-Dec)	Total
2001	20.9 (137.2)	86.7 (113.5)	908.2 (107.1)	192.2 (323.2)	1208 (120.9)
2002	48.9 (320.9)	66.8 (87.4)	896.9 (105.7)	33.2 (55.8)	1045.8 (104.6)
2003	19.2 (126)	93 (121.7)	767.6 (90.5)	128.9 (216.7)	1008.7 (100.9)
2004	23.7 (155.5)	41.4 (54.2)	906.1 (106.8)	60.1 (101.1)	1031.3 (103.2)
2005	0.1 (0.7)	89.5 (117.2)	777.6 (91.7)	30.2 (50.8)	897.4 (89.8)
2006	0.1 (0.7)	90 (117.8)	925.9 (109.2)	27.8 (46.7)	1043.7 (104.4)
2007	28.3 (185.7)	76.4 (100)	1360 (160.3)	40.5 (68.1)	1506.1 (150.7)
2008	30.6 (200.8)	61.8 (80.9)	1084 (127.8)	19.3 (32.5)	1196 (119.7)
2009	0.1 (0.7)	98.2 (128.5)	699.2 (82.4)	71.1 (119.6)	868.6 (86.9)
2010	0.7 (4.9)	49.3 (64.5)	584.4 (68.9)	43.4 (73)	677.9 (67.8)
2011	5.2 (34.1)	79.4 (103.9)	1028 (121.2)	0.5 (0.8)	1113.1 (111.4)
2012	11.2 (73.5)	31.3 (41)	704.2 (83)	51.2 (86.1)	797.9 (79.8)
2013	17.1 (112.2)	73.8 (96.6)	518.4 (61.1)	164.3 (276.3)	773.6 (77.4)
2014	33.3 (218.5)	96.1 (125.8)	788.3 (92.9)	41.9 (70.5)	959.6 (96)
2015	11.7 (76.8)	89.3 (116.9)	690.7 (81.4)	4.3 (7.2)	796 (79.6)
2016	7.5 (49.2)	72.6 (95.1)	936.9 (110.5)	54.5 (91.7)	1071.6 (107.2)
2017	0.4 (2.7)	103.1 (135)	843.2 (99.4)	47.6 (80)	994.4 (99.5)
2018 (Up to September)	0	65.3	689.6	-	754.9
Average (2001-2017)	15.2	76.4	848.2	59.5	999.4

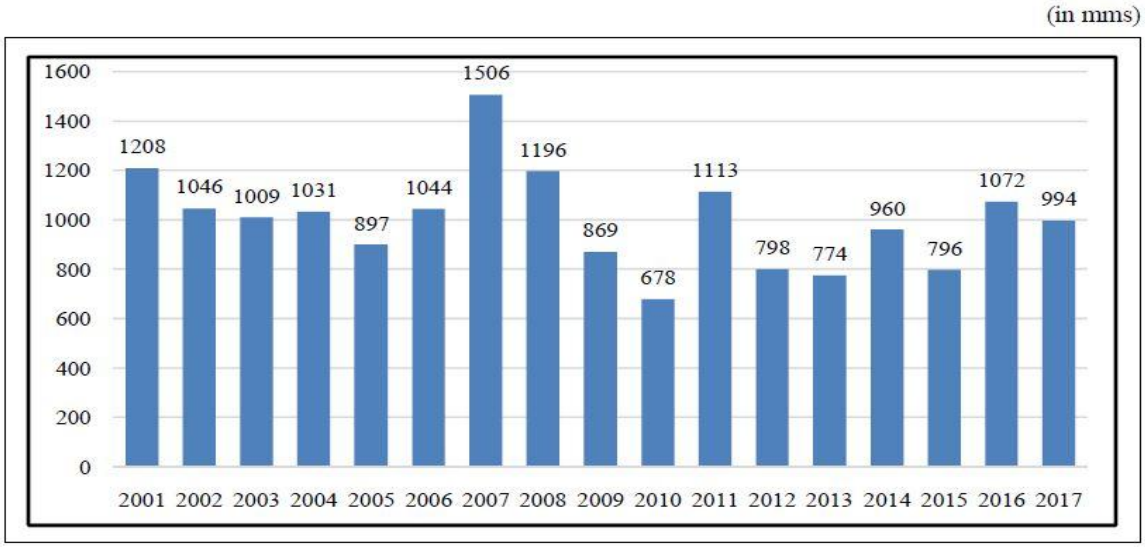
Source: Website of Directorate of Economics and Statistics, Government of Bihar-www.dse.bih.nic.in

Note: Figure in parentheses denote actual rainfall as percentage of average rainfall

Overall, Bihar received an annual rainfall of 999.4 mms during 2001-2017. About 84.9 percent of this rainfall was largely due to the south-west monsoons, occurring during the period of June to September. Winter rain, hot weather rain and north-west monsoons together accounted for the remaining 15.1 percent of the total rainfall in the state. During 2018, the annual rainfall received due to the south-west monsoons in Bihar stood at 689.6 mms, which is about 20 percent less than the long run average rainfall of 848.2 mms. The season-wise distribution of actual rainfall trends show that there is extreme variability in rainfall in Bihar. Poor or irregular rainfall is bound to induce stress on the supply response of crops which has obvious consequences for food and nutritional security for the growing population in the state.

Chart-1 presents an overview of the annual rainfall in Bihar for the period 2001 to 2017. In the above period of 17 years, the annual rainfall received in Bihar varied between 677.9 mms (2010) to 1506.1 mms (2007). During 2018, there was a rainfall deficit of more than 20 percent due to the south-west monsoons, compared to the long run average rainfall. This has resulted in setback for sowing of rainfed kharif crops. Such changes in rainfall patterns and intensities have obvious implications for crop yields. The limited access to water management and conservation structures in the state makes its agriculture vulnerable to weather.

Chart 1: Annual Rainfall in Bihar (2001 to 2017)



Source: Economic Survey 2018-19, Government of Bihar, p. 79

Rainfall patterns are also varied across the different agro-climatic zones in the southern and northern plains of Bihar. In 2017, Kishanganj received the highest rainfall of 2089 mms, while Arwal received the lowest rainfall of 588 mms. Out of the 38 districts, 17 districts received rainfall higher than the state's average of 994 mms in 2017. The district of Kishanganj continued to record the highest rainfall in 2018 due to the southwest monsoons at 1358 mms, while the lowest rainfall was observed in the district of Jehanabad (395 mms). Clearly, the northern districts receive more rainfall on an average from the south-west monsoons during the period of June-September. As a result, the southern districts of Bihar experience poorer groundwater levels making them drought prone, while the northern districts suffer from extreme flood and waterlogging.

Irrigation

The agricultural sector in the state is largely dependent on monsoons and the varying water resource endowments in the southern and northern parts of Bihar calls for a need to identify mechanisms to ensure adequate, timely and assured irrigation for cultivation. In the context of adoption of productivity enhancing inputs such as improved seeds, fertilizers and new methods of cultivation, irrigation plays an important role in rainfed agriculture. Access to irrigation facilitates cultivation in drought-prone areas during rabi season and to adopt high yield varieties of seeds to enhance crop productivity and diversify cropping pattern.

Similar to other states of eastern India, irrigation potential in Bihar has remained untapped to a considerable extent. Given the sensitivity of crops to rain spells, it is imperative to invest in irrigation to compensate for rainfall deficits. In this background, the state government has envisaged specific initiatives for better water management and creation of irrigation potential through measures such as restoration and expansion of canals, linking river projects by intrabasin transfer, command area development, flood control, and schemes for surface and groundwater irrigation. The Agriculture Road Map III (2017-22) presents the

details of state government's efforts in monitoring the usage of groundwater through installation of automatic digital water level recorder. This is expected to minimize the over-exploitation of groundwater resource.

Land Resources

Given the limits to the supply of land resource, it is vital to recognize the different uses of the land resources for productive activities. Rational use of land is important for its implications on economic growth, food supply and ecosystem management. As a landlocked state, Bihar's total geographical area stands at 9.4 million hectares, while its share in country's population is around 8.6 percent.

Landholding in Bihar

The concerns of finite resource of land in the face of growing population are serious for Bihar's economy. As the third populous state in India and having a population density of 1106 persons per sq. km in 2011, the demand for land for alternative uses other than agriculture along with fragmentation of landholdings has increased in recent years. Table 2.4 presents the distribution of landholdings in Bihar for two years, 2010-11 and 2015-16. The figures for the year 2015-16 are provisional, as given in the latest Agriculture Census, 2015-16. About 91.2 percent of Bihar's farm households are marginal (holdings of less than 1 hectare), accounting for 57.7 percent of total land area in 2015-16.

Table 3: Distribution of Landholding in Bihar

Size Class	Number of Operational Holdings ('000)			Area of Operational Holdings ('000 hectares)			Average Size of Operational Holdings (Hectares)	
	2015-16	2010-11	Percentage Change	2015-16	2010-11	Percentage Change	2015-16	2010-11
Marginal	14971	14744	1.54	3728	3669	1.61	0.25	0.25
Small	944	948	-0.45	1178	1186	-0.64	1.25	1.25
Semi-Medium	414	415	-0.16	1076	1073	0.26	2.60	2.59
Medium	81	81	-0.09	431	415	3.75	5.29	5.09
Large	3	3	-1.28	45	45	-1.12	14.48	14.45
All	16413	16191	1.37	6457	6388	-1.09	0.39	0.39

Note: Percentage variation is based on absolute figures, Data for 2015-16 are Phase-I (Provisional Results)

Source: Agriculture Census, 2015-16

The average land holding size is very small in Bihar at 0.39 hectare in 2015-16. Merely 3 percent of the farm households have semi-medium and medium size land holdings in 2015-16 in the state. As regards the number of holdings, it has increased only for the category of marginal, in all the other categories recording a decrease. This indicates a slight increase in the inequality of landholdings in Bihar over the period of five years. Such inequality in land holding and fragmentation of land are serious deterrents for agricultural growth in Bihar.

Cropping Pattern

The agro-ecological conditions of the alluvial plains have enabled diversification of cropping system in Bihar. Besides cereals, cultivation of pulses, fruits and vegetables are crucial to meet the food and nutritional needs of the population. The diversification of crops also helps the farmers in risk management. Table 2.5 presents the trend in cropping pattern in Bihar during the period 2012-13 to 2017-18. The cropping pattern, nearly unchanged over the years, reveals that Bihar is primarily a cereal economy, with more than 85 percent of its gross cropped area under cereals. Despite the emphasis on the need to increase acreage on

pulses for ensuring nutritional security, there has been a gradual decrease in this acreage from 7.1 percent in 2012-13 to 6.8 percent during 2017-18. Considering the fact that Bihar has achieved self-sufficiency in foodgrain production, specific schemes for cultivation of pulses and oilseeds in rice fallows areas have been undertaken in the state under the scheme of 'Targeting Rice Fallow Areas (TRFA) in Eastern India'. Foodgrains (cereals and pulses) together accounted for 93.7 percent of the gross cropped area in the state. Around 3.3 percent of GCA was occupied by sugarcane crop, which indicates limited commercialization of agriculture in the state.

Table 4: Cropping Pattern in Bihar

Crops	Percentage of Area					
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Foodgrains	93.02	92.89	93.25	93.27	93.60	93.72
Cereals	85.9	85.8	86.14	86.18	86.69	86.94
Pulses	7.11	7.08	7.09	7.07	6.90	6.77
Oilseeds	1.59	1.74	1.63	1.69	1.53	1.46
Fibre Crops	1.94	1.71	1.58	1.58	1.53	1.50
Sugarcane	3.46	3.66	3.56	3.46	3.35	3.33
Total Area	100	100	100	100	100	100

Source: Website of Directorate of Economic and Statistics, Government of Bihar-www.dse.bih.nic.in

Trends in Production and Productivity

Bihar's agricultural productivity has increased substantially in the last few years. The abundance of water and rich soil in the state has enabled this growth, along with diversifying agricultural produce among a variety of food and non-food crops. Increasing cereal crop productivity with use of improved technologies has been an important phenomenon in Bihar's agriculture in the recent years.

Crop Sector

Bihar registered a substantial increase in the production of total cereals from 15.72 lakh tonnes in 2013-14 to 17.35 lakh tonnes in 2017-18, registering an annual growth rate of 4.4 percent. Among the major cereals, an increasing trend in production can be seen for both maize and rice, registering growth rates of 6.0 and 4.0 percent respectively, during the last five years. The increase in maize production was from 2.9 lakh tonnes in 2013-14 to 3.23 lakh tonnes in 2017-18 and much of this can be attributed to increase in rabi and summer maize. However, the declining trend in production of pulses and oilseeds is a cause of concern. Among the coarse cereals, the production of bajra, barley and jowar increased at the rate of 11.5 percent, 4.9 percent and 4.2 percent, respectively during the five-year period. The total production of coarse cereals was 3.15 lakh tonnes in 2017-18, registering a growth rate of 6.0 percent between 2013- 14 and 2017-18.

It is important to note here that the production performance of Bihar's cereal economy has been improving, owing to the efforts of the state government in providing technological support to the farmers. The System of Rice Intensification (SRI), adoption of zero-tillage methods and provision of assured irrigation facilities through electric tubewells have led to the achievement of high production targets. Despite the fluctuations in rainfall in recent years, the increasing trend of production for some of the major crops is a sign of the resilience of state's agriculture in the face of climate change.

CONCLUSION

Considering that no less than 88.7 percent of the state's population reside in rural areas, agricultural sector holds the key for its overall growth. Two main features characterise agricultural sector in Bihar — First, around 74 percent of the workforce in Bihar depend on agricultural and allied activities for their livelihood (Census of India, 2011) and, second, the rich natural resources of the Gangetic plains offer substantial opportunities for high agricultural productivity to enhance the welfare of the rural population. In recent years, similar to other developing economies, Bihar's economic growth seems to be moving away from agriculture indicating a structural change. Still, agricultural sector contributes about 20 percent to the state's GSDP.

The agricultural sector in the state is largely dependent on monsoons and the varying water resource endowments in the southern and northern parts of Bihar calls for a need to identify mechanisms to ensure adequate, timely and assured irrigation for cultivation. In the context of adoption of productivity enhancing inputs such as improved seeds, fertilizers and new methods of cultivation, irrigation plays an important role in rainfed agriculture. Access to irrigation facilitates cultivation in drought-prone areas during rabbi season and to adopt high yield varieties of seeds to enhance crop productivity and diversify cropping pattern.

The concerns of finite resource of land in the face of growing population are serious for Bihar's economy. As the third populous state in India and having a population density of 1106 persons per sq. km in 2011, the demand for land for alternative uses other than agriculture along with fragmentation of landholdings has increased in recent years.

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