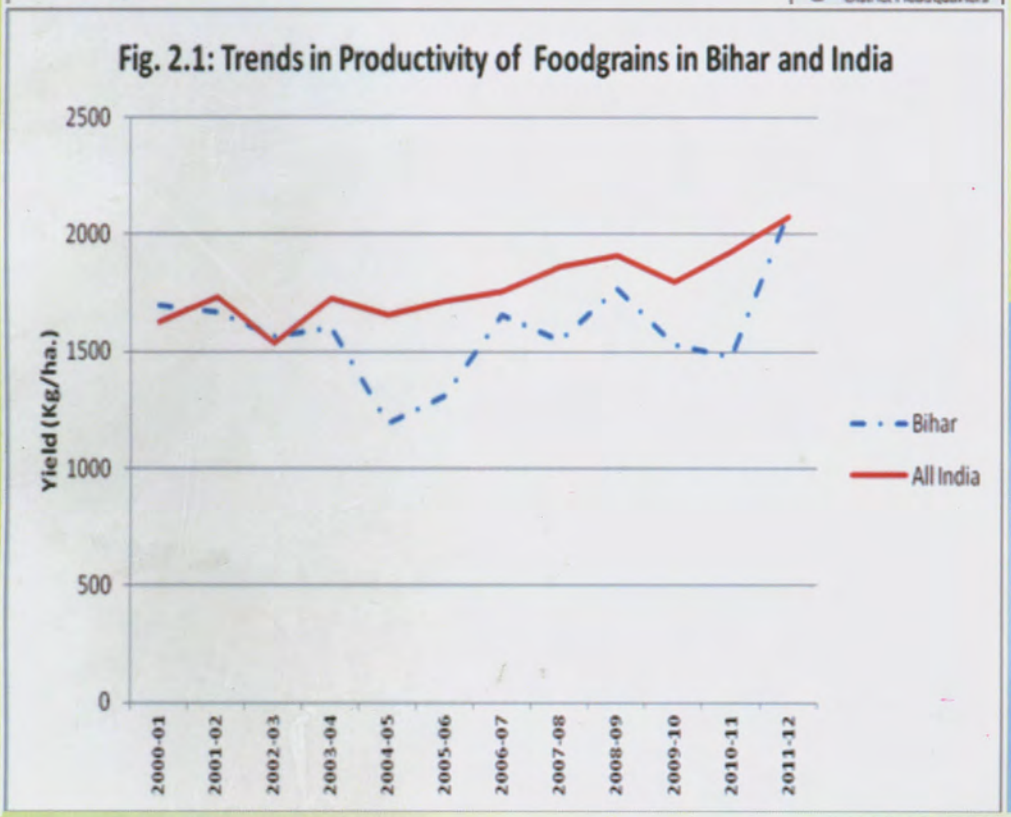
AGRICULTURAL DEVELOPMENT IN BIHAR

Challenges & Opportunities



By
T. Haque

Council for Social Development
New Delhi

AGRICULTURAL DEVELOPMENT IN BIHAR

CHALLENGES
AND
OPPORTUNITIES

BY
T. HAQUE

About the author

Dr. T. Haque is a well known Agricultural Economist. He is currently Director, Council for Social Development, New Delhi, Senior Adviser, LANDESA (Rural Development Institute), New Delhi, and Vice-Chairman, Council for Development of Bihar and Jharkhand, New Delhi. Earlier he served as Chairman, Commission for Agricultural Costs and Prices, Govt. of India, ICAR National Fellow at the National Centre for Agricultural Economics and Policy Research, New Delhi and Director, Centre for Agrarian Studies, NIRD, Hyderabad and Senior Scientist at the Indian Agricultural Research Institute, New Delhi. His email id is **drt.haque@gmail.com**

Acknowledgements

The author is grateful to Dr. P.K. Joshi, Director, IFPRI in South Asia, New Delhi for his help and support in preparing an earlier research report, based on which this Policy paper has been produced. The help received from Gaurav Tripathi of IFPRI in South Asia and Gitesh Sinha of CSD, New Delhi in compilation of data is also thankfully acknowledged.

T. Haque

CONTENT

		Page No.
1.0	Overview	1
2.0	Agricultural Growth and Variability	6
2.1	Crop Production	6
2.2	Horticulture	12
2.3	Livestock	15
2.4	Fish Production	18
2.5	Agro-Industries	19
3.0	Challenges and Opportunities	21
3.1	Technological Innovations	21
3.2	Ago-Industrialisation	24
3.3	Agricultural Extension	24
3.4	Irrigation and Water Management	25
3.5	Literacy and Education	26
3.6	Input Management	27
3.7	Agricultural Credit	29
3.8	Infrastructure	30
3.9	Agricultural Insurance	31
3.10	Public Investment	32
3.11	Cost of Production and Farm Profitability	32
3.12	Land Reform	32
3.13	Land Utilization pattern	33
3.14	Soil health	34
3.15	Variations in Rainfall	35
3.16	Floods and Drought	35
4.0	Conclusions and The Ways Forward	36
	References	44

Key Words: agricultural diversification, infrastructure, innovative land reform, institutional change, legalization of land leasing, policy support, seed replacement rate, technological innovations, value addition, yield gaps

Abbreviations:

ATMA: Agricultural Technology Management Agency

CACP: Commission for Agricultural Cost and Prices

CAGR: Compound Annual Growth Rate

GSDP: Gross State Domestic Product

CD Ratio: Credit Deposit Ratio

COMFED: Co-operative Milk Producers Federation

CSD: Council for Social Development

CV: Co-efficient of Variation

FCI: Food Corporation of India

FLD: Frontline Demonstration

GOB: Government of Bihar

HDI: Human Development Index

ICAR: Indian Council of Agricultural research

IFPRI: International food Policy Research Institute

LBSNAA: Lal Bahadur Shastri National Academy of Administration

NMS: Nutrient Management System

NSDP: Net State Domestic Product

NSSO: National Sample Survey Organization

SRI: System of Root Intensification

SRR: Seed Replacement Rate

1

Overview

1.0 Background

The State of Bihar is situated in the eastern part of India. It borders West Bengal in the east, Uttar Pradesh in the west, Jharkhand in the South and Nepal in the north. Despite an impressive economic growth in the past few years, Bihar continues to be economically backward. According to the latest estimate for the year 2009-10, still about 53.9 percent of the total population in Bihar lived below the poverty line (Govt. of India, 2012). In rural Bihar, the incidence of poverty was as high as 55.3 percent against an all India average rural poverty ratio of 33.8 percent. In 2011-12, the per capita Net State Domestic Product (NSDP) in Bihar at current prices was only Rs. 24681 against an all India average Per-capita NSDP of Rs. 60972. In fact, Bihar has the lowest level of per-capita income in the country. In terms overall Human Development Index (HDI), Bihar was next only to Odisha from the bottom and in terms of education index; it was at the bottom, as Odisha and Jharkhand performed relatively better (Govt. of India, 2011a).

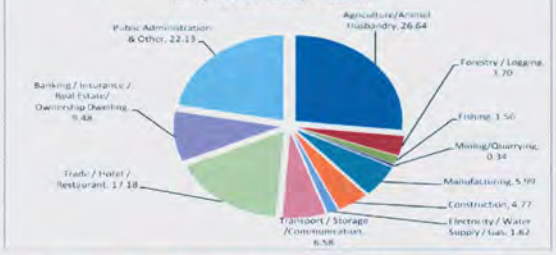
During 2004-05 to 2011-12, the average annual growth rate of Gross State Domestic Product (GSDP) at Constant Prices was about 11.72 percent, against the all India average growth rate of 8.37 percent. But the annual growth rate of GSDP in the agriculture and allied sector in Bihar continued to be lower at 2.93 per cent, against the all India average growth rate of 3.62 percent per year (Table-1.1). Further, the average annual growth rate of agricultural GSDP per capita of rural population was only 0.24 percent during the past two decades. Thus, increasing the per-capita income of agricultural and rural population is a real challenge for the state, as nearly 77 percent of the total workforce was dependent on agriculture and about 89 percent of the total population lived in rural areas. Besides, accelerated growth of per-capita agricultural income would provide the basis for demand led, albeit inclusive and faster economic growth.

1.1 Economic Structure

The share of agriculture, including animal husbandry in Gross State Domestic Product (GSDP) dropped from 26.6 percent in 2000-01 to 19.9 percent in 2011-12, while the share of fisheries declined from 1.56 percent in 2000-01 to about 1.0 percent in 2011-12. In the secondary sector, there was a decline in the share of

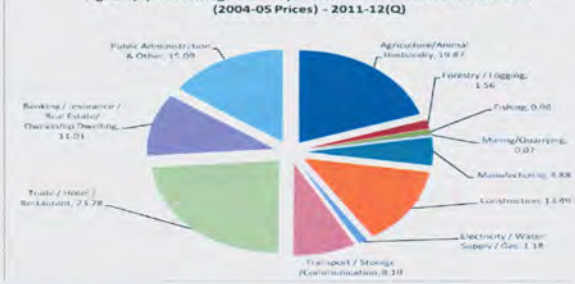
manufacturing sector from about 6.0 perent in 2001-02 to 4.9 percent in 2011-12, while that of construction improved significantly from 4.1 percent in 2000-01 to 13.5 percent in 2011-12. In the tertiary sector, there was an improvement over time, especially as the share of trade/hotel/restaurant increased significantly from 15.0 percent in 2000-01 to 23.8 percent in 2011-12 (Table 1.2). Thus, at present, agriculture is not the leading economic sector in Bihar. However, even though the service sector led economic growth has gained momentum in the past few years; the state continues to be one of the most underdeveloped regions of India. While a big question remains whether the service sector led economic growth pattern is sustainable in the long run, one would also ask a question why the pace of agricultural and agro-industrial development in Bihar is slow.

Fig. 1.1(a): Percentage share by secctor GSDP of Bihar at Factor Cost (2004-05 Prices) - 2001-02



Source: Directorate of Economics and Statistics, GOB

Fig. 1.1(b): Percentage share by secctor GSDP of Bihar at Factor Cost (2004-05 Prices) - 2011-12(Q)



Source: Directorate of Economics and Statistics, GOB

1.2 Structure of Workforce

According to 2011 census, the state of Bihar had a total population of 103.80 million of which 92.07 million lived in rural areas. The proportion of rural population was as much as 88.7 percent. The detailed break-up of working population for 2011 is not yet available. But the earlier census of 2001 showed that working population constituted hardly 33.7 percent of the total population, while in rural areas, it was 34.7 percent (Table-1.3). The high proportion of non-working population poses additional burden on limited farm income. Also agricultural sector shared about 77.3 percent of the total workforce. The 64th Round of National Sample Survey (Govt. of India, 2010) for the year 2007-08, further showed that about 35.3 percent of the total workforce was self-employed in agriculture, and 17.2 percent was self-employed in non-agriculture, while agricultural labourers accounted for 34.7 percent of the total work force. The structure of the workforce in the state poses several important questions. First, can the present low yielding and subsistence agriculture sustain such a high burden of population and if not how to promote horizontal and vertical diversification for improving the present pattern of labour utilization. Second, what is the scope for upward mobility of the agricultural labourers which constituted as much as 35 percent of the total workforce in the state? Further, the state has overwhelmingly large proportion of small and marginal farmers. According to Agricultural Census, 2005 (Govt. of India, 2011a), it had 14.66 million operational holdings, of which 89.6 percent was marginal holdings, having less than 1

hectare each, while small holdings in the category of 1 to 2 hectare accounted for 6.7 percent of the total operational holdings. Thus, about 96.3 percent of operational holdings were marginal and small which operated nearly 69.6 percent of the total area. There were only 4 thousand large holdings above 10 hectare which operated 1.2 percent of the total area. Also about 72.3 percent holdings were sub-marginal in the size class of 0.5 hectare that operated about 27.1 percent of the total area. Nearly 7.6 percent rural households were reported landless. Both Agricultural Census and NSSO data for recent years clearly indicate that there is a rising trend towards marginalization of land holding as well as landlessness in the state. This poses a challenge to promote and sustain inclusive economic growth as majority of the small and marginal farmers are forced to live below the poverty line and lack the ability to save and invest for their upward mobility, while the landless labourers may still look for distress migration as a survival strategy. The question is whether the state government can think of and adopt some innovative land reform measures to contain landlessness and marginalization and also promote commercialization, diversification and value addition in agriculture for adequate employment and income growth of the rural households.

1.3 Incidence of Tenancy

Although the Bihar Land Reforms Act, 1961 (Section 19) prohibited leasing out agricultural land except by certain disabled categories of persons, there was large number of informal tenants without any security of tenure and incentive to cultivate land efficiently (Haque 2012). According to 59th round of NSSO (Govt. of India, 2006), tenant households constituted about 12.3 percent of total rural households in Bihar, covering nearly 8.9 percent of the total cultivated area, while some independent studies (Sharma: 2005; LBSNAA: 1992) had estimated the incidence of tenancy to be higher in the range of 20 percent to 37 percent. The question that remains to be addressed is whether informal, albeit insecure tenancy creates disincentives to raise farm productivity and also whether or not, legalization of land leasing would help improve the land access and livelihood of marginal farmers and landless labourers. One has also to see the whole issue of agricultural tenancy from the point of view of occupational mobility of farmers and development of non-farm activities.

1.4 Low Yield and High Yield Gaps Syndrome

The crop yields in Bihar are reported to be low in most cases and the productivity growth is slow. It would be seen from Table – 1.5 that the average per hectare yield of rice during the triennium ending 2011-12 was only 1457 kg against 2253 kg in the country and 3860 kg in Punjab, 3342 kg in Tamil Nadu and 2947 kg in Haryana. In the case of wheat it was only 2079 kg in Bihar against 3001 kg in the country and 4633 kg in Punjab and 4623 kg in Haryana. The average yield of maize in Bihar was 2319 kg per hectare, quite close to

an all India average of 2347 kg/ha. But it was much lower than that in Tamil Nadu (5062 kg/ha), Andhra Pradesh (4359 kg/ha) and West Bengal (3880 kg/ha). There are also reports of high yield gaps (ICAR, 2008), reflecting the difference between actual and potential yields of crops. However, there are indications that Govt. of Bihar is making systematic effort to bridge the yield gaps through appropriate infrastructural, institutional and policy changes. In 2011-12, there was a significant improvement in the yields of crops because of various initiatives undertaken by the Government. Neverthless, the yields continue to be lower than those in the relatively developed states like Punjab, Haryana, Tamil Nadu etc.

1.5 Agricultural Diversification and Value Addition

Agricultural diversification is often suggested as a means to improve farm income. In this context, Bihari farmers do not seem to lag behind. The state has a diverse cropping pattern. In 2009-10, about 81.2 percent area was under cereal crops, 7.7 percent was under pulses, 1.8 percent under oilseeds, 3.6 percent under fruits and vegetables, 1.4 percent under sugarcane and 1.9 percent under jute and other fibre crops. In terms of value of output, fruits and vegetables with just 3.6 percent area share, contributed 38 percent of the total value of output of agriculture and allied sector. The livestock shared 35 percent and the fisheries accounted for 4.4 percent of the total value of output of agriculture and allied activities, while the forestry shared about 4.5 percent. The question is whether there is scope for further agricultural diversification in favour of high value crops and enterprises and if so, what are the major technological, infrastructural and policy constraints? Similarly, there is need for analyzing the constraints and potentials of agro-processing for value addition and employment generation.

1.6 Agro-climatic Features

Agriculture in Bihar is largely dependent on rainfall. Even though about 61 percent of the total area is irrigated, frequent occurrence of either excess or scanty rainfall results in either flood or drought, causing loss of crops and livestock. The agro-climatic features also vary between different zones.

1.7 Cropping Patterns

The principal crops grown in Bihar include rice, wheat, maize, pulses, sugarcane and jute. Table 1.4 shows the percentage area under various crops. Rice constitutes about 46.3 percent of the total cropped area followed by wheat (29.4 percent), maize (9.4 percent) and pulses (7.3 percent).

1.8 Agro-climatic Zone

There are three distinct **Agro-climatic zones** in Bihar. These are (i) North West Alluvial Plains (Zone-I), North East Alluvial Plains (Zone-II) and South Bihar Alluvial Plains (Zone-III). The key characteristics of each zone are described below:

i) **Zone-I:North West Alluvial Plains**: This zone consists of the districts of Begusarai, Champaran East, Champaran West, Darbhanga,

Gopalganj, Madhubani, Muzaffarpur, Samastipur, Seohar, Sitamarhi and Vaishalli. The average rainfall is 1234.7 mm. The detailed district wise rainfall is given in Table 1.5. The soils are mostly calcareous. The soils in Gopalganj and Siwan are also affected by salinity and alkalinity. Although the average agricultural productivity in Zone-1 is good, there is scope for further improvement through appropriate soil and water management.

ii) Zone-II: North East Alluvial Plains: This zone comprises the districts of Arariya, Katihar, Khagaria, Kishanganj, Madhepura, Purnea, Saharasa and Supaul. The average normal rainfall in this zone is 1382.2 mm. The zone is full of dead channels of river Koshi. Its' sudden change of course has left several small lakes and marshes. There are vast areas which remain water logged during the monsoon season. Both agriculture and people of Zone-II, frequently bear the brunt of floods.

iii) Zone-III: South Bihar Alluvial Plains: Zone-III consists of the districts of Aurangabad, Arwal, Bhabua, Bhagalpur, Banka, Bhojpur, Buxer, Gaya, Jahanabad, Jamui, Lakhisarai, Munger, Nalanda, Nawada, Patna and Rohtas. The average rainfall is 1102.1 mm. The soils are mostly medium to heavy textured. There is hardly any marshy land in this zone. Several areas of this zone are drought prone and may require an appropriate drought proofing and drought mitigating agricultural production strategy.

1.9 Objectives of the Study

This study is a modest attempt to analyse various challenges and opportunities of agricultural development so that concrete pathways be built for accelerated, diversified and sustainable development of Bihar.

The specific objectives of this study were as follows:

i) To analyse the trends and patterns of agricultural development in Bihar,
ii) To identify the key challenges as well as drivers and opportunities for accelerated sustainable, diversified and inclusive agricultural growth in Bihar and
iii) To suggest appropriate policies and road map for accelerated and broad based agriculture and rural development in the state.

1.10 Methodology

The study is based on the analysis of available secondary data and review of relevant literature. Both tabular and regression analysis techniques has been used to arrive at the conclusions.

2

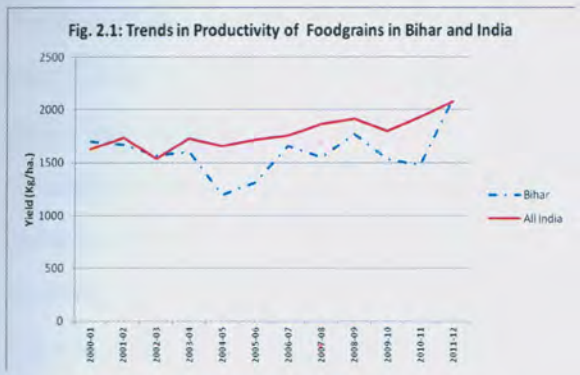
Agricultural Growth and Variability

2.0 Introduction

Agriculture continues to be the main source of livelihood for as much 77 percent of the states total workforce, while the share of agriculture and allied sector in the State Domestic Product was only about 22 percent in 2011-12. Therefore, accelerated and diversified agricultural growth is critical for household level food security and poverty reduction in the State. At the same time, agricultural production in Bihar is subjected to high variability which is a cause for concern.

2.1 Crop Production

There were some discrepancies in the data sourced from the Directorate of Economics and Statistics (DE&S), Govt. of India and that from the Economic Survey, Govt. of Bihar. It would be seen from Table-2.1 that production growth rate of foodgrains in Bihar during 2000-01 to 2011-12 was 1.77 percent per year as per the Bihar Government data, but only 0.23 percent based on data sourced from DE&S, Govt. of India. In fact, the annual growth rates of both production and yield of foodgrains were lower in Bihar than that of all India average, using Govt. of India's comparable data. The average per hectare yield of foodgrains in Bihar during the triennium ending 2011-12 was one of the lowest as per the Govt. of India data in the country. It was 1702 kg in Bihar against 1935 kg in the country and 4263 kg in Punjab, 2677 kg in Tamil Nadu, 3596 kg in Haryana and 2589 in West Bengal. However, it increased phenomenally in 2011-12, according to both sources. It increased from 1479 kg per hectare during 2010-11 to 2653 kg/ha in 2011-12 according to Govt. of Bihar data and 2098 kg/ha according to Govt. of India's data.Even using Govt. of Bihar's data, the annual growth rate of Per-capita foodgrain production in the State during 2000-01 to 2011-12 worked out to -0.22 percent against 0.87 percent in India as a whole.



Source: **Based on data of Govt. of Bihar, Economic Survey, 2012-13 use All India Data**

In the case of rice, the production growth rate continued to be negative based on both the sources of data, while the yield of rice increased at the rate of 1.24 percent per year based on Bihar Govt. data and 0.60 percent per year, using Govt. of India's data, as against the all India average growth rate of yield, estimated at 1.81 percent per year (Table 2.1). The yield of wheat continued to be lower in Bihar, based on both sources of data, but production growth rate of wheat was as high as 3.10 percent per year, using Bihar Govt. data and 1.03 percent based on Govt. of India's data. Similarly, the production growth rates of maize, oilseeds, jute, fruits, vegetables and fish in Bihar, based on Govt. of India's comparable data was much lower than that based on Bihar Govt. data. Also the average yields as well as the growth rates of yields of maize, pulses, oilseeds and rice were lower in Bihar, using Govt. of India's comparable data, while the variability (CV%) in both production and yield was higher than all India average variability in most cases. Despite significant improvement in the yields of crops in recent years, the low productivity and high instability syndrome continues, in the state.

2.1.1 District wise Yield Gaps

There was not only wide inter-district variation in the yield performance of various crops, but also huge yield gaps as shown by ICAR Frontline Demonstrations and SRI experiments.

2.1.1.1 Rice

During 2000-01 to 2010-11, for which the districtwise data were available, the annual growth rate of yield of rice was positive only in the districts of Khagaria, Nalanda, Nawada, Saharsa, Araria, Bhojpur and Darbhanga. In all other districts, it was negative (Table 2.2). Also the annual variability (CV%) in the yield of rice was quite high (above 40 percent), in Nalanda, Gaya, Muzaffarpur, East Champaran, West Champaran, Sitamarhi, Sheohar, Vaishali, Madhubani, Samastipur, Begusarai, Sheikhpura, Lakhisarai, Jamui and

Khagaria. The existing average yield was the highest in the districts of Bhojpur (2.03 tonne/ha), followed by Banka (2.00 tonne/ha), Kaimur (1.81 tonne/ha), Arwal (1.79 tonne/ha), Buxar (1.75 tonne/ha), and Rohtas (1.65 tonne/ha). At the bottom, the yield of rice was the lowest in Sheohar (0.28 tonne/ha), followed by Sitamarhi (0.35 tonne/ha), Begusarai (0.40 tonne/ha), Jamui (0.42 tonne/ha), Lakhisarai (0.44 tonne/ha), Munger (0.45 tonne/ha) and Sheikhpura (0.48 tonne/ha). In the remaining districts, the yield averaged between 0.50 tonne/ha and 1.43 tonne per hectare only. In fact, about 70 percent of the total rice area in the state had an average yield of less than 1.5 tonne/ha. The districts having relatively high area and low yield include Nalanda, Siwan, East Champaran, West Champaran, Sitamarhi, Darbhanga, Madhubani, Banka, Supaul and Purnia (Table 2.3). Almost 100 percent of the kharif rice area, 64 percent of rabi rice area and 11 percent of summer rice area had an average yield of less than 1.5 tonne per hectare.

The ICAR Frontline Demonstrations during 2009-10, showed that the yield of rice could be raised upto 4.96 tonne per hectare against the existing average yield of 1.57 tonne per hectare during the triennium ending 2011-12 and 2.46 tonne per hectare in the year in 2011-12. The yield gap varied from about 83.4 percent to 1259.5 percent in different districts. Further, the System of Root Intensification (SRI) experiments in Nalanda district of Bihar have shown that the yield of rice can be as high 14 tonne per hectare, against the present yield of 2.46 tonne per hectare, as observed in 2011-12 (Government of Bihar, 2012-13). Bridging such yield gaps through appropriate technology transfer, infrastructure and policy support may bring about the much needed rice revolution in the state.

2.1.1.2 Wheat

The annual growth rate of yield of wheat during 2000-01 to 2010-11, was negative in several districts, including Patna, Nalanda, Buxer, Bhabhua, Jehanabad, Aurgangabad, East Champaran, West Champaran, Lakhisarai, Supaul and Kishenganj (Table 2.2), while the yearly variability (CV%) in the yield of wheat was as high as 30 to 44 percent in East Champaran, Sheohar, Madhubani, Khagaria, Banka, Araria and Katihar.

There was wide inter-district variation in the yield of wheat. As of 2010-11, it was the highest in Gopalganj (3.39 tonne/ha), followed by Vaishali (3.32 tonne/ha), Katihar (3.06 tonne/ha) and East Champaran

(3.03 tonne/ha). At the bottom, the yield of wheat was the lowest in Kishanganj (1.22 tonne/ha), followed by Jamui (1.49 tonne/ha), Supaul (1.54 tonne/ha) and Sheikhpura (1.63 tonne/ha). All other districts had an average yield, ranging from 1.72 tonne to 2.94 tonne/ha. Table 2.3 shows the districts having relatively high area with low yield and high area with high yield of wheat. In fact, 40 percent of wheat area in the state had obtained yield of less than 2 tonne per hectare, while 4 percent had above 3 tonne per hectare and 23 percent area had 2.5 tonne to 3.0 tonne per hectare, during the triennium ending 2010-11.

The results of Frontline Demonstrations (FLD) conducted in Bihar in 2008-09, showed that the average yield of wheat could be increased to about 3.98 tonne per hectare, against the existing average yield of 2.21 tonne per hectare, as of 2011-12. Based on mean FLD yield, the gap ranged between 0.59 tonne per hectare in Gopalganj to 2.49 tonne per hectare in Jamui. Table 2.4 shows that the high yield gaps were observed in several districts including Kishanganj (226 percent), Jamui (168 percent), Sheikhpura (145 percent), Arwal (128 percent), Purnea (106 percent) and Munger (119 percent). Thus, bridging the yield gap of wheat through appropriate support system provides a good opportunity to make the state food secure and wheat surplus.

2.1.1.3 Maize

During 2000-01 to 2011-12, the average yield of maize declined at the rate of -0.06 perent per year, against an all India annual growth rate of 2.93 percent. It showed declining trends in several districts, including Patna, Nalanda, Buxar, Rohtas, Bhabua, Saran, Gopalganj, East Champaran, Vaishali, Begusarai, Lakhisarai and Madhepura. Also the annual co-efficient of variation in yield was above 30 percent in Bhojpur, Rohtas, Bhabua, East Champaran, West Champaran, Samastipur, Jamui and Araria (Table 2.3).

In the kharif season, about 34.4 percent maize had an average yield of less than 1 tonne per hectare and another 30 percent area had only 1 to 1.5 tonne per hectare. About 25 percent area had 1.5 to 3.0 tonne per hectare and only 11 percent area had an average yield of above 3 tonne per hectare. In the rabi season however, about 70 percent area had an average yield of above 3 tonne per hectare. In the summer season, nearly 66 percent maize area in the state had an average yield of above 3 tonne per hectare.

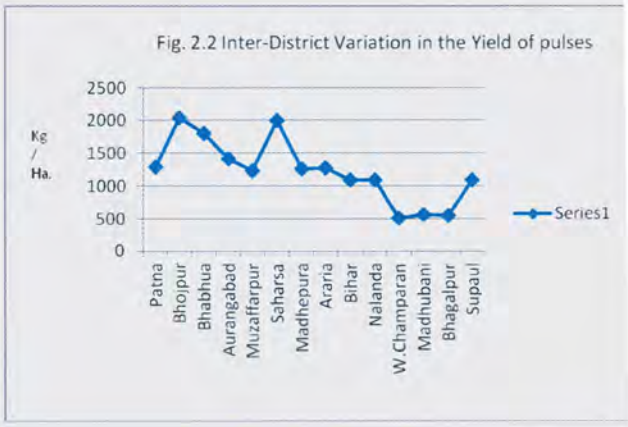
The Frontline Demonstrations conducted in Bihar in kharif 2007 showed that variety like

Shaktiman-4 could yield upto 3.77 tonne per hectare, against the current average yield of 1.40 tonne per hectare, while the average yield of rabi maize could be raised upto 7.7 tonne per hectare. The yield gap in maize was above 100 percent in Buxar, Begusarai, Khagaria, Patna, Lakhisarai, Nawada, Bhabua, Rohtas, Saran, Aurangabad and Munger. (Table 2.4).

2.1.1.4 Pulses

During 2000-01 to 2011-12, the average yield of pulses in Bihar increased at the rate of 1.55 percent per year (Table 2.2). But it declined in several districts, including Patna, West Champaran, Madhubani, Bhagalpur, Siwan, East Champaran, Sitamarhi, Sheohar, Begusarai, Sheikhpura, Lakhisarai and Jamui (Table 2.3). The annual variability in yield was as high 60.4 percent in Saharsa followed by 40.3 percent in Arwal, 33.9 percent in Samastipur, 32.0 percent in West Champaran, 31.8 percent in Bhojpur, 31.6 percent in Supaul and 31.4 percent in Bhabua. Besides, in several districts, the yield of pulses was much lower than the state average yield of 1.09 tonne per hectare. These districts include Jamui, Lakhisarai, Sheikhpura, Mungher, Begusarai, Samastipur, Sheohar, Sitamarhi, East Champaran, Vaishali, Bhagalpur, Madhubani and West Champaran where the yield of pulses was lower than even 0.6 tonne/ha. In fact, nearly 81 percent pulses area in the state had an average yield of less than 1 tonne per hectare.

The results of ICAR Frontline Demonstrations in Bihar showed huge yield gaps in various pulses (Table 2.4).



2.1.1.5 Oilseeds

The annual growth of yield of oilseeds (comprising mainly rapeseed & mustard and linseed) averaged about 2.65 percent per year in the state, as per Govt. of India's data and 3.70 percent per year, based on data of Govt. of Bihar. This was against the all India average growth rate of 3.09 percent. But districts like Saran, Purnia, Samastipur, East Champaran, West Champaran, Supaul and Araria had witnessed negative growth

(Table 2.2). The variability in the yield of both rapeseed & mustard and linseed was high in several districts. Also there was relatively high area and low yield in several districts, including Aurangabad, West Champaran, Purnia, Kishanganj, Araria and Katihar (Table 2.3).

2.1.1.6 Sugarcane

The average per hectare yield of sugarcane in Bihar was only 51.7 tonne against 71.7 tonne in the country and 101.5 tonne in Tamil Nadu, 90.3 tonnes in Karnataka and 84.9 tonnes in Maharashtra, as of 2011-12. During 2000-01 to 2011-12, the yield of sugarcane in Bihar increased at the rate of 1.21 percent per year, while the production growth rate was 7.66 percent per year, mainly under the impact of area increase (Table 2.1).

In several districts, including Banka, Bhagalpur, Kaimur, Rohtas, Kishanganj, Katihar, Purnia, Begusarai, Samastipur and Sitamarhi, the yield of sugarcane was lower than the state average yield.

2.1.1.7 Jute

During 2000-01 to 2011-12, area under jute declined at the rate 1.74 percent per year and production increased only by about 2.0 percent per year (Table 2.1). The per hectare yield of jute in Bihar was only about 1.28 tonne against the all India average yield of 2.39 tonne and about 2.42 tonne in West Bengal. The jute production was concentrated largely in the districts of Purnia, Kishanganj, Katihar and Araria.

2.2 HORTICULTURE

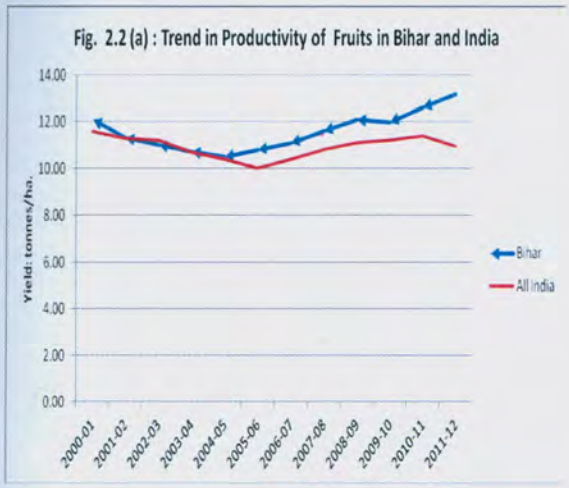
Bihar is known for its good quality litchi and mango. During 2011-12, about 0.298 million hectare of area was under fruit crops and the state produced about 3.93 million tonnes of fruits. Area under fruits constituted nearly 3.7 percent of the total cropped area. Also about 0.85 million hectare area was planted under vegetable crops and the state produced nearly 15.50 million tonne of vegetables. During 2000-01 to 2011-12, the production of fruits in the state increased at the compound annual growth rate of 1.93 percent per year of which the contribution of area was 0.67 percent and that of yield was 1.26 percent. The All India average growth rate of fruit production during the same period was about 5.62 percent mainly on account of high growth rate of area, estimated at 5.71 percent per year. But the annual growth rate of yield of fruits in Bihar was higher at 1.23 percent than the All India average growth rate of -0.08 percent (Table 2.1). During the same period, vegetable production in Bihar grew at the compound annual rate of 5.05 percent of which the share of area was 3.07 percent and that of yield 1.98 percent. The All India growth rate of vegetable production during this period was 4.77 percent per year, with an average yield growth rate of 1.34 percent per year.

The district wise time series data on fruits and vegetables are available for the past few years i.e. 2005-06 to 2011-12. The earlier data for some fruits and vegetables are also available, but are not comparable with recent data for various omissions and inadequacy.

2.2.1 Fruits

It would be seen from Table 2.5 that during 2005-06 to 2011-12, several districts had above 3 percent annual growth rate of area under fruits in Bihar. The average yield of fruit crops increased at the rate of 2.11 percent per year. Table – 2.5 further shows that the districts which had relatively higher annual growth rate of yield in recent years include Nalanda (3.01 percent), Kaimur (3.75 percent), Gaya (3.29 percent), Aurangabad (3.74 percent), Jehanabad (3.84 percent), Arwal (3.38 percent), Nawada (3.57 percent), Siwan (4.09 percent), Gopalganj (3.74 percent), Munger (4.14 percent), Lakhisarai (3.56 percent), and Khagaria (3.88 percent). The district Purnea had not only low annual growth rates of area

(1.72 percent) and production (1.67 percent), but also negative growth rate of yield (-0.04 percent). Other low growth performing districts were Bhojpur (1.32 percent), Sitamarhi (1.63 percent), Darbhanga (0.91 percent), Saharsa (0.76 percent) and Araria (1.11 percent). The average per hectare yield of fruits during 2011-12 was the highest in Rohtas (12.70 quintal) and lowest in Purnia (3.76 quintal). The annual variation in the yield of fruits was relatively high in Rohtas, Banka, Munger, Kaimur, Gaya, Aurangabad and Jehanabad. (Table 2.5).

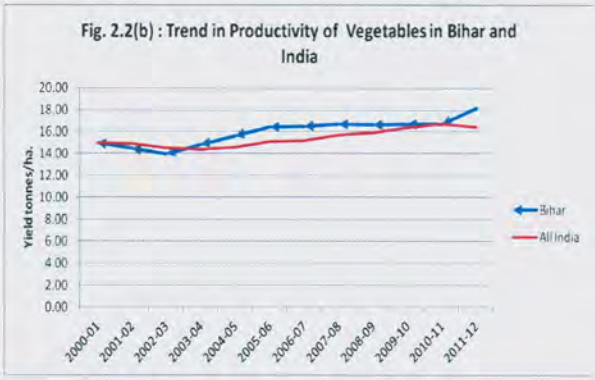


Source: **Based on data of Govt. of Bihar, Economic Survey, 2012-13**

During the triennium ending 2009-10, mango occupied nearly 49.87 percent of the total area under fruits in the state, followed by banana (10.59 percent), litchi (10.40 percent), guava (10.02 percent) and lemon (6.12 percent). Other fruit crops such as pineapple, papaya, aonla and a few other fruit crops were also grown on small scale. In terms of production weight, banana occupied the highest share (36.80 percent), followed by mango (33.72 percent), guava (7.05 percent) and litchi (6.27 percent).

2.2.2 Vegetables

The vegetable production in Bihar was spread throughout the state. During 2000-01 to 2011-12, the production of vegetables increased at the rate of 5.05 percent and yield increased at the rate of 1.98 percent per year (Table 2.1). More recently, during 2005-06 to 2011-12, the production growth rate of vegetables in Bihar was as high as 8.38 percent per year. In several districts, including Rohtas, Buxar, Bhojpur, Jehanabad, Arwal, Siwan, Goplaganj, West Champaran, Supaul, Banka, Munger, Lakhisarai and Sheikhpura, there was double digit growth in the production of vegetables per year (Table 2.5).



Source: **Based on data of Govt. of Bihar, Economic Survey, 2012-13**

Potato is the most important vegetable crop in the state, occupying about 313 thousand hectare of area with an average annual production of about 5.40 million tonne followed by cauliflower with an area of 62 thousand hectare and onion with 52 thousand hectare. The average yield of potato in the state was only 17.27 tonne per hectare against about 25 tonne per hectare in states like Gujarat, West Bengal and Punjab and 21 tonne per hectare in Uttar Pradesh. The Potato is produced in all districts of the State.

The average yield of onion in the state was 1.93 tonne per hectare as against the All India average yield of 1.63 tonne per hectare. But the yield of onion in Bihar was lower than that in Gujarat (2.80 tonne). During 2005-06 to 2010-11, the production of onion in the state increased at the rate of 1.22 percent per year, mainly on account of area expansion, as the yield declined at the rate of -0.13 percent per year.

Besides, Bihar had about 768.2 hectare area under flowers in 2010-11, of which 619.6 hectare was under loose flower and 148.6 hectare under cut flowers. During 2005-06 to 2010-11, the area under flowers increased at the rate of 32.3 percent per year. The annual growth rate of area under gladiolus and rose was as high as 63.4 percent and 33.7 percent per year respectively. During the same period, the production of cut flowers like gladiolus and rose increased at the rate of 63.4 percent and 35.7 percent respectively, while the production growth rate of loose flowers was 25.2 percent per year. However, there was no improvement in the yield of cut flowers, while the growth rate of yield of loose flowers was negative (-4.0 percent). During the same period, the yield of loose flowers in India increased at the rate of 0.47 percent per year.

2.3 LIVESTOCK

The estimated livestock population of Bihar in 2007 was 30.3 million, comprising 12.6 million cattle, 6.7 million buffalo, 10.2 million goats, 0.2 million sheep and 0.6 million other livestock. Bihar shared about 6.3 percent of India's cattle population, 6.4 percent of buffalo population and 7.2 percent of the country's total goat population. However, as the share of Bihar in total human population in the country was higher at 8.4 percent, the number of livestock per-capita of human population was relatively low in Bihar.

From the point of view of livelihood, access to livestock by agricultural workers is all the more important. In this respect, agricultural workers in Bihar had comparatively lower access to livestock. The number of cattle population per thousand agricultural population was only 505 against 769 in the country and the number of goats per thousand agricultural workers was 409 in Bihar against 543 in the country. The total number of livestock per thousand agricultural workers was only 1220 in Bihar against 2601 in Andhra Pradesh and 2046 in the country. The number of poultry birds per thousand agricultural workers was 459 in Bihar against 5359 in Andhra Pradesh and 2506 in the country as a whole.

During 2003 to 2007, the average annual growth rate of livestock in Bihar was 2.8 percent, against 2.2 percent in the country. During this period, cattle and buffalo population in Bihar increased at the rate of 4.0 percent against 1.8 percent in India. The number of poultry birds declined at the rate of -4.8 percent per year against the positive annual growth rate of 7.3 percent in India. Also the growth rate of goat was only 1.7 percent in Bihar against 3.1 percent in India (Table 2.6).

One positive feature of livestock development in Bihar is that the number of indigenous cattle declined overtime, while the number of cross bred cattle increased. The number of cross bred cattle increased at the compound annual rate of 11.6 percent in Bihar against 7.6 percent in India during 2003 to 2007, while during 1997 to 2007 it increased at the rate of 23.9 percent per year in Bihar and 5.1 percent in the country (Table 2.6). In fact, the number of cross bred female cattle increased at the rate of 30.4 percent per year in Bihar against 5.9 percent annual growth in the number of cross bred female cattle in India. The number of cross bred milch cows increased at the rate of 28.5

percent in Bihar against an all India average growth rate of 5.6 percent per year. The number of milch buffalo increased at the rate of 0.7 percent in Bihar and 1.3 percent in India during 1997 to 2007, but during 2003 to 2007, there was an improvement in the rate of increase in milch buffalo in Bihar (1.5 percent per year) against an all India average growth of 0.7 percent per year.

Livestock contributed nearly 40 percent of the value of output of agriculture and allied sector in Bihar, as against 26 percent in India (as of 2008-09). Milk shared nearly 60 percent of the total value of livestock output, followed by meat (18.0 percent), increment in stock (12.0 percent), Egg (2 percent) and others (CSD, 2011). The State produced about 6.1 million tonne of milk per year (as of 2009-10) of which 1.1 million tonne was from cross bred cows, 2.0 million tonne from non-descript cows and 2.8 million tonnes from buffaloes. Thus, about 51 percent of the total milk produced in the state was from cows, while buffaloes contributed 45.8 percent and goat shared 3.6 percent of the total milk production in Bihar.

However, the average yield per cross bred cow in milk was lower at 6.19 kg per day in Bihar against 8.45 kg per day in Gujarat and 6.87 kg per day in India. Also the average yield of non-descript cows was only 2.91 kg per day in Bihar against 4.68 kg per day in Haryana, 3.68 kg per day in Gujarat and Rajasthan. The average yield of buffalo in milk was only 3.92 kg per day in Bihar, while it was 6.67 kg per day in Haryana and 5.66 kg per day in Rajasthan and 4.57 kg per day in the country.

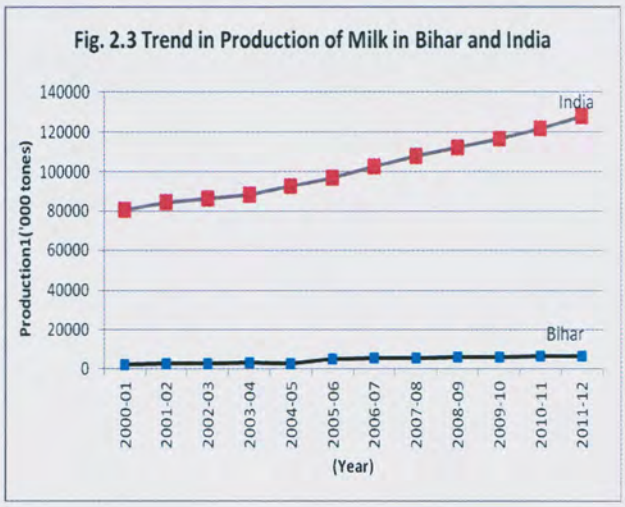
Goats contributed nearly 219 thousand tonne of milk in Bihar. But the average yield of goat milk also was as low as 0.14 kg per day in the state, against 0.79 kg per day in Haryana and 0.74 kg per day in Uttar Pradesh and 0.37 kg per day in India.

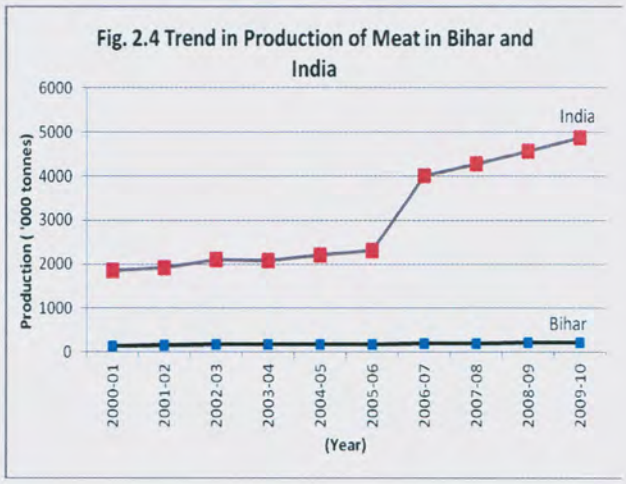
During 2000-01 to 2011-12 the average milk production in Bihar increased at the compound annual rate of about 10.67 percent against an all India average growth rate of 4.36 percent per year (Table 2.7). The per-capita availability of milk from all sources in the state increased from about 147 gram per day in 2004-05 to 175 gram per day in 2009-10 (Table-2.9). Figure 2.3 shows the trend in milk production in the State during 2000-01 to 2011-12.

The state produced nearly 1100 million eggs annually during 2007-08 to 2009-10. During 2000-01 to 2009-10, the average annual growth rate of egg production in Bihar was 5.78 percent against 5.68 percent in India.

During 2000-01 to 2009-10, the meat production in the state increased at the compound annual rate of 3.39 percent per year against an all India average growth rate of meat production of 9.41 percent per year during the same period. Figure 2.4 indicates the recent trend in meat production in Bihar.

The livestock census of 2007 further revealed that medium and large farmers in the state possessed more number of cattle and buffalo per holding, while marginal and small farmers had relatively more number of small ruminants such as goats, sheep & pigs and also poultry birds and ducks.

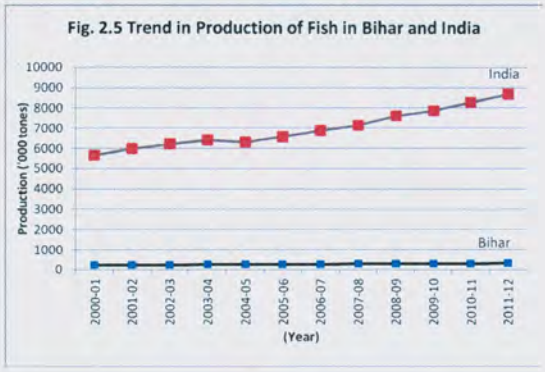




Source: **Based on data of Govt. of Bihar, Economic Survey, 2012-13**

2.4 FISH PRODUCTION

Bihar is endowed with vast water resources, which are suitable for fisheries and aquaculture. The state has about 0.197 million hectare of permanent water area and 0.119 million hectare of seasonal water area. These are in the form of rivers, reservoirs, lakes, ponds, community tanks, mauns, chaurs and irrigation canals. Unfortunately, these resources remain underutilized. It has been estimated that Bihar has about 69000 hectare of ponds and tanks, 9000 hectare of oxbow lakes, 35000 hectare of chaurs (water logged areas) and 3200 kms. of rivers and canals (Govt. of India, 2008). Fish production in the state increased from 0.222 million tonne in 2000-01 to 0.344 million tonne in 2011-12. Also the contribution of fisheries to GSDP dropped overtime from about 1.6 percent in 2001-02 to 1.0 percent in 2011-12. It would be seen from Table 2.7 that fish production in Bihar increased at the compound annual rate of about 3.20 percent per year during 2000-01 to 2011-12, a little lower than the all India average growth rate of 3.76 percent.



Source: Based on data of Govt. of Bihar, Economic Survey, 2012-13

2.4.1 Districtwise Distribution

Fish production takes place in all districts of Bihar (Table 2.8). But it is largely concentrated in the districts of Darbhanga, Madhubani, Sitamarhi, Sheohar, West Champaran, Saran, East Champaran, Samastipur, Katihar, Saharsa, Nalanda and Begusarai. Table 2.8 also shows that fish seed production in the state has large concentration in the districts of Darbhanga, Begusarai, West Champaran, Madhubani, Katihar, Muzaffarpur, Saharsa and Aurangabad.

2.4.2 Reservoir Fisheries

The potential of reservoir fisheries is reported to be poor in Bihar, compared to the neighbouring states of Uttar Pradesh and Jharkhand (Govt. of India, 2008). There are 29 reservoirs in Bihar out of which 26 are under the control of water resources department. The important reservoirs include Badu, Chandan and Orhini in Banka District, Phulwar in Patna and Nagi in Jamui district. The average level of fish productivity in reservoirs is very low, i.e. about 5 kg/ha. Using the available scientific knowledge in the country as ICAR claims (ICAR: 2008), production level can be increased to 30 kg/ha in large reservoirs, 50 kg/ha in medium reservoirs and 100 to 200 kg/ha in small reservoirs.

2.5 AGRO-INDUSTRIES

Bihar being primarily an agro-based state, agro-industries hold huge potentials for vertifical economic diversification. According to Annual Survey of Industries for the year 2007-08, agro-based industries in Bihar accounted for 88 percent of the total value added of Rs. 1159 crore of all industrial units in the state. However, the potential remains unutilized, even though Bihar is the third largest producer of vegetables in India and sixth largest producer of fruits. Also fish, chicken and meat get imported from other neighbouring states. Due to non-availability of storage facility, there are huge post-harvest losses. It has been estimated that 15 to 25 percent of total banana, 30 to 50 percent of papaya and 17 to 25 percent vegetables get wasted, due to poor methods of harvesting and transportation (Government of Bihar, 2011). Besides most of the food processing units are in unorganized sector, which has very few success stories, even though the state has potential for milling and processing of foodgrains like rice, wheat, maize and pulses. The existing rice mills require expansion and modernization. Besides, there are opportunities for utilization of rice by products for making starch, bran oil etc, along with establishing husk based power generation units. Also the level of maize processing in the state is insignificant, even though it produces large quantity of maize. The state may gain immensely by setting up maize processing units for making starch, corn oil, corn flakes, poultry feed etc.

In addition, the existing fruit and vegetable processing units need expansion and modernization for large scale, albeit quality production of fruit juices, pulps, squashes, pickles, jam/jelly, fruit beverages, tomato sauces/puree/paste etc. Bihar produces 0.20 million tonne of litchi and 1.4 million tonne of banana and 1.3 million tonne of mango, which offer significant opportunities for processing. Moreover, Bihar is the only Indian state, producing mahkana on commercial basis. It is rich in protein and carbohydrates which can be processed and sold. In the past few years, tea cultivation has expanded in Kishanganj district, covering about 10 thousand acres of land, which can increase further. At present, there are two tea processing units in the district, producing 2300 tonne of tea.

Bihar had about 0.26 million hectare under sugarcane (during the triennium ending 2008-09), producing about 14 million tonne of sugarcane. There are 28 sugar mills in the state, of which 19 are sick and non-functional. The production of sugar fluctuates from year to year. It was 0.451 million tonne in 2006-07, 0.390 million tonne in 2007-08 and 0.220 million tonne in 2008-09. There is need for early revival of the sugar industry in the state. The revival and modernization of sugar industry is required not only for adequate sugar production, but also for power generation, using ethanol.

However, dairy industry has made substantial progress in Bihar in the past few years, mainly under the impact of dairy co-operative movement. Bihar State Co-operative Milk Producer's Federation (COMFED) which is the implementing agency of operation flood programme is trying to promote dairy on the pattern of Anand model in Gujarat. There are six district level Milk Producer's Co-operative Unions, affiliated to COMFED, covering 26 districts in the state. Upto September, 2010 there were 9130 organised dairy co-operatives, of which 6451 were functional. The total registered membership of dairy co-operatives was 0.490 million. The average milk procurement per day increased from 281 thousand kg in 1999-2000 to 608 thousand kg in 2006-07. In 2007-08 and 2008-09, the procurement was low due to flood situation in most parts of the state.

3

Challenges and Opportunities

3.0 Key Challenges and Opportunities

It becomes clear from the foregoing discussion that productivity enhancement remains the key issue in all the sub-sectors of agriculture in Bihar, for which appropriate technological innovations, irrigation, input management, infrastructure and policy design present the important challenges as well as opportunities. Some of the key drivers of accelerated, diversified and sustainable agricultural growth in the State can be briefly discussed as follows:

3.1 Technological Innovations

Technology has been the key driver of agricultural and economic growth in all parts of the world in the past and there is no reason why adoption of appropriate technology cannot result in higher agricultural productivity growth in Bihar. The question is whether appropriate location specific, albeit high yielding varieties of seeds of various crops are adequately available and if so, how can these be taken to the field for productivity enhancement. A crop or sub-sector specific analysis is in order here:

3.1.1 Rice

The ICAR frontline demonstrations show that the yield of rice in Bihar can be substantially increased by bridging the existing technological gaps. The technological intervention suggested by ICAR include (i) cultivation of short duration and drought tolerant varieties, namely Vandana, Tulasi, Rajasthree, (ii) cultivation of Rajendra Mahsuri, Rajendra Sweta and Swarna in flood prone and submergence areas and Hybrid ARH2, DRRH 2 in normal situation, (iii) cultivation of bacterial blight resistant varieties such as Ajaya, 1R-64 and (iv) application of zinc sulphate in zinc deficient areas. (ICAR: 2008)

3.1.1.1 The System of Root Intensification (SRI)

The System of Root Intensification (SRI) is one of the new crop management systems through which production of rice can be substantially increased in an efficient and sustainable manner. It is said to be most suitable for small farmers in water scarce areas. Pradhan, a reputed non-government organization which is actively involved in promoting SRI in north Indian states claims that SRI requires less seed rate of about 2 kg per acre as compared to 20 kg per acre under improved rice cultivation. It also requires less water, less chemical fertilizers and in some cases even less labour if weeder is available. The Govt. of Bihar has already taken initiatives to promote

SRI on wider scale, in the past few months. The author's interaction with SRI adopters in the Gaya district reveal that rice yield can be increased by four times over the current average yield and also 60 percent more than the optimal yield obtained on ICAR Front line Demonstrations. Besides, there was a news item recently reporting that some paddy growers in Darveshpura village of Nalanda district obtained paddy yield, ranging from 17 tonne to 22 tonne per hectare.The adoption of Bayer hybrid variety Arize-6444 and Syngenta's hybrid 6302, along with appropriate agronomic practices under SRI method of cultivation was responsible for such high yields. If this is true, the extension of SRI method of cultivation and adoption of hybrid paddy are likely to result in greener green revolution in the State. (Agriculture Today: June, 2012)

3.1.1.2 Hybrid Rice

The experiments of Hybrid rice carried out in 48 sites in Bihar showed that it could yield as much as 7.45 tonne per hectare. Therefore, widescale adoption of hybrid rice could bring about substantial increase in rice production.

3.1.1.3 Flood Resistant Rice Varieties

In Bihar, nearly 40 percent of Kharif paddy area is flood prone, where paddy is grown under waterlogged conditions. Upto 30 cms of water depth, Swarna rice variety does well in rainfed low lands, but not in deep water condition. Swarna – Sub-1 variety does even better with an average yield of 3.07 tonne per hectare.

3.1.2 Wheat

The main constraints to productivity enhancement in wheat are low seed replacement rates, late sowing, low farm mechanization and folier blight disease. The recommended technological interventions (ICAR, 2008), include:

(i) cultivation of improved varieties such as KO307, HD 2733, HD 2824, HP 1761, PBW 443, HUW 468, K9017 and NW 1012 under irrigated timely sown conditions ;
(ii) cultivation of DBW 14, NW 2036, HW 2045, NW 1014, HD 2643, HP 1744 under irrigated late sown condition;
(iii) cultivation of K 8962, K8027, MACs 6145, HD 2888 under rainfed timely sown condition.
(iv) growing salinity/alkalinity tolerant varieties such as KRL 19 and KRL 1
(v) application of balanced nutrients ;
(vi) resource conservation technologies such as zero tillage, FIRBS and laser land leveling.

Besides, site specific nutrient management system and System of Root Intensification (SRI) method of wheat cultivation can enhance yield and reduce cost significantly. In Sabour (Bhagalpur district), the yield achieved using balanced Nutrient Management System (NMS) was as high as 13.8 tonne per hectare, as revealed through personal interaction with farmers. Using SRI method, the yield of wheat can be further increased. In fact, an effort is already being made by the State Government to extend SRI methods of cultivation in wheat.

3.1.3 Maize

The average yield of maize in Bihar was about 3.68 tonne per hectare in 2011-12, higher than the national average yield of 2.48 tonne per hectare. But the yield gap as seen from results of frontline demonstration was as high as 182 percent in kharif maize, 115 percent in rabi maize and 39 percent in summer maize. It was 300 to 400 hectare in some districts. In fact, with appropriate technological interventions, the yield level can easily be raised to 6 to 8 tonnes per hectare. The recommended interventions include

(i) cultivation of QPM hybrids HQPM1, Shaktiman 1, Shaktiman 2, Shaktiman 3 and Shaktiman 4 and normal grain single cross hybrids DHM 115, JH 3851, Prakesh, HM 5 and HM 4 for baby corn;
(ii) Winter maize as a better alternative to wheat under rice – wheat system due to rising temperature
(iii) Inter-cropping with potato, pea and vegetables in winter maize. (ICAR, 2008)

It may be noted that yield of winter maize has shown declining trend in recent years due to non-availability of adequate quantity of seeds of high yielding hybrids, while kharif maize suffer from water logging and floods and autumn maize faces moisture stress. Technological solutions would have to be found for all such constraints.

3.1.4 Pulses

Although the average yield of pulses in Bihar (0.99 tonne per hectare), was a little above the national average yield of 0.70 tonne per hectare, there were yield gaps, bridging of which would help enhance pulse production in the state. The yield gaps ranged from 44.8 percent in arhar to 91.8 percent in Masur, 106.5 percent in bengal gram and 150.9 percent in green gram. Also there was wide inter-district variation in the yield of pulses. Although there was not much breakthrough in technology for pulses, there were some improved varieties of chickpea, the adoption of which could help improve production. The recommended interventions (ICAR, 2008), are

(i) Growing high yielding, wilt, resistant varieties such as KWR 108, DCP 92-3, BG 256, RAU 52, Pusa Kabuli 1003, for timely sown and Udai, pusa 372 and Radhey for late sown.
(ii) Balanced nutrition with due emphasis on sulphur (20kg/ha) and Zn sou (25 kg/ha);
(iii) Intercropping with mustard
(iv) Cultivation of large seeded and fusarium wilt resistant varieties in diara area

3.1.5 Fruits

Some of the technological interventions for raising horticultural output in the state, according to ICAR would be as follows:

(i) Replacement of old senile orchards of mango and litchi by location specific superior varieties;
(ii) Adoption of high density planting, protected cultivation, micro propagation, hybrid etc.
(iii) Drip irrigation
(iv) Integrated nutrient management
(v) Food safety and quality control
(vi) Upgradation of cold storage units

3.1.6 Vegetables

i) Replacement of old varieties of potato like kufri jyoti, kufri luvkar etc. by heat tolerant variety kufri surya
ii) Adoption of advance nursery production technology for vetetables
iii) Use of hybrid summer king, Sychf 203 and DCH 541 varieties of cauliflower,
iv) Use of IVREC 2 cauliflower variety grown during September-October;
v) Application of boron and molybdenum for high yield of quality curd and better shelf life of cauliflower;
vi) Adoption of hybrid tomato varieties such as ARTH-4, NA 501, Arka vardhan, JKTH 3055
vii) Integrated nutrient and pests management.

3.1.7 Livestock and Poultry

According to ICAR (ICAR, 2008), Bihar can increase the productivity of cattle, buffaloes, goats and poultry by adopting the following technological improvements:

i) improved germplasm of frieswal cattle and murrah buffalo for 5 percent increase in milk production black Bengal goat for increased twinning percentage and backyard poultry (vanaraja, gramapriya, CARI priya) for 100 percent increase in egg production over indigenous birds;
ii) field based diagnostic kits and vaccines for all major diseases and
iii) hormonal modulation of poultry in organized farms for increase in egg production.

3.1.8 Fisheries

The main constraints to higher production of fish in Bihar are:

(i) Inadequate access to seed and feed,
(ii) Low stocking and
(iii) Lack of proper marketing

The recommended measures for productivity enhancement would include

(i) Adequate stocking of quality seeds
(ii) Carp culture
(iii) Fresh water prawn culture
(iv) Integrated fish–duck – poultry culture
(v) Rice – fish farming
(vi) Pen culture in wet lands and
(vii) Establishment of protected habitats along rivers.

These interventions can raise the fish production level in Bihar to about 0.45 million tonne, making the state self-sufficient in fish.

3.2 Ago-Industrialisation

The non-farm vertical diversification by way of development of agro-processing industries would be critical for improving the employment and income of agricultural workers. The growth of agro-industrial sector would critically depend on rural electrification, road connectivity, and legal and institutuional factors such as co-operatives, contract farming, retail chains, e-choupal etc. Also imparting quality education, training and skills would be important for improving employability of rural youth in non-farm enterprises.

3.3 Agricultural Extension

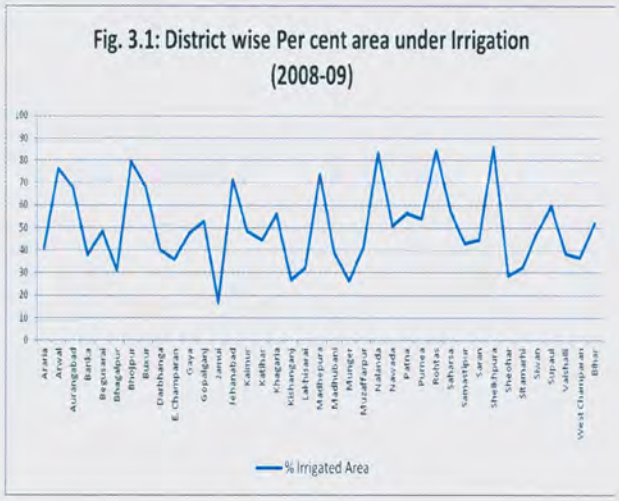
The agricultural extension system has a major responsibility and challenge in bridging the yield

gaps through transfer of location specific appropriate technologies and agronomic practices. Till recently the agricultural extension system in Bihar was more or less defunct and farmers were getting technical information mainly from input dealers and neighbouring farmers. During the 10th and 11th Five Year Plans, Agricultural Technology Management Agency (ATMA) was created in all the states of India, including Bihar, to revive the agricultural extension system. It aimed at putting in place a decentralized, albeit participatory agricultural extension system for better results. But in Bihar ATMA was dovetailed with the Department of Agriculture and was not made autonomous. It involved about 4000 Panchayat staff and farmer advisers. But as the location specific farmers' problems were not addressed and block agriculture officer lacked interest in many cases and also the partnership links between various stakeholders remained weak, the result of ATMA in bridging the technological gaps turned out to be insignificant (The World Bank, 2007). The other constraints included (i) non-transfer of funds to ATMAs directly, (ii) lack of adequate number of extension workers, (iii) lack of appropriate training of extension workers and (iv) lack of concurrent monitoring, evaluation and impact assessment. In the past one year, however, the state government has taken some measures to recruit additional agricultural extension workers and train them for technology transfer. Yet there is a need for more co-ordination between ICAR and state government as well as Manage and other training institutions for effectively extending the available technologies for improving farm productivity.

3.4 Irrigation and Water Management

As of 2008-09, about 61 percent of total cropped area in Bihar was irrigated against 45.3 percent in the country. About 57.2 percent of rice area, 60.5 percent of maize area, 91.8 percent of wheat area, 13.3 percent of barley area, 2.4 percent of pulses area, 38.8 percent of area under oilseeds and 27.7 percent area under sugarcane was irrigated. The correlation co-efficients of percentage of cropped area irrigated with crop yields were positive and statistically significant for rice and maize and fruits and positive, but statistically non-significant for wheat, rapeseed & mustard, linseed, sugarcane and vegetables. The correlation co-efficient for rice was 0.723 at 0.01 level of significance and .678 for maize at 0.01 percent significance level. In the case of fruits, it was 0.423 at 0.01 level of statistical significance.

Gross irrigated area in the state increased from 4.46 million hectare in 2000-01 to 4.92 million hectare in 2008-09. Of the total irrigated area, canal shared 34 percent, while well accounted for 7 percent and tubewell shared 55 percent and the rest was others. Also major tubewell irrigated area (about 92 percent) was diesel operated.



Since tubewells are the major source of irrigation in most places, it would be of interest to know that diesel operated tubewells increase the cost of production of farmers quite substantially, as the access to power operated tubewell irrigation is limited. This is much more a problem for the marginal and small farmers who depend on water hired from others on rent for which they have to pay higher prices. Whenever there is an increase in the diesel price, pump irrigation rental tends to jump. In several areas, farmers are changing their cropping pattern in response to high costs of diesel operated tubewell irrigation and also rental on it. Besides, surface irrigation system remains highly mismanaged in terms of water allocation, water use efficiency, cost recovery etc. In 2005, the status paper of Water Resources Department clearly pointed out that 'the existing irrigation system was breaking down and it called for urgent remedial measures, including participation of farmers, in the management of irrigation system'. In February 2006, about 1,50,000 hectare irrigated command area was transferred to water users' Associations, which are now taking care of maintenance and repairs. Water fee collection also has improved in areas where WUAs exist in the state. The Association gives 30 percent of the water charges collected for each crop season to the state government and it spends the remaining 70 percent on maintenance etc.

Out of the 5.353 million hectare of ultimate irrigation potential in the state through major and medium irrigation schemes, an irrigation potential of 2.880 million hectare was created upto March 31, 2010. By 2015, additional irrigation potential of 0.472 million hectare is planned to be created. Moreover, Seven Restoration Schemes are under execution to restore the lost irrigation potential of 1.214 million hectare. However, the utilization efficiency of irrigation potential (2.880 million ha) worked out to only 57 percent, as the area under major and medium irrigation was 1.637 million hectare, in 2009-10. By 2020-21, the state aims to have an estimated net irrigated area of 6 million hectare and gross irrigated area of 8 million hectare. But it is equally important to achieve water use efficiency. Also irrigation projects should be self-financing in the long run.

3.5 Literacy and Education

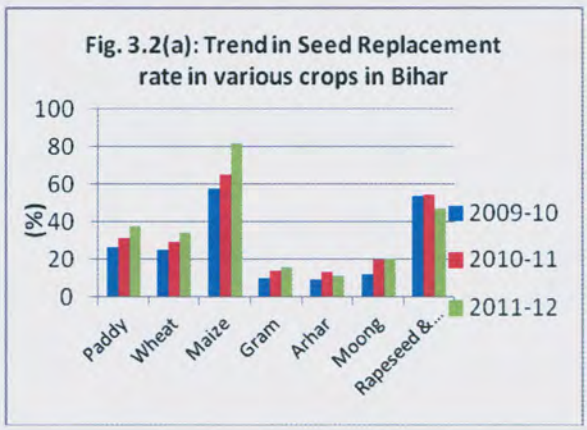
Farmers' literacy and education are important for their acquisition of skill for productivity enhancement in agriculture and also for their upward occupational mobility. The Perason correlation co-efficeints of literacy rate with crop

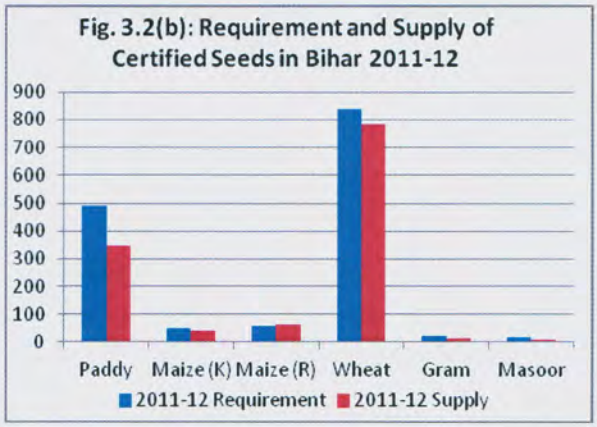
yields were found to be positive and statistically significant for wheat, rice, pulses, rapeseed & mustard, sugarcane and fruits. India's Eleventh Five Year Plan (Govt. of India, 2007) rightly points out that education, in its broadest sense of development of youth, is the most critical input for empowering people with skills and knowledge and giving them access to productive employment in future. According to 64th Round of National Sample Survey for the year 2007-08, about 52.5 percent rural population in Bihar was illiterate. In case of rural females, the illiteracy rate was as high as 63.6 percent.

3.6 Input Management

3.6.1 Seed

Inadequate availability of quality seeds and low Seed Replacement Rates (SRR) are often cited as reasons for low productivity of agriculture in Bihar. However, recent initiatives such as Chief Ministers' Crash Seed Programme, Seed Village Programme, provision of subsidized supply of seeds to farmers, revival of hitherto dormant Bihar State Seeds Corporation, and multiplication of seeds by state farm seems to have helped raising the SRR and farm productivity. The SRR for paddy increased from 26.4 percent in 2009-10 to 38.0 percent in 2011-12. During the same period, it increased from 58.0 percent to 82.0 percent for kharif maize, 9 percent to 11.2 percent for arhar, 11.0 percent to 22.1 percent for urad, 12 percent to 20.2 percent for moong, 25.3 percent to 34.8 percent for wheat 8 percent to 15.8 percent for gram and 10 percent to 15 percent for masoor. However, SRR in rapeseed & mustard seems to have declined from 54 in 2009-10 to 47.4 in 2011-12. Figures 3.2(a) and 3.2(b) show the SRR and demand supply gaps in seed respectively.





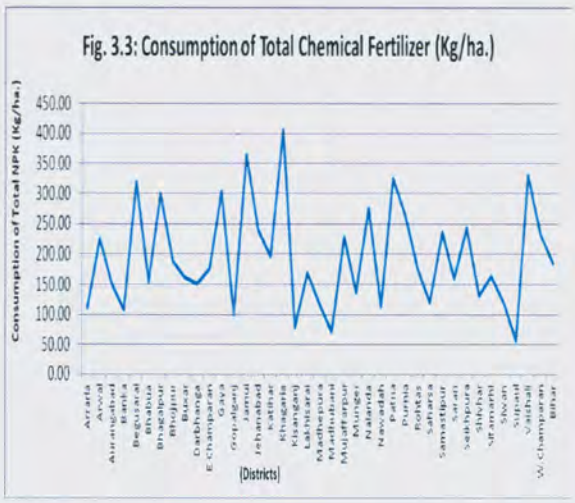
3.6.2Chemical Fertilizers

The consumption of chemical fertilizers (NPK) increased in Bihar from 96 kg per hectare in 2001-02 to 185 kg per hectare in 2010-11. This is much higher than the All India average consumption of 144.1 kg/ha, but lower than that of Punjab (242 kg/ha), Haryana (209 kg/ha),

Andhra Pradesh (253 kg/ha) and Pondichery (890 kg/ha).

However, there was large scale inter district variation in the use of chemical fertilizers (Table 3.1). There were 15 districts, which used more than 200 kg/ha. including Patna (324 kg/ha),

Nalanda (276 kg/ha), Gaya (304 kg/ha), Muzaffarpur (228 kg/ha), Jehanabad (240 kg/ha), Vaishalli (330 kg/ha), Jamui (364 kg/ha), Khagaria (406 kg/ha), Bhagalpur (299 kg/ha), Purnia (263 kg/ha), Samastipur (236 kg/ha), Sheikhpura (242 kg/ha), Begusarai (318 kg/ha), and Arwal (225 kg/ha). At the bottom, there were three districts which had less than 80 kg/ha of NPK consumption. These include Madhubani (72 kg/ha), Supaul (56 kg/ha) and Kishanganj (79 kg/ha). The co-efficient of inter-district variation in fertilizer consumption (CV%) declined from 56 in the triennium ending 2005-06 to 42 during the triennium ending 2009-10. In the case of nitrogenous fertilizer, it dropped from 54 percent in the first period to 41 percent in the later period, while for P_2O5 it declined from 77 percent in the first period to 45 percent in the later period, and for pottassic fertilizers, it dropped from 108 percent to 65 percent during the same period.



Source: Fertilizer Association of India,

The pearson correlation co-efficient of fertilizer use with crop yields was positive and statistically significant for vegetables, rapeseed & mustard, while it was positive, but statistically non-significant for wheat and pulses, and negative but statistically non-significant for rice, maize, linseed, sugarcane and fruits.

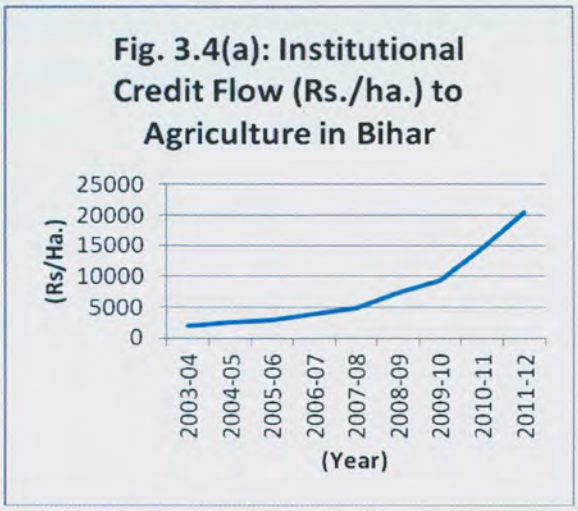
3.6.3 Organic Nutrients

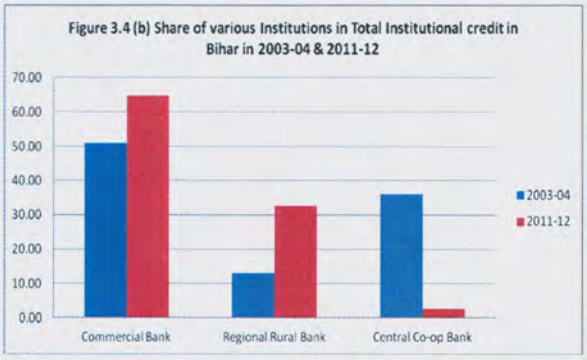
In order to maintain soil health and environment, it is necessary to apply organic nutrients in soil. Currently, the average use of organic nutrients in farming is negligible. However, the state government has recently supported the production and consumption of vermi-compost in Bihar. Besides, the use of bio-fertilizers is being promoted. About 0.30 million farmers are reported to have benefitted from various schemes.

3.7 Agricultural Credit

Farmers' access to institutional credit is one of the important determinants of private investment in agriculture. During 2011-12, about Rs.14998 crore of institutional credit was supplied to agriculture in Bihar, of which Rs. 9689 crore was from commercial banks, Rs. 4882 crore from Regional Rural Banks and Rs. 387 crore from Central Co-opeative banks. Figures 3.4(a) and 3.4(b) show the trends in the flow of institutional credit and shares of various sources in total institutional credit in the State. The compound annual growth rate of institutional credit flow to agriculture was 30.6 percent during 2003-05 to 2011-12.

The overall institutional credit flow to agriculture per hectare of cropped area was low in several districts, namely Supaul (Rs. 6162/ha), Sheohar (Rs. 6560/ha), Madhepura (Rs. 6650/ha) Araria (Rs. 6249/ha), Madhubani (Rs. 8176/ha), Sitamarhi (Rs. 9463/ha), and Darbhanga (Rs. 9475/ha), as against (Rs. 47505/ha) in Munger and (Rs. 44751/ha) in Patna (GoB, Economic Survey - 2010-11).





3.7.1 Credit - Deposit Ratio

The Credit Deposit ratio of all banks in Bihar was relatively low. At the end of 2009-10, the total deposit was Rs. 98588 crore and credit advanced was Rs. 31679 crore. The credit deposit ratio of the scheduled commercial banks dropped from 49 in March 2007 to 26.6 in March 2009, as against the average CD ratio of 75.0 in 2007 and 72.6 in 2009 at the All India level. Even when calculated on the basis of investment plus credit to deposit ratio, this was relatively very low in Bihar at 34.8 in March 2009 and 53.8 in March 2010, against 78.7 in March 2009 and 80.2 in March 2010 in the country as a whole

(Economic survey 2010-11, Govt. of Bihar). The CD ratio of Regional Rural Banks was comparatively higher than that of Commercial banks, but even in this case, the CD ratio dropped from 41.7 in 2007 to 38.70 in 2010.

3.8 Infrastructure

3.8.1 Road Connectivity

The provision of quality roads is necessary for transportation and marketing of agricultural inputs and output. This has been one of the neglected areas in Bihar, although the present government has shown active interest in developing the road infrastructure. In Government's own admission, about half of the villages in Bihar lack all weather road connectivity (Economic Survey, 2010-11, Govt. of Bihar). The pearson correlation co-efficients of road density with crop yields were positive for wheat, rice, maize, pulses, linseed, sugarcane and vegetables.

3.8.2 Power

The role of electricity in agricultural development is well recognized. Access to electricity plays a very important role in reducing the cost and improving the efficiency of irrigation and overall development of agro-processing units. The power consumption per lakh of total population in Bihar was only around 3.1 Gwh units against an all India average of 44.7 Gwh. During the past 25 years, no new power generating unit came up. The total installed capacity including hydel in the state was only 600 MW against the peak demand of 3000 MW. The deficit which was about 17 percent in 2006-07 increased to 40 percent in 2009-10 and about 45 percent in 2010-11. (Govt.of Bihar, 2011).

The State already lags behind others in terms of power availability and the situation is likely to worsen in the near future. At the end of 2009, Bihar State Electricity Board supplied only 15 percent electricity to irrigation consumers, while 27 percent went to industries and 33 percent to domestic consumers. In states like Punjab, Haryana, Andhra Pradesh, Madhya Pradesh, Rajasthan and Karnataka about 31 percent to 40 percent electricity consumption was for agriculture.

3.8.3 Markets

As on March 31, 2008, Bihar had about 1794 organised markets, of which 325 were wholesale markets and 1469 were rural primary markets. The number of markets per lakh hectare of gross cropped area was 23.5 in Bihar, against 14.2 in the country as a whole. But it was as high as 49.8 in Jharkhand, 47.2 in Kerala. The Pearson correlation co-efficients of market density with crop yields were found to be positive, for wheat, maize, linseed, sugarcane, fruits and vegetables. Recently, the Government abolished the Agriculture Marketing Societies, without an alternative institutional arrangement, which is likely to affect agricultural growth in the state adversely.

3.8.4 Warehouses/Godowns

In 2008-09, Bihar had about 97 warehouses and godowns of State warehousing Corporation and Food Corportion of India, which worked out 12.7 per one million hectare of gross cropped area, against an all India average of 17.1. The total storage capacity of these warehouses and godowns was 0.877 million tonne in absolute term and 1.3 tonne per one lakh rupees of value of output of foodgrains. In both absolute and per rupee of value of output term, this was much lower than the All India average figure.

It should be noted that non-availability of adequate godowns and warehouses could be a constraint to agricultural development in Bihar, in as much as it tends to depress the agricultural produce prices and discourages the farmers to produce more and also disables the state government and FCI to procure more at minimum support prices fixed by the Central Government.

3.8.5 Cold Storage

In 2010-11, Bihar had 251 cold storage units with a total capacity of 1.18 million tonnes. It worked out to 63.76 kg per tonne of production of fruits and vegetables in the state. The number and capacity of cold storage was higher in other states. For example, Uttar Pradesh had 1589 cold storage units with a total capacity of 10.11 million tonne. It worked out to 30.08 tonne per 1 million rupees of value of output of perishable commodities as against 6.46 in Bihar, Punjab had 422 cold storage units with 1.35 million tonne capacity and Gujarat had 398 cold storage units with 1.27 million tonne capacity.

Within Bihar, there was wide iner-district variation. The CV% showings inter district variation in the number of cold storages per unit of area and per tonne of production of fruits and vegetables was 123 and 107 respectively. The cold storage facility was largely concentrated in the districts of Patna, Saran, East Champaran, Vaishalli, Samastipur, Begusarai and Purnea. The Pearson correlation co-efficients of number of cold storage with yields of crops were positive for both fruits and vegetables.

3.9 Agricultural Insurance

Nearly 50 percent of cultivated area in Bihar is highly prone to natural calamities like floods and drought. But the insurance coverage is quite low. During rabi 1999-2000 to rabi 2008-09, only about 1.27 million farmers in Bihar benefitted from it, while 3.73 million farmers and 4.53 million hectare area were covered by insurance. Also the existing crop insurance policy is not very farmer friendly. Small farmers are generally risk averters and unless there is a comprehensive, albeit farmer friendly agricultural insurance policy, agricultural growth in flood and drought prone areas of Bihar is likely to suffer. Also the unit of application should be either individual or village, not tehsil or block, as is the case at present.

3.10 Public Investment

The capital expenditure for agriculture in Bihar increased from about Rs. 260 million in 2000-01 to Rs. 1263 million in 2008-09 and Rs. 1173 million in 2009-10 (BE). The overall public expenditure on agriculture and allied activities as percent of GDP of agriculture and allied sector at current prices increased only marginally from 2.2 percent in 2000-01 to 3.9 percent in 2008-09 and 2.7 percent in 2009-10 (BE). The share of agricultural education and research remained low in the range of 0.1 to 0.3 percent during this period. It improved only marginally from 0.1 in 2000-01 to 0.3 in 2008-09 and 0.2 in 2009-10.

Box - 3.1: Public expenditure on agriculture and allied activities as percent of GDP of Agriculture & Allied Sector

Year	Agri. & Allied Activities	Agri. Education & Research
2000-01	2.2	0.1
2001-02	1.8	0.2
2002-03	1.6	0.2
2003-04	1.7	0.2
2004-05	1.7	0.2
2005-06	2.0	0.2
2006-07	1.9	0.3
2007-08	2.4	0.3
2008-09(RE)	3.9	0.3
2009-10(BE)	2.7	0.2

Source: Based on State Finance, Ministry of Finance, Govt. of India

3.11 Cost of Production and Farm Profitability

Based on existing costs of production, minimum support prices and yields, most of the food crops in Bihar do not yield much return. It would be seen from Table-3.2 that the net return per hectare for paddy in Bihar was Rs. 5775 only in 2008-09, against Rs. 16389 in Punjab. In the case of wheat, it was Rs. 7848 per hectare against Rs. 11862 in Haryana. For maize, the net return per hectare however, was higher at Rs. 16220 in Bihar, one of the highest in the country. The net return per hectare in the production of gram was Rs. 8495 in Bihar which was relatively higher than all other states. The net return per hectare in the production of lentil also was relatively higher in Bihar (Rs. 2807). In the case of arhar it was Rs. 4298 per hectare, better than other states. But the question is even if a small farmer takes two crops from all his plots, his income from these crops is not sufficient enough to provide decent livelihood. He needs to supplement his income from diverse sources for sustenance. Anyway his ability to invest in farm improvement remains low because of low income. This is so even if he receives minimum support prices for his farm products. It should be noted that farm harvest prices in Bihar remain generally lower than minimum support prices for several important commodities (Govt. of India, CACP Reports, 2008-09 to 2011-12)

3.12 Land Reform

Bihar was one of the early states to initiate legislation on abolition of zamindari (intermediaries) in 1947, which was later incorporated in the Bihar Land Reforms Act, 1950. The Bihar Land Reform Act, 1961 also imposed ceiling on land holdings, which was not effectively implemented. However, due to

growing pressure of population on land and other socio-economic dynamics, the traditional semi-feudal production relations have disappeared, while marginalization of land holding and landlessness have increased. Besides, The Bihar Tenancy Act, 1885, as amended in 1970, provides that an under raiyat in continuous possession of land for twelve years can acquire the right of occupancy provided the landowners from whom the land is leased in, owns more than five acres of irrigated land or ten acres of other land, which create fear in the minds of landowners while leasing out land. Also the Bihar Land Reforms Act, 1961 prohibits creation of future tenancy, except by certain categories of disabled persons i.e. minor, widow or unmarried, divorced or separated woman or person suffering from mental or physical disability or a person in the Armed Forces or in Public Service receiving salary not exceeding Rs. 250 per month. Since the law prohibits sub-letting, the sub-lessee who has all the characteristics of an under-raiyat does not acquire the right of occupancy. Even though the tenancy is prohibited in Bihar, informal albeit insecure tenancy continues, which creates inefficiency in agriculture. According to 59th round of NSSO for the year 2002-03, about 12.3 percent rural households in Bihar leased in land, covering about 8.9 percent of the total cropped area. Some independent studies (Sharma, 2005; LABSNAA, 1992) however, showed that incidence of leasing was as high 25 to 37 percent in Bihar. Nearly 99 percent of those who leased in land were landless and semi landless households. About 87 percent of them owned less than 0.5 hectare land. Informal tenancies according to some recent studies (Haque 2001: Sharma 2012), impede agricultural efficiency as well as equity, as tenants are mostly small and marginal farmers.Therefore, land leasing reform especially by way of legalization of land leasing and improvement in tenant farmers' access to institutional credits, insurance etc. could be an important source of inclusive agricultural growth.

3.13 Land Utilisation Pattern

Land utilization pattern in Bihar is quite unbalanced. Forests cover hardly 6.6 percent of the total reported geographical area of the state. It was only in the few districts, where there are some forests, namely Kaimur (33 percent), Jamui (30 percent), Nawada (26 percent), Munger (20 percent), Rohtas (17 percent), Gaya (16 percent), Banka (15 percent), Lakhisarai (10 percent) and Aurangabad (6 percent). In all other districts it is either nil or negligible. Forests cover should increase in the state, for maintaining agro-ecological balance. This can be done by converting some barren and culturable waste and permanently kept fallow land in different districts.

There may not be much scope for increasing the net sown area in most places, unless some culturable waste land and permanently held fallow lands are brought under cultivation. In the districts of Jamui, Khagaria, Sheikhpura, Bhagalpur, Munger, Katihar, Kishanganj,

Purnea, Araria, Saharsa, Bhojpur, Nalanda, Rohtas, Kaimur, Buxer, Nawada, Saran and Gopalganj, above 1 percent of the area was kept fallow other than current fallow. It was highest in Jamui (5.4 percent) followed by Khagaria (4.9 percent), Sheikhpura (2.7 percent), Lakhisarai (5.0 percent) and Arwal (2.6 percent). These areas can be suitably put under either agro-forestry or agriculture.

Cropping intensity differed widely from district to district. The districts having relatively higher cropping intensity included Saharsa (1.76 percent), Madhepura (1.73 percent), Sheohar (1.72 percent), Supaul (1.64 percent), Sheikhpura (159 percent), Khagaria (159 percent), Araria (154 percent), Katihar (154 percent) and Vaishalli (153 percent) (Table 3.3). The cropping intensity was comparatively low in Jamui (110 percent), Banka (114 percent), Bhagalpur (116 percent), Patna (111 percent), Nalanda (117 percent), Saran (122 percent), Munger (122 percent), Gaya (123 percent), Darbhanga (128 percent), East Champaran (126 percent), Rohtas (128 percent) and Samastipur (129 percent). The cropping intensity does not seem to be always positively associated with irrigation. For example, Nalanda had about 83 percent area irrigated, but cropping intensity was only 117 percent. Patna with 57 percent irrigated area had 111 percent cropping intensity and Rohtas with 85 percent irrigated area had only 128 percent cropping intensity (Table 3.3), while Sheohar with only 29 percent area under irrigation had 172 percent cropping intensity. There is a need to look into these aspects more closely so that cropping intensity could be improved where feasible.

3.14 Soil Health

Notwithstanding the fact that Bihar is endowed with fertile land and plenty of surface and sub-surface water for agriculture, there are about 0.414 million hectare saline and alkaline soil (chaur lands) and 0.516 million hectare of diara land. While Chaur lands are fit for fish farming and vegetable cultivation and could be improved for productivity enhancement, diara lands are inundated by water for varying period. About 0.253 million hectare of land in Bihar has been identified by the government which requires soil conservation treatment. While works are under progress to treat 60 thousand hectare under existing watershed development programmes, the remaining area also needs to be treated. The area requiring soil conservation treatment is largely concentrated in Patna (24140 ha), Gaya (32044 ha), Rohtas (23794 ha), Aurangabad (19450 ha), Bhagalpur (19350 ha), Bhojpur (18060 ha), Bhabua (17082 ha), Banka (17720 ha) and Jamui (16212 ha), Buxur (12710 ha), Jehanabad (11925 ha), Lakhisarai (9785 ha), Nawada (5572 ha), Sheikhpura (4635 ha) and Munger (2615 ha).

Besides, in most places, soils are deficient in zinc and magnesium, calcium and broming and also iron and suffer in some places. A balanced use

of macro and micro nutrients is necessary for agricultural productivity improvement.

3.15 Variations in Rainfall

Even though about 61 percent of the cropped area in Bihar is reported to be irrigated, agricultural production and productivity is still heavily dependent on rainfall. The correlation co-efficients of annual rainfall as well as south west monsoon rainfall with food grains were positive.

3.16 Floods and Drought

Bihar is rich with water resources, endowed with 14 rivers and a good average rainfall of 1271.9 mm. But both river water and rainfall are quite unevenly distributed and the occurrence of floods and drought are quite frequent in some places. The flood prone area in Bihar is estimated at 6.88 million hectare which constitutes about 73.1 percent of its geographical area and 41 percent of the total cropped area. It would be seen from Table 3.4 that about 2.2 million hectare of cropped area in the state is flood prone. The cropped area generally affected by flood is as high as 100 percent in Araria, Muzaffarpur and Sheohar, while it is 50 to 75 percent in Katihar, Begusarai, Sitamarhi and Sheikpura. It has been estimated that during the kharif season, 23 percent of rice area in the state remains waterlogged, for which there are not many rice varieties which can be grown there for high yields. Floods also affect not only crop yields, but also rural infrastructure such as roads, houses, market etc. In several places, it also results in large deposit of sand, gravel and stone, making the cultivation of land difficult.

The focus of the state government has so far been on short term measures like creating embankment while there is no concrete plan to prevent siltation and heavy erosion. As a result, the state suffers heavy losses due to flood quite frequently. In 2007 about 20 million people were affected by flood and 495 persons lost their lives. Besides, 555 livestock was lost. Nearly 1.59 million hectare of cropped area was affected (Down to Earth, Sept. 15, 2007). There should be planned efforts to create an extensive network of water retaining bodies such as lakes, ponds and groundwater recharge to help reduce the inflow of water into big rivers like Koshi. Also feasibility of interlinking of rivers having proper co-ordination and support from Govt. of Nepal, Union Govt. of India and neighbouring state governments could be worked out. Moreover, districts such as Munger, Nawada, Rohtas, Bhojpur, Aurangabad and Gaya witness drought frequently affecting crop as well as livestock output adversely. Appropriate drought proofing and drought mitigating strategies such as adoptions of drought tolerant crop varieties, rain water harvesting may help improve productivity in drought prone areas. In fact, climate change is likely to create more agricultural uncertainties in future in this regard which need to be properly addressed.

4

Conclusions and The Ways Forward

4.0 Key Findings

The state of Bihar has achieved an impressive economic growth in recent years. But the agricultural sector continues to be in low level equilibrium trap. Due to low productivity, low size of holding, low income, low or no savings and low access to non-farm income, majority of the farmers in the state are in poverty trap. In rural Bihar, about 55.3 percent of the population still lived below the poverty line in 2009-10. During 2000-01 to 2011-12, the average annual growth rate of Gross State Domestic Product at constant price was 11.72 percent, against an all India average growth rate of 8.37 percent. However, this remained largely a non-agriculture led economic growth. The annual growth rate of gross state domestic product from agriculture and allied activities in Bihar was only 2.93 percent during this period, against an all India average growth rate of 3.62 percent per year. In fact, the annual growth rate of agricultural GSDP per-capita of rural population was only 0.85 percent during 2001-02 to 2010-11. Increasing the per-capita income of agricultural and rural population is a real challenge for achieving inclusive economic growth in the state, as about 77 percent of the total workforce were engaged in agriculture and nearly 89 percent of the total population lived in rural areas. Besides, per-capita availability of foodgrains, milk, fish and fruits and vegetables in Bihar is one of the lowest in the country.

Nearly 93 percent of the total cropped area in Bihar was under food grain crops. But the yields of all food crops were very low in most places. Also due to high growth rate of population and decline in the foodgrains production, the per-capita production of foodgrains declined from about 145 kg in 2000-01 to 95 kg in 2010-11. About 90 percent of the total rice area in the state had an average yield of less than 2 tonne per hectare and only 10 percent area had an average yield of more than 2 tonnes per hectare. In the case of wheat, nearly 73 percent of the area had less than 2.5 tonne per hectare and only 4 percent area had an average yield of above 3 tonnes per hectare. Similarly, about 34 percent of maize area had less than 2.5 tonne per hectare yield, although 88 percent of the area under summer maize and 95 percent of the area under rabi maize had an average yield of above 2.5 tonnes per hectare. In the case of pulses, the average yield was less than 1 tonne per hectare in almost all the districts, excepting Samastipur, Gaya, Patna, Sheikhpura and Bhojpur. Improving the yields

of cereals and pulses is necessary not only for ensuring household level and state level food security, but also for releasing area for high value crops such as fruits, vegetables, flowers, spices, fodders etc. The yield gaps exist even in the case of horticultural crops, livestock and fisheries. There are both biotic and abiotic constraints to yield improvement. The major biotic constraints in the crop sector include sheath blight, bacterial leaf blight, blast and stem borer for rice, rust for wheat, stem borer and termite for maize and pod borer for lentil. The key abiotic constraints include flood, drought, water logging, soil sodicity and soil acidity. Besides, knowledge gap, inadequate access to quality seeds and fertilizers, irrigation, credit, insurance and market and price incentive act as constraints to agricultural development in general. Regarding vertical diversification through agro-industries, inadequate and erratic power supply, poor road connectivity and lack of quality education and skills for rural youth act as bottlenecks, aside from other technological, institutional and policy constraints.

4.1 Potentials for Growth

Bihar has huge untapped potentials for accelerated and inclusive growth. It has relatively good rainfall, fertile soils, abundant sunshine, comparatively high proportion of irrigated area and hard working farmers and other agricultural workers. The ICAR frontline demonstrations show huge yield gaps in respect of all crops, the bridging of which would pave the way for accelerated and inclusive growth. Besides, the potentials for both horizontal and vertical diversification exist. However, there are several challenges, proper understanding of which would be necessary to work out an appropriate strategy for utilizing the growth potentials in the agriculture and allied sector.

4.2 Key Challenges

The key challenges to rapid agricultural development in Bihar include the following:

- improving crop yields and bridging the technological gaps
- ensuring timely and adequate supply of quality inputs
- improving irrigation and water management
- reducing cost of production and improving farm profitability
- improving supply of institutional credit
- increasing public investment in agriculture
- creating adequate organized markets and commodity supply chains
- establishing adequate warehouses and godowns
- setting up adequate cold storage facilities
- providing effective insurance against loss of crops and livestock due to natural calamities
- providing quality education and skills to farm youth
- improving road connectivity
- improving farmers access to electricity
- providing integrated support for the development of livestock and dairy

- providing technological and institutional support to increase fish production
- providing integrated support for development of rural non-farm activities
- implementing innovative land reforms
- improving soil health and land utilization

4.3 The Ways Forward

The broad road map for accelerated, diversified, inclusive and sustainable agricultural development in Bihar would be as follows:

4.3.1 Bridge the yield gaps and Improve yields of various crops through appropriate technological, institutional and policy changes. The key interventions would include

(i) adoption of appropriate location specific drought tolerant and flood tolerant crop varieties, as already indicated.

(ii) adoption of the system of rice/root intensification,

(iii) adoption of hybrid rice,

(iv) adoption of salinity/alkanity tolerant wheat varieties,

(v) adoption of resource conservation technologies, such as zero tillage, FIRBS, laser land leveling etc.

(vi) application of location specific balanced nutrients,

(vii) adoption of hybrid maize varieties,

(viii) encourage winter maize to wheat under rice-wheat system,

(ix) adoption of high yielding, albeit wilt resistant varieties of pulses and mustard,

(x) adoption of tissue culture for raising sugarcane production.

(xi) Strengthen agricultural extension and linkage between agricultural research and extension.

The yield gaps exist also in respect of horticultural crops. The key necessary steps for yield improvement would include high density planting, protected cultivation, micro propagation and hybrid. Besides, improvement in production would require replacement of old and senile orchards of litchi and mango and expanded market by way of improved road connectivity, cold storage, air cargo, institutional credit facility, integrated nutrient management, irrigation, food safety and quality control.

4.3.2 Ensure Adequate and Timely Supply of Quality Inputs

Availability of inputs, especially quality seeds, fertilizers and pesticides in time has always remained a problem for the farmers in Bihar. Therefore, this problem has to be addressed on priority basis. The measures to improve the supply of quality inputs would include (a) public sector investment in seed production and processing, (b) implementation of seed village programme, (c) strengthening of Bihar state seed corporation to process and market seeds produced by farmers, (d) providing punishment for sale of spurious seeds, (e) assessing the

demand for various macro and micro nutrients well before the crop season and ensuring their adequate supply at affordable prices, (f) extension services for promoting balanced use of macro and micro nutrients, (g) organic farming in niche areas and a few selected products, keeping in view their export potentials, (h) promotion of integrated pest management and integrated nutrient management, including bio-pesticides. Farmers may be organized as self-help groups to be in contact with input suppliers and to obtain quality inputs in an empowered manner.

4.3.3 Improve Irrigation and Water Management

Even though about 61 percent of gross cropped area in the state is irrigated, there is wide inter district variation. The districts like Araria, Sheohar, Sitamarhi, Gopalganj, Muzaffarpur, East Champaran, West Champaran, Madhubani, Siwan, Jamui and Bhagalpur had less than 50 percent area under irrigation. Efforts should be made to increase area under irrigation in these districts. Besides, irrigation use efficiency should be improved through drip irrigation, sprinkler irrigation etc, especially in horticultural crops. In addition inter-linking of rivers and rivulets, drainage improvement, conjuctive use of surface and groundwater, participatory irrigation management through water users associations and electrification of private tubewells can significantly enhance irrigation and water use efficiency. The recent initiative for intra-linking of rivers like Noon, Budhi Gandak and Ganges within the state needs to be speedily implemented and work on interlinking of rivers in co-operation with Govt. of Nepal would have to be appropriately planned.

4.3.4 Reduce Cost of Production and Improve Farm Profitability

Due to high costs of production, low yield, low farm harvest prices and low net returns, cultivation of rice, wheat and pulses and oilseeds is not very rewarding for the farmers in Bihar. The per hectare net return for paddy was Rs. 5775 only in 2008-09 against Rs. 16389 in Punjab and in the case of wheat, it was Rs. 7848 against Rs. 11682 in Haryana. In addition, farm harvest prices fluctuate widely from year to year and there is no effective mechanism for implementation of minimum support prices. While there is need for reducing the cost of production by way of increased use of organic matters, electrification of tubewells, balanced use of macro and micro nutrients, low rate of interest on credit and improved resource use efficiency, improvement in yield and remunerative prices would hold the key to profitability and viability of small farms.

4.3.5 Improve Supply of Institutional Credit

The farmers' access to institutional credit is highly inadequate in Bihar. Also the credit – deposit ratio in the state from all institutional

sources is one of the lowest in the country. The state government should work in close coordination with the Commercial Banks, Regional Rural Banks, Co-operatives and also NABARD to ensure adequate and timely availability of crop loans as well as term loans at reasonable rates of interest.

4.3.6 Create Adequate Organized Markets and Commodity Supply Chains

At present, the number of organized agricultural markets per hectare of cropped area is very small in several districts, namely Rohtas, Gaya, East Champaran, West Champaran, Sheohar, Lakhisarai, Jamui, Khagaria, Banka and Saharsa. There is need for creation of additional organized markets in these districts. The state has recently abolished agricultural marketing societies without putting an alternative system in place which is the need of the hour. Besides, agricultural commodities like maize, dairy, litchi, mango and potato in Bihar which have comparative trade advantage due to high productivity, lose value and competitiveness due to transportation and wastage costs, as the processing and marketing facilities are highly inadequate. Also considerations of quality, brand power and transaction costs act as barriers to entry to international markets. The setting up of processing units and commodity supply chains would help improve the situation.

4.3.7 Set up Adequate Warehouses and Godowns

The non-availability of adequate godowns and warehouses act as a constraint to agricultural development by depressing the agricultural product prices and discouraging the farmers to produce more. Also the FCI fails to procure agricultural commodities at minimum support prices fixed by the central government due to lack of adequate storage facilities. Hence the central and state government should create adequate godowns and warehouses in the state.

4.3.8 Set up Adequate Cold Storage Facility

There is a huge gap between the demand for and the availability of cold storage facilities in the state, in the absence of which perishable commodities like fruits and vegetables lose value. Therefore the state government should set up adequate cold storage facility with adequate capacity in different districts.

4.3.9 Provide Effective Insurance Against Loss of Crops and Livestock Due to Natural Calamities

In view of frequent occurrence of natural calamities like floods, drought and diseases, farmers should be provided adequate insurance coverage for loss of crops and livestock, in the absence of which their ability and willingness to invest in agriculture remain low.

4.3.10 Provide Compulsory Education and Skill to Farm Youth

The present level of access to education and skill is abnormally low in Bihar, which constrain productivity enhancement in both agriculture and non-agriculture and also higher occupational mobility of the people. Therefore, government should accord top priority to providing education and skills to farm youth.

4.3.11 Improve road connectivity

The state government has given priority to construction and upgradation of roads, in recent years. But still 50 percent villages in Bihar lack all weather road connectivity which hampers timely transportation and marketing of agricultural inputs and outputs. There is a need to give top priority to improve rural road connectivity for accelerated agricultural development.

4.3.12 Improve Farmers Access to Electricity

Bihar provides only 15 percent electricity to irrigation consumers against 31 to 40 percent in Punjab, Haryana, Andhra Pradesh, Madhya Pradesh, Rajasthan, and Karnataka. Besides, during the past 25 years, no new power generating unit has been set up, while the demand for electricity for various purposes is going up. In fact, lack of adequate power supply is the biggest constraint to rural industrialization in Bihar and therefore, the state government, in close coordination with central government should increase power generation capacity and power availability in the villages for accelerated and diversified agricultural and rural development.

4.3.13 Increase Public Investment in Agriculture

Even though capital expenditure for agriculture in Bihar increased quite substantially in recent years, the overall public expenditure on agriculture and allied activities as percent of GDP of agriculture and allied sector increased only marginally from 2.2 percent in 2000-01 to 2.7 percent in 2009-10. Unless investment in agriculture is substantially stepped up along with improved resource use efficiency, there would be no escape from the low level equilibrium trap in agriculture and poverty trap of the farmers. The key areas of investment would include (a) post harvest infrastructure, such as markets, godowns, cold storage, supply chain management, (b) Intra and inter linking of rivers, (c) construction of water reservoirs, (d) drainage improvement, (e) renovation of village ponds and tanks. Some of these activities could be very well integrated with Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

4.3.14 Provide Integrated Support for the Development of Livestock and Dairy

The state of Bihar has several advantages in livestock and dairy sector, namely (i) large proportion of cross bred cattle, (ii) large

proportion of dairy cattle in milk, (iii) high proportion of pasture land per animal in milk and the (iv) existence of cooperative marketing organization (COMFED) which helped in increasing milk production in the state at the rate of 13.8 per year in recent years. Also the livestock output in the state has been growing at the annual rate of 10.7 percent per year. However, the key constraints in raising production and productivity in the sector are (i) lack of adequate facilities for artificial insemination, (ii) poor veterinary services, (iii) inadequate production of green fodder (iv) insufficient and costly cattle feed and insufficient coverage of dairy cooperatives. Removing these constraints on priority basis would be needed to enhance livestock and dairy production. Also risks of contamination exist due to old processing equipment and spoilage because of long hours of transportation. In the poultry sector, introduction of superior birds, adequate feed supply and organized marketing cooperatives would help enhance productivity.

4.3.15 Provide Technological and Institutional Support to Enhance Fish Production

At present, the main constraints to improving fish production in the state are (a) shortage of quality fish seeds, (b) use of traditional methods of fish production, (c) absence of proper marketing and storage, (d) loss of fish due to floods and diseases and lack of price incentive for the fish farmers. The suggested measures for improvement in fish production include (a) adoption of carp and cat fish culture, fresh water prawn culture, paddy-fish farming in flood water paddy areas, (b) organized cooperative marketing on the line of COMFED, (c) control of pollution in rivers and other water bodies, (d) renovation of fish ponds (e) timely supply of quality fish seeds to farmers, (f) construction of fish seed hatchery in indifferent districts and (g) training of fish farmers to undertake scientific fish farming.

4.3.16 Provide Integrated Support for Development of Rural Non-Farm Activities

Developing rural non-farm activities would be essential for reducing the pressure of population on agriculture and also improving farmers' income, through vertical integration. However, this would require establishment of strong firm-farm linkages through contract farming, supply chain management, improvement in rural infrastructure such as road connectivity, electricity, market etc. through public – private partnerships, pre-processing facilities such as cooling, grading, sorting, pack houses etc; access to quality education, training and skills for improving the employability of rural youth in non-farm enterprises, integrated development of local, national and international market access opportunities and increased investment and incentives for agro-industrial development.

4.3.17 Implement Innovative Land Reforms for Inclusive Growth

The scope for traditional land reforms such as implementation of ceilings on land holding, abolition of tenancy etc. seems to be limited. Therefore, the state needs to think of some innovative land reform approaches for inclusive growth. The areas of intervention would include (i) legalisation of land leasing (ii) allocation of homestead plot of 10 cents size to all landless families, (iii) provision of land rights for women through implementation of Hindu Succession Act and redistribution of available govt. land, bhoodan land and ceiling surplus land if any, in their names and (iv) updation and digitization of land records.

----------***----------

References

Council for Social Development (2011), Potentials and Constraints of Agricultural Diversification in Eastern India – Unpublished Project Report submitted to the Planning Commission, Govt. of India.

Down to Earth (2007), Centre for Science and Environment, New Delhi, September 15.

Govt. of Bihar (2011), Economic Survey 2010-11, Patna, February, 2011.

Govt. of Bihar (2012-13), Economic Survey, Patna, February 2013

Govt. of India (2012), Planning Commission, Press note on Poverty Estimates, 2009-10, New Delhi, March, 2012.

Govt. of India (2011), Planning Commission, IAMR, Indian Human Development Report, 2011, Oxford University Press, New Delhi.

Govt. of India, (2010), National Sample Survey on Employment, Unemployment 64th Round.

Govt. of India, CACP Reports for 2008-09 to 2011-12, Ministry of Agriculture, New Delhi.

Govt. of India, (2006a), National Sample Survey on Operational Holdings, 59th Round.

Govt. of India, (2006b), National Sample Survey Report on Income, Expenditure and Productive Assets of Farmer Households, 59th Round.

Govt. of India, (2008), Bihar's Agriculture Development: Opportunities and Challenges – A Report of the Special Task Force on Bihar, New Delhi, April, 2008

Haque, T. (2012), Land Policies for Inclusive Growth, Concept publishing Company, New Delhi.

Indian Council of Agricultural Research (ICAR-2008), State Specific Technological Interventions for Higher Agricultural Growth, New Delhi.

LBSNAA (1992), Land Reforms in India, Report of IAS Probationers, Land Reform Unit (CRS), Mussorie.

Sharma, Alakh N. (2005), Agrarian Relations and Socio-Economic Change inBihar, EPW, March, Mumbai.

The World Bank (2007), Bihar Agriculture: Building on Emerging Models of Success, Discussion Report No. 4, South Asia Region.

Table 1.1: State wise Annual Compound growth Rates of GSDP and GSDP from Agricultural & Allied Sector during 2004-05 to 2011-12 (At constant 2004-05 prices)

State\UT	GSDP	GSDP from Agri. & Allied Sector
	CAGR (2004-05 to 2011-12)	
Andhra Pradesh	8.89	4.94
Arunachal Pradesh	8.79	4.73
Assam	6.06	3.94
Bihar	11.72	2.93
Jharkhand	5.44	8.23
Goa	8.91	-0.59
Gujarat*	9.81	3.90
Haryana	9.45	4.19
Himachal Pradesh	8.28	1.47
J & K	6.07	0.50
Karnataka	8.61	5.20
Kerala	8.14	-0.52
Madhya Pradesh*	8.58	5.05
Chhattisgarh	9.03	5.85
Maharashtra*	10.53	6.17
Manipur	5.88	6.66
Meghalaya	8.75	3.01
Mizoram*	9.61	7.57
Nagaland	6.14	2.70
Odisha	8.73	3.45
Punjab	7.33	1.92
Rajasthan*	7.98	4.82
Sikkim*	13.57	3.84
Tamil Nadu	9.45	3.23
Tripura	8.36	6.32
Uttar Pradesh	7.06	2.79
Uttarakhand	12.51	2.12
West Bengal	7.30	2.54
A & N Islands	8.34	4.64
Chandigarh*	10.33	4.50
Delhi	11.52	5.10
Puducherry	9.27	10.19
All India	**8.37**	**3.62**

* CAGR & CV (%) -2004-05 to 2010-11

Source: Economic Survey of India 2012-13, Govt. of India

Table 1.2: Changes in the Sectoral Composition of GSDP at constant prices (percent) during 2000-01 to 2011-12

Sector	2001-02	2004-05	2011-12
Agriculture/Animal Husbandry	26.64	26.6	19.9
Forestry/ Logging	3.70	3.5	1.6
Fishing	1.56	1.5	1.0
Agriculture & Allied Sector	31.91	31.5	22.4
Mining/Quarrying	0.34	0.1	0.1
Sub-Total (Primary)	**32.24**	**31.6**	**22.5**
Manufacturing	5.99	5.6	4.9
Registered	1.48	1.4	1.8
Un-registered	4.51	4.2	3.1
Construction	4.77	6.6	13.5
Electricity/ Water Supply/ Gas	1.62	1.5	1.2
Sub-Total (Secondary)	**12.38**	**13.7**	**19.6**
Transport/ Storage/ Communication	6.58	5.9	8.1
Railways	2.70	1.9	1.6
Other Transportation	2.86	2.6	2.5
Storage*	0.00	0.1	0.1
Communication	1.02	1.4	4.0
Trade/ Hotel/ Restaurant	17.18	20.9	23.8
Sub-Total)	23.76	26.9	31.9
Banking/ Insirance	4.05	3.3	5.9
Real Estate/ Ownership of Dwelling/ Business Service	5.42	5.2	5.1
Sub-Total (10 and 11)	9.48	8.5	11.0
Public Administration	7.74	6.7	5.6
Other Services	14.40	12.7	9.5
Sub-Total (Tertiary)	**55.37**	**54.7**	**58.0**
Total GSDP	**100.00**	**100.00**	**100.00**

Source: Directorate of Economics and Statistics, Govt. of Bihar

Table 1.3: Structure of Population and Workforce

1.	Total Population (2011 Census)	103.80 million
2.	Total Male Population (2011 census)	54.20 million
3.	Total Female Population (2011 census)	49.60 million
4.	Decade Growth rate of Population (2001-2011)	25.07 percent
5.	Ratio of working population (2001 census)	33.7 percent
6.	Share of cultivators in total rural working population (2001 census)	31.4 percent
7.	Share of Agricultural Labourers in rural working population (2001 census)	51.0 percent
8.	Share of Agriculture in total workforce in the state	77.3 percent
9.	Percent of tenant households	12.3 percent
10.	Percent of landless rural households	6.9 percent
11.	Percent of small and marginal Holdings	96.3 percent

Source: Census of India, 2011 and 2001 and NSSO, 2003.

Table 1.4: Changes in Percentage area under various crops

Crops	2000-01	2004-05	2011-12
	% of Total Area		
Foodgrains	94.47	94.37	93.17
Cereals	84.97	84.81	85.87
Rice	48.55	45.61	46.26
Wheat	27.45	29.45	29.81
Maize	8.24	9.11	9.39
Coarse Cereals	0.74	0.64	0.44
Pulses	9.49	9.56	7.30
Oilseeds	2.04	1.92	1.86
Fibre Crops	2.25	2.24	1.91
Jute	1.80	1.95	1.63
Sugarcane	1.24	1.47	3.04

Source: Department of Agriculture, Govt. of Bihar

Table 1.5: State wise TE Average Yield (kg/ha) of crops (2009-10 to 2011-12)

State/ UT	Rice	Wheat	Jowar	Bajra	Maize	Gram	Arhar (Tur)	Total Cereals	Total Coarse Cereals	Total Pulses	Foodgrains
Andhra Pradesh	3081.80	1225.00	1316.47	1344.69	4359.49	1153.60	385.40	3108.98	3288.51	684.04	2447.91
Arunachal Pradesh	1922.04	1618.69			1429.16		848.48	1688.84	1266.37	1083.50	1661.78
Assam	1786.75	1137.65			722.49	508.41	713.79	1762.76	671.66	562.68	1709.82
Bihar	1456.68	2079.32	1056.37	1107.95	2319.06	1165.33	1477.20	1777.39	2257.31	896.67	1702.28
Goa	2393.95							2390.53	1366.67	991.57	2175.33
Gujarat	1965.39	2949.29	1094.02	1300.38	1411.01	1073.61	981.62	2002.95	1298.55	777.58	1758.93
Haryana	2946.93	4622.58	502.56	1808.59	2272.22	877.21	1078.86	3698.77	1782.90	787.22	3595.75
Himachal Pradesh	1586.05	1376.21		708.10	2178.17	831.15		1695.39	2069.94	948.98	1664.91
Jammu & Kashmir	1977.93	1409.22	364.83	605.96	1628.65	542.66		1610.63	1504.27	516.06	1577.84
Karnataka	2664.91	946.27	1076.08	851.52	2969.44	610.50	507.38	2065.57	1898.68	501.33	1563.48
Kerala	2580.73		677.23				1559.56	2563.30	703.25	838.69	2521.62
Madhya Pradesh	1105.89	2027.95	1416.82	1772.40	1337.97	1005.05	604.27	1670.38	1255.15	776.62	1319.42
Maharashtra	1700.76	1642.56	841.82	935.98	2661.41	847.46	765.61	1298.21	1127.63	720.87	1126.01
Manipur	2328.17							2287.80	2045.58	778.65	2145.56
Meghalaya	1936.74	1709.43			1519.02	581.77	764.37	1859.30	1432.74	875.49	1828.13
Mizoram	1169.99				1356.29			1201.88	1356.29	1529.96	1224.22
Nagaland	1877.95	1540.88	811.11			700.32	798.84	1772.11	1544.56	1061.83	1692.34
Orissa	1550.20	1517.29	625.73	618.52	2256.39	764.48	856.26	1547.82	1483.52	472.33	1377.44
Punjab	3859.64	4632.60		1111.11	3697.71	1139.68	961.70	4273.23	3621.71	862.18	4262.67
Rajasthan	1808.70	3072.63	528.58	713.57	1478.26	747.37	602.71	1469.14	890.31	478.32	1176.17
Sikkim	1775.50	1072.42			1658.73			1573.47	1556.12	926.53	1479.62
Tamil Nadu	3342.35		1073.64	1842.76	5061.56	642.45	765.73	3223.43	2874.61	440.13	2677.26
Tripura	2653.93	2002.97			1227.01	688.89	740.78	2637.19	1227.01	705.52	2583.98
Uttar Pradesh	2187.10	3024.13	1008.01	1714.06	1534.97	979.63	868.10	2589.68	1618.44	857.57	2372.96
West Bengal	2624.60	2735.18	442.44	391.88	3880.28	1076.54	860.67	2647.50	3509.31	809.61	2589.35
A & N Islands	2956.67				2200.49			2940.42	2200.49	527.92	2397.91
Delhi	4252.86	4346.79	3864.96	1878.86	18916.67		1771.59	4228.22	3395.86	1852.58	4199.78
D & N Haveli			899.02			932.58	800.77	1636.96	1124.36	888.59	1330.74
Daman & Diu								1524.28			1448.15
Pondicherry	2546.00			2280.07				2546.69	2759.22	356.63	2305.71
Chhattisgarh	1460.23	1152.53	1151.75		1620.16	944.53	460.84	1405.17	758.59	613.87	1271.89
Jharkhand	1739.38	1762.93	455.01	599.13	1291.80	1010.76	820.26	1652.73	1200.45	789.02	1461.78
UttaraKhand	2030.20	2278.06			1440.78	928.40	901.96	1922.68	1267.09	820.26	1855.34
All India	**2252.58**	**3001.70**	**923.55**	**993.45**	**2347.19**	**912.74**	**676.21**	**2248.86**	**1444.93**	**673.07**	**1935.46**

State/ UT	Total Oilseed	Groundnuts	Rapeseed & Mustard	Sunflower	Cotton	Sugarcane	Jute & Mesta
Andhra Pradesh	744.90	772.63	562.33	749.86	432.26	77944.29	1504.36
Arunachal Pradesh	953.99	765.00	906.15	611.45		18918.28	
Assam	552.94		555.37		80.04	37961.48	1742.95
Bihar	1045.25	1258.23	1021.37	1427.84		48867.24	1790.58
Goa	2722.90	2834.34				54432.37	
Gujarat	1469.78	1479.89	1571.95		637.07	72019.78	
Haryana	1631.52	988.89	1640.09	1755.56	651.09	72143.19	
Himachal Pradesh	454.23	776.36	479.57		37.78	18990.09	
Jammu & Kashmir	803.46		829.91			1748.54	
Karnataka	649.84	739.10	383.33	505.24	355.17	91446.08	150.00
Kerala	962.35				221.10	97227.30	
Madhya Pradesh	1114.95	1424.10	1109.81	500.00	414.22	40157.99	206.41
Maharashtra	1113.92	1188.44	338.68	568.28	316.10	84866.13	256.00
Manipur	779.67		639.72			50452.42	
Meghalaya	723.97		680.50			2445.89	1187.36
Mizoram	1092.04		750.00			6594.56	
Nagaland	972.68	892.86	900.17	740.71		38831.07	312.39
Orissa	623.17	1178.27	210.09	1044.25	526.56	63720.13	1021.80
Punjab	1350.11	1504.24	1299.48	1769.52	679.72	63966.87	
Rajasthan	1170.81		1217.88		428.34	64866.80	
Sikkim	877.15		853.12				
Tamil Nadu	2151.45	2409.63	265.08	1431.30	523.28	107073.71	
Tripura	733.30	1114.30	758.61		253.33	50551.39	1453.64
Uttar Pradesh	804.34	886.19	1145.27	2011.90	170.00	58520.57	
West Bengal	1035.69	1772.07	1003.06	1177.33	430.34	84231.86	2623.53
A & N Islands						15323.53	
Delhi	1269.01		1278.21				
D & N Haveli	711.17						
Daman & Diu							
Pondicherry	1517.06				1360.00	147458.05	
Chhattisgarh	614.36	1378.48	420.85	413.76	255.00	2554.22	355.71
Jharkhand	622.06	955.32	633.82	663.50		69090.98	
UttaraKhand	1077.39	1363.64	823.16			60061.77	
All India	**1094.73**	**1241.77**	**1162.76**	**660.98**	**464.59**	**70592.73**	**2269.77**

Source: DACNET, Govt. of India

Table 2.1 : Trends and variability in area, production and yields of crops (2000-01 to 2011-12) in Bihar and All India

	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
	Bihar*			Bihar[1]			India[1]		
Food grains									
CAGR (2000-01 to 2011-12)	-0.55	1.77	2.33	-0.69	0.23	0.92	0.40	2.41	2.00
CV (%)	3.26	21.66	21.36	4.15	15.91	14.22	2.60	10.45	8.40
Rice									
CAGR (2000-01 to 2011-12)	-1.02	-0.09	1.24	-1.23	-0.64	0.60	0.00	1.82	1.82
CV (%)	5.82	30.95	28.76	7.20	27.93	25.15	3.08	9.46	7.93
Wheat									
CAGR (2000-01 to 2011-12)	0.51	3.10	2.88	0.315	1.034	0.716	1.35	2.65	1.29
CV (%)	3.22	21.70	20.25	2.790	12.031	10.008	5.18	11.13	6.15
Maize									
CAGR (2000-01 to 2011-12)	0.71	4.33	3.21	0.80	0.74	-0.06	2.79	5.80	2.93
CV (%)	5.29	20.91	16.96	3.53	7.87	7.21	9.97	22.26	13.38
Total Pulses									
CAGR (2000-01 to 2011-12)	-2.48	-1.89	1.03	-2.45	-1.47	1.01	1.55	3.48	1.90
CV (%)	10.08	11.93	9.28	9.66	10.88	8.92	7.19	14.63	8.06
Total Oilseeds									
CAGR (2000-01 to 2011-12)	-0.52	2.74	3.70	-0.80	1.82	2.65	1.83	4.98	3.09
CV (%)	4.32	13.01	14.86	4.61	9.53	10.30	8.79	20.30	14.71
Jute									
CAGR (2000-01 to 2011-12)	-1.74	2.00	3.65	-1.29	1.91	3.24	-0.69	0.58	1.28
CV (%)	7.90	13.23	19.25	6.83	12.48	16.29	4.53	5.41	5.72
Sugarcane									
CAGR (2000-01 to 2011-12)	6.98	6.35	1.16	6.37	7.66	1.21	1.34	2.10	0.75
CV (%)	46.60	50.77	8.76	38.23	50.48	10.41	10.48	14.17	5.15
Vegetables									
CAGR (2000-01 to 2011-12)	3.07	5.05	1.91				3.43	4.77	1.27
CV (%)	11.52	18.38	7.51				12.46	17.66	5.22
Fruits									
CAGR (2000-01 to 2011-12)	0.67	1.93	1.23				5.71	5.62	-0.08
CV (%)	3.30	8.70	7.16				19.96	20.64	4.35

* Department of Agriculture, Govt. of Bihar

[1] Department of Economics and Statistics, Department of Agri. And Cooperation, Ministry of Agriculture, Govt. of India

Table 2.2 : District wise growth and variability in the yields of crops

Districts	CAGR (2000-01 to 2010-11) of yield					Variability in yield (2000-01 to 2010-11)				
	Rice	Wheat	Maize	Pulses	Oilseed**	Rice	Wheat	Maize	Pulses	Oilseed**
Patna	-5.55	-1.75	-5.43	-1.09	4.17	34.67	11.71	24.44	16.05	42.6
Nalanda	1.95	-0.38	-1.63	3.96	0.91	40.74	22.65	19.96	24.48	31.1
Bhojpur	0.23	3.07	4.09	4.64	12.96	35.40	16.89	34.48	31.79	48.4
Buxer	-1.88	-0.17	-3.04	2.79	3.30	32.64	16.76	21.86	30.14	21.5
Rohtash	-1.50	1.26	-6.55	3.99	3.53	14.16	12.50	31.08	25.88	19.9
Bhabhua	-4.62	-1.72	-8.61	0.47	1.93	28.00	15.95	36.86	31.38	8.0
Gaya	-0.27	2.92	2.62	3.08	3.26	46.76	22.48	20.63	19.42	22.2
Jahanabad	0.96	-0.41	0.04	2.86	1.00	30.75	13.05	11.72	19.83	13.1
Nawada	1.70	2.53	6.23	3.32	2.79	40.39	24.25	20.50	16.57	14.3
Aurangabad	-2.23	-2.81	4.53	1.01	2.63	26.23	21.43	29.35	25.54	9.4
Saran	-0.15	1.89	-3.66	0.35	-1.18	20.93	13.05	21.98	21.98	7.7
Siwan	-7.23	1.31	0.42	-3.94	1.62	28.96	14.02	17.61	27.43	12.5
Gopalgunj	-3.71	1.26	-0.81	2.96	1.55	24.13	25.92	25.11	14.76	11.5
Muzaffarpur	-7.78	1.57	1.85	2.03	2.76	53.55	22.68	18.21	29.67	21.1
E.Champaran	-9.02	-1.72	-6.17	-2.64	-6.70	43.12	36.20	37.49	23.73	27.8
W.Champaran	-8.11	-0.01	1.10	-2.09	-0.04	41.12	26.37	31.46	32.00	45.1
Sitamarhi	-6.15	1.61	1.32	-0.88	5.14	44.58	12.96	17.38	21.18	39.7
Sheohar	-10.40	2.90	1.93	-6.28	0.16	51.01	35.99	14.81	25.89	24.0
Vaishali	-4.04	4.87	-0.89	0.13	3.33	42.67	29.30	17.16	18.88	16.4
Darbhanga	0.22	6.55	4.73	1.75	3.49	31.97	28.48	19.43	24.35	24.1
Madhubani	-0.45	6.32	5.42	-1.78	3.09	44.42	37.35	29.77	15.99	21.2
Samastipur	-2.68	5.40	5.42	1.77	-0.28	54.62	25.16	41.50	33.86	22.8
Begusarai	-8.99	0.87	-2.34	-2.67	3.20	52.14	15.91	24.21	21.54	28.5
Munger	-5.17	2.50	3.50	0.19	0.71	25.95	17.50	15.97	19.47	18.0
Shekhpura	-4.01	1.28	3.58	-0.23	4.77	44.91	13.83	21.15	28.62	20.9
Lakhisarai	-3.00	-0.62	-4.39	-2.13	0.25	48.24	24.48	24.03	26.32	45.2
Jamui	-2.94	1.96	3.66	-1.65	4.57	49.62	20.00	44.46	28.83	29.9
Bhagalpur	-3.56	1.62	3.52	-0.93	11.23	33.67	37.98	20.97	12.34	40.4
Banka	-0.80	3.63	1.58	4.18	10.73	17.61	23.48	19.48	18.53	37.9
Saharsa	5.74	5.69	4.48	3.27	1.25	35.49	30.67	21.92	60.42	10.8
Supaul	-0.75	-0.97	3.23	5.04	-0.49	12.32	26.65	20.07	31.62	17.6
Madhepura	-0.63	1.23	6.24	3.75	0.43	9.97	19.67	26.07	29.23	15.4
Purnia	-1.60	0.92	-3.48	0.26	-8.36	23.56	24.96	15.73	24.29	31.5
Araria	0.63	2.38	1.95	3.05	-0.38	20.59	24.90	21.54	27.17	16.1
Kisangunj	-2.55	-3.01	1.67	1.98	4.48	21.47	25.90	24.96	21.19	21.3
Katihar	-1.44	1.30	9.52	2.79	4.32	23.01	44.45	35.28	20.91	17.8
Khagaria	8.44	3.03	4.27	4.83	8.48	57.40	40.53	19.90	28.86	29.8
Arwal*	na	na	na	na	NA	10.61	11.75	22.62	40.29	NA
Bihar	**-1.78**	**1.56**	**1.91**	**1.61**	2.45	**18.85**	**15.08**	**11.27**	**13.01**	10.1

*Arwal CV (%) of 2007-08 to 2010-11

** Oilseed CAGR & CV (%) 2000-01 to 2009-10

Source:- Directorate of Statistics & Evaluation, Govt. of Bihar

Table 2.3 : Districts having relatively high area and low yield and high area and high yield

Sl.No.	Districts	% of total rice area (2009-10)	Yield (Kg/ha) (2010-11)	Sl.No.	Districts	% of total rice area (2009-10)	Yield (Kg/ha) (2010-11)
	Rice						
	High Area High Yield				**High Area Low Yield**		
1	Bhojpur	3.23	2033.83	1	Nalanda	3.01	1086.26
2	Rohtash	5.88	1653.20	2	Siwan	3.40	900.68
3	Aurangabad	3.78	1416.07	3	E.Champaran	6.69	622.83
4	Muzaffarpur	4.14	1235.70	4	W.Champaran	4.60	503.33
5	Araria	4.28	1267.90	5	Sitamarhi	3.21	351.02
6	Katihar	3.19	1132.47	6	Darbhanga	3.36	959.08
				7	Madhubani	5.70	563.72
				8	Banka	3.61	954.55
				9	Supaul	3.31	1089.92
				10	Purnia	3.37	800.52
	Bihar	**100.00**	**1093.91**				
	Wheat						
	High Area High Yield				**High Area Low Yield**		
1	Bhojpur	3.50	2599.22	1	Nalanda	3.19	2092.62
2	Buxer	3.70	2933.57	2	Bhabhua	3.10	2412.95
3	Rohtash	5.95	2940.11	3	Aurangabad	4.63	2014.26
4	Saran	4.28	2779.34	4	Siwan	4.82	2011.64
5	Gopalgunj	3.81	3390.89	5	Darbhanga	3.68	2338.26
6	Muzaffarpur	4.66	2684.36	6	Madhubani	4.66	2372.90
7	E.Champaran	4.59	3028.27				
8	W.Champaran	3.72	2460.15				
	Bihar	**100.00**	**2425.48**				
	Maize						
	High Area High Yield				**High Area Low Yield**		
1	Samastipur	8.26	4284.09	1	Saran	3.93	1919.01
2	Khagaria	9.28	3624.78	2	Muzaffarpur	3.78	2758.93
3	Bhagalpur	5.50	3491.14	3	Vaishali	5.23	2314.98
4	Saharsa	5.93	5347.07	4	Begusarai	9.50	2409.81
5	Araria	3.17	5351.22	5	Madhepura	7.04	3071.09
6	Katihar	7.21	3735.92	6	Purnia	5.66	2477.69
	Bihar	**100.00**	**3225.03**				
	Total Pulses						
	High Area High Yield				**High Area Low Yield**		
1	Patna	9.23	1285.12	1	Nalanda	4.86	1086.26
2	Bhojpur	4.67	2033.83	2	W.Champaran	3.91	503.33
3	Bhabhua	3.05	1806.96	3	Madhubani	3.18	563.72
4	Aurangabad	7.06	1416.07	4	Bhagalpur	3.45	544.72
5	Muzaffarpur	4.52	1235.70	5	Supaul	4.80	1089.92
6	Saharsa	3.69	1996.25				
7	Madhepura	3.84	1262.17				
8	Araria	3.20	1267.90				
	Bihar	**100.00**	**1093.91**				

	Total Oilseeds						
	High Area High Yield				**High Area Low Yield**		
1	Gaya	3.33	1224.79	1	Aurangabad	5.89	856.16
2	Muzaffarpur	3.28	1097.98	2	W.Champaran	16.86	585.88
3	Samastipur	7.06	999.25	3	Purnia	4.00	900.95
4	Begusarai	4.21	1333.89	4	Kishanganj	3.52	891.43
				5	Araria	3.86	826.69
				6	Katihar	4.10	946.12
	Bihar	**100.00**	**963.78**				
	Total Vegetables (Yield in tonnes/ha.)						
	High Area High Yield				**High Area Low Yield**		
1	Patna	4.73	18.67	1	Saran	3.39	17.53
2	Nalanda	7.04	19.83	2	Gopalganj	3.07	17.94
3	Muzaffarpur	4.80	18.97	3	Darbhanga	3.14	17.24
4	W.Champaran	4.04	19.03	4	Madhubani	3.15	17.66
5	E.Champaran	3.74	18.79	5	Katihar	3.71	18.02
6	Vaishali	5.21	18.69				
7	Samastipur	3.82	18.98				
8	Begusarai	3.24	18.99				
	Bihar	**100.00**	**18.18**				
	Total Fruits (Yield tonnes/ha.)						
	High Area High Yield				**High Area Low Yield**		
1	Muzaffarpur	8.59	16.64	1	Rohtas	3.45	9.15
2	Vaishali	6.17	16.14	2	Saran	3.26	11.42
3	Samastipur	5.63	14.46	3	Sitamarhi	3.35	11.18
				4	W Champaran	5.01	11.40
				5	E Champaran	5.55	10.80
				6	Darbhnaga	6.13	12.38
				7	Madhubani	3.49	12.32
				8	Bhagalpur	4.04	12.95
	Bihar	**100.00**	**13.20**				

*Total Pulses: % of Total Area (2009-10) and Yield (Kg/ha.) (2009-10), CAGR (2000-01 to 2009-10)

**Total Vegetables and Fruits: % of Total Area (2011-12), CAGR (2005-06 to 2011-12)

Source:- Directorate of Statistics & Evaluation, Govt. of Bihar

Table - 2.4 : District wise yield gaps (%) in various crops in Bihar (2010-11)

Districts	Yield Gap between FLD Yield and District Yield (2010-11)							
	Rice		Wheat		Maize		Total Pulses	
	(t/ha)	(%)	(t/ha)	(%)	(t/ha)	(%)	(t/ha)	(%)
Patna	2.44	190.25	1.65	70.45	2.47	165.25	2.54	198.03
Nalanda	2.64	243.38	1.89	90.19	1.62	69.39	2.74	252.59
Bhojpur	1.70	83.40	1.38	53.12	1.20	43.73	1.80	88.31
Buxer	1.98	112.98	1.05	35.67	2.43	159.45	2.08	118.69
Rohtash	2.08	125.62	1.04	35.37	2.46	164.00	2.18	131.67
Bhabhua	1.92	106.42	1.57	64.94	2.46	164.00	2.02	111.96
Gaya	2.64	242.21	1.78	81.20	1.42	55.73	2.74	251.38
Jahanabad	2.42	184.07	2.01	101.67	1.59	66.74	2.52	191.69
Nawada	2.70	260.81	1.96	96.68	1.59	66.74	2.80	270.48
Aurangabad	2.31	163.41	1.97	97.59	2.29	137.60	2.41	170.47
Saran	2.48	197.82	1.20	43.20	2.04	106.36	2.58	205.80
Siwan	2.83	314.13	1.97	97.85	1.92	94.32	2.93	325.23
Gopalgunj	2.78	292.96	0.59	17.37	1.56	65.25	2.88	303.49
Muzaffarpur	2.49	201.85	1.30	48.27	1.20	43.53	2.59	209.94
E.Champaran	3.11	498.88	0.95	31.43	1.88	90.22	3.21	514.94
W.Champaran	3.23	641.07	1.52	61.78	1.39	54.38	3.33	660.94
Sitamarhi	3.38	962.60	2.16	118.59	0.65	19.55	3.48	991.09
Sheohar	3.46	1259.49	1.25	45.70	0.60	17.73	3.56	1295.93
Vaishali	3.06	455.84	0.66	20.01	1.65	71.06	3.16	470.75
Darbhanga	2.77	288.91	1.64	70.21	0.89	29.06	2.87	299.34
Madhubani	3.17	561.68	1.61	67.73	0.02	0.57	3.27	579.42
Samastipur	3.20	601.56	1.33	49.92	-0.32	-7.56	3.30	620.37
Begusarai	3.33	834.07	1.33	49.93	1.55	64.33	3.43	859.11
Munger	3.28	721.86	2.17	119.68	2.24	130.33	3.38	743.90
Shekhpura	3.26	690.40	2.35	144.83	1.46	58.40	3.36	711.60
Lakhisarai	3.30	770.33	2.22	125.55	2.07	109.65	3.40	793.67
Jamui	3.31	796.20	2.49	167.68	1.39	54.00	3.41	820.23
Bhagalpur	3.19	584.76	2.26	131.43	0.34	9.25	3.29	603.12
Banka	2.78	290.76	1.40	54.46	0.47	13.43	2.88	301.24
Saharsa	1.73	86.85	2.18	121.01	0.81	25.70	1.83	91.86
Supaul	2.64	242.23	1.68	72.98	-1.39	-25.94	2.74	251.40
Madhepura	2.47	195.52	2.44	157.83	-0.97	-19.62	2.57	203.45
Purnia	2.93	365.95	2.05	106.26	0.89	28.94	3.03	378.44
Araria	2.46	194.19	2.02	102.61	1.48	59.83	2.56	202.08
Kisangunj	2.69	257.93	2.76	226.07	0.89	28.82	2.79	267.53
Katihar	2.60	229.37	1.54	63.41	-1.39	-26.00	2.70	238.20
Khagaria	2.16	137.41	0.92	30.23	0.22	6.00	2.26	143.77
Arwal	1.95	109.20	2.23	128.02	0.96	32.00	2.05	114.81
Bihar	**2.64**	**240.98**	**1.55**	**64.09**	**0.73**	**22.79**	**2.74**	**250.12**

Sources: Average Yield FLD, Directorate of Statistics & Evaluation, Govt. of India
District wise yield, Directorate of Statistics & Evaluation, Govt. of Bihar

Table – 2.5 : District wise growth and variability in area, production and yield of fruits and vegetables in Bihar

Districts	Fruits						Vegetables					
	CAGR (2005-06 to 2011-12)			CV % (2005-06 to 2011-12)			CAGR (2005-06 to 2011-12)			CV % (2005-06 to 2011-12)		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Patna	1.37	4.07	2.67	2.96	10.64	8.59	6.61	7.8	1.11	17.24	21.22	7.5
Nalanda	1.53	4.59	3.01	3.34	11.29	8.78	7.5	8.85	1.26	19.24	22.55	6.63
Rohtas	0.68	3.44	2.74	1.5	13.36	12.7	9	10.69	1.55	22.43	25.05	5.83
Kaimur	0.92	4.71	3.75	1.99	12.88	11.58	6.7	9.28	2.41	17.52	21.33	6.62
Buxar	1.08	2.69	1.6	2.36	9.67	8.73	8.23	10.77	2.35	19.41	23.33	6.51
Bhojpur	0.79	2.13	1.32	1.72	9.05	8.47	8.52	11.14	2.41	20.31	24.18	6.87
Gaya	2.14	5.5	3.29	4.62	13.78	10.68	6.41	8.27	1.75	18.09	21.08	5.66
Aurangabad	2.51	6.35	3.74	5.41	14.31	10.19	5.27	8.03	2.62	14.47	18.55	6.37
Jehanabad	4.49	8.5	3.84	9.52	17.72	10.11	8.57	10.34	1.63	20.11	23.3	5.62
Arwal	5.98	9.57	3.38	12.59	19.89	9.56	10.88	13.39	2.27	22.72	26.11	5.85
Nawada	1.33	4.95	3.57	2.88	12.09	9.89	5	6.97	1.88	14.41	17.06	4.64
Saran	0.99	3.65	2.63	2.15	9.37	7.89	7.71	9.62	1.77	19.74	22.74	5.5
Siwan	1.48	5.64	4.09	3.19	12.09	9.18	8.04	12.46	4.1	19.33	24.7	9.94
Gopalganj	1.54	5.34	3.74	3.38	11.84	9	7.95	10.43	2.3	20.07	23.27	6.02
Muzaffarpur	0.7	3	2.29	1.52	7.02	5.72	4.34	6.7	2.26	12.3	15.66	5.35
Sitamarhi	1.12	2.76	1.63	2.42	9.06	7.67	5.76	8.43	2.53	15.34	18.61	5.68
Sheohar	1.23	3.01	1.76	2.64	9.89	8.37	6.55	8.4	1.74	17	20.07	5.19
W.Champaran	2.18	4.31	2.09	4.9	9.9	6.04	6	10.36	4.11	14.69	21.9	9.86
E.Champaran	0.76	3.35	2.57	1.66	9.11	7.96	4.55	7.13	2.46	14.15	17.31	5.98
Vaishali	1.16	3.53	2.34	2.56	7.94	5.68	4.67	6.41	1.67	13.04	15.84	4.27
Darbhanga	0.52	1.44	0.91	1.16	7.64	7.39	2.2	3.28	1.06	9.45	11.27	3.41
Samastipur	1.36	2.97	1.59	2.93	8.22	6.25	6.17	7.67	1.41	16.36	19.41	5.36
Madhubani	1.01	2.42	1.39	2.22	7.4	6.16	6.22	9.08	2.69	16.59	20.23	6.39
Saharsha	1.69	2.46	0.76	3.65	7.95	6.4	5.89	8.45	2.42	15.43	18.66	5.92
Supaul	1.4	3.21	1.78	3.33	9.35	7.63	8.33	10.42	1.93	20.8	23.67	5.98
Madhepura	1.13	3.27	2.12	2.55	7.66	5.6	4.92	7.15	2.13	13.61	16.37	5.48
Poornea	1.72	1.67	-0.04	3.73	5.04	3.76	4.66	7.21	2.44	12.78	15.82	6.43
Araria	2.69	3.83	1.11	5.79	9.34	5.09	5.83	8.76	2.77	15.53	18.99	8.02
Kishanganj	2.28	3.77	1.46	4.9	8.01	3.46	6.95	9.59	2.47	18.05	21.11	7.9
Katihar	3.19	6.64	3.34	6.89	14.93	8.86	3.42	5.91	2.41	9.69	13	6.55
Bhagalpur	1.2	2.93	1.7	2.6	8.63	7.02	5.61	7.96	2.22	14.82	18.12	5.3
Banka	0.21	1.3	1.08	1.47	13.08	12.35	8.55	11.52	2.74	21.36	24.21	6.5
Munger	4.01	8.32	4.14	8.64	18.25	10.75	9.21	11.08	1.7	21.27	23.37	4.61
Lakhisarai	4.48	8.2	3.56	9.61	17.9	9.8	13.07	15.46	2.12	26.14	28.98	5.72
Begusarai	1.5	3.82	2.29	3.24	9.2	6.74	5.68	7.8	2.01	12.91	16.65	5.45
Jamui	2.11	3.98	1.83	4.84	12.1	9.01	5.73	8.06	2.2	16.21	19.35	5.79
Khagaria	2.71	6.7	3.88	5.8	14.33	9.01	5.83	7.58	1.65	15.24	17.87	4.27
Sheikhpura	1.54	3.38	1.81	4.1	11.7	9.18	12.06	16.36	3.84	26.11	30.34	10.03
Bihar	**1.33**	**3.47**	**2.11**	**2.89**	**8.48**	**6.25**	**6.16**	**8.38**	**2.09**	**16.21**	**19.38**	**5.34**

Source: Department of Agriculture, Govt. of Bihar

Table 2.6 : Compound Annual Growth Rate of cattle, buffalo, sheep, goat and cross bred livestocks (1997 to 2007)

Category	CAGR 2003-2007		CAGR 1997-2007	
	Bihar	All India	Bihar	All India
Cattle	4.0	1.8	-6.5	0.0
Cross bred male cattle	12.2	8.5	11.4	2.5
Cross bred female cattle	11.5	7.3	30.4	5.9
Total cross bred cattle	11.6	7.6	23.9	5.1
Indigenous male cattle	1.6	-0.2	-10.1	-1.6
Indigenous female cattle	3.8	1.8	-6.1	0.1
Total Indigenous cattle	2.9	0.8	-8.0	-0.7
Buffalo	3.9	1.8	1.3	1.6
Sheep	-13.1	3.9	-19.7	2.2
Goats	1.7	3.1	-6.6	1.4
Pigs	-1.5	-4.7	-3.7	-1.8
Total Livestock	2.8	2.2	-5.6	0.9
Total Poultry	-4.8	7.3	-5.4	6.4

Source: Livestock Census, Govt. of India

Table – 2.7: Growth and variability in the production of Milk, Meat and Fish in Bihar and India

Year	Milk		Meat		Fish	
	Production in (000' tonnes)					
	Bihar	India	Bihar	India	Bihar	India
2000-01	2489	80607	140	1851	0.222	5.656
2001-02	2664	84406	157	1922	0.240	5.986
2002-03	2869	86159	174	2113	0.241	6.200
2003-04	3180	88082	175	2080	0.256	6.399
2004-05	2974	92500	175	2211	0.267	6.305
2005-06	5060	97100	176	2310	0.279	6.572
2006-07	5450	102600	175	2200	0.267	6.869
2007-08	5585	107900	203	4009	0.288	7.127
2008-09	5934	112200	209	4280	0.306	7.616
2009-10	6124	116400	218	4566	0.297	7.852
2010-11	6500	121848	223	4869	0.289	8.295
2011-12	6517	127900			0.344	8.666
CAGR (2000-01 to 2011-12)	10.67	4.36	4.16	11.24	3.20	3.76
CV (%)	35.30	15.54	14.10	40.76	12.13	13.75

Source: State/UT Animal Husbandry Departments

Table 2.8: District wise Production of Fish and fish seeds for the year 2011-12

Districts	Fish Production ('000 tonnes)	Fish Seed (Lakhs)
Patna	11.0	20.7
Nalanda	14.8	72.5
Rohtas+Kaimur	8.8	40.0
Buxer	6.0	10.0
Bhojpur	9.0	10.0
Gaya	5.6	20.0
Aurangabad	4.9	0.0
Jehanabad+Arwal	4.5	0.0
Nawada	4.1	111.0
Saran	19.1	700.0
Siwan	10.4	45.0
Gopalgunj	8.2	50.0
Muzaffarpur	16.6	75.0
Sitamarhi+Sheohar	17.0	0.0
West Champaran	14.0	134.3
East Champaran	18.2	79.0
Vaishali	13.0	40.0
Darbhanga	16.5	900.0
Samastipur	9.3	60.8
Madhubani	19.3	75.0
Saharsa	14.0	0.5
Supaul	8.1	45.0
Madhepura	9.5	22.0
Purnia	12.4	60.0
Araria	5.4	0.0
Kishanganj	6.6	60.0
Katihar	12.6	0.0
Bhagalpur	10.9	0.0
Banka	4.9	130.0
Munger+Sheikhpura+Lakhisarai	8.1	43.7
Begusarai	12.1	0.0
Jamui	3.1	0.0
Khargaria	7.1	800.0
Bihar	**344.5**	**3604.6**

Source: Economic Survey, Govt. of Bihar, 2012-13

Table – 3.1: District wise consumption of chemical fertilizers in Bihar

Districts	Consumption in Kg/ha. (2010-11)			
	N	P_2O_5	K_2O	Total
Arraria	62.48	24.96	22.79	110.24
Arwal	153.25	55.38	16.35	224.99
Aurangabad	111.28	29.74	7.36	148.38
Banka	76.21	18.21	12.21	106.63
Begusarai	193.78	77.18	47.54	318.50
Bhabua	111.22	35.65	8.10	154.96
Bhagalpur	201.02	59.00	38.52	298.54
Bhojpur	138.31	41.69	9.33	189.32
Buxar	112.30	41.70	7.43	161.43
Darbhanga	98.83	34.36	17.53	150.72
E.Champaran	119.82	36.18	20.66	176.67
Gaya	219.52	60.44	23.72	303.68
Gopalganj	74.84	18.64	6.85	100.33
Jamui	247.53	68.65	48.19	364.38
Jehanabad	159.49	62.19	18.62	240.31
Katihar	122.15	42.23	31.57	195.95
Khagaria	257.58	79.58	69.26	406.42
Kisanganj	46.68	17.98	14.61	79.27
Lakhisarai	107.35	44.21	17.44	168.99
Madhepura	76.03	19.24	23.02	118.30
Madhubani	47.40	16.70	7.95	72.05
Mujaffarpur	149.47	51.19	27.65	228.32
Munger	86.34	31.85	17.30	135.49
Nalanda	197.99	52.57	25.05	275.60
Nawadah	89.37	17.75	6.26	113.39
Patna	220.97	72.07	30.95	323.99
Purnia	161.01	54.07	47.87	262.96
Rohtas	125.42	38.76	9.58	173.76
Saharsa	80.02	21.01	18.94	119.97
Samastipur	146.99	57.81	30.90	235.69
Saran	114.26	31.68	14.52	160.46
Seikhpura	184.57	40.63	17.27	242.47
Shivhar	86.93	28.50	14.86	130.28
Sitamarhi	114.16	32.15	16.61	162.92
Siwan	86.41	25.53	8.72	120.65
Supaul	35.06	10.55	10.74	56.35
Vaishali	206.43	80.03	43.59	330.05
W.Champaran	160.04	48.53	22.98	231.55
Bihar	**124.47**	**39.69**	**21.36**	**185.53**

Source : Fertilizer Association of India,

Table-3.2: Economics of Selected Crops in Bihar and Other States (As of 2008-09)

States	C_2 Cost of Cultiv-ation Rs./hectare	Yield Qtl/ ha	MSP Rs./ Qtl	Gross Returns /ha	Net Return per Hect.
		Paddy			
Andhra Pradesh	46450	56.00	900	50400	3950
Tamil Nadu	40242	42.00	900	37800	-2442
West Bengal	33046	39.04	900	35136	2090
Bihar	18210	26.65	900	23985	5775
Punjab	45291	67.41	915	61680	16389
Haryana	43623	42.01	915	38439	-5184
		Wheat			
Bihar	19789	25.59	1080	27637	7848
M.P.	22490	23.59	1080	25477	2987
U.P.	31903	34.99	1080	37789	5886
Punjab	35423	39.83	1080	43016	7593
Haryana	37451	45.66	1080	49313	11862
		Maize			
Andhra Pradesh	37802	42.68	840	31754	-6048
Bihar	19858	42.95	840	36078	16220
M.P.	13055	10.81	840	9080	-3975
Tamil Nadu	31835	45.05	840	37842	6007
U.P.	21045	13.70	840	11508	-9537
		Gram			
Andhra Pradesh	26762	16.69	1730	28874	2112
Bihar	13666	12.81	1730	22161	8495
Madhya Pradesh	16873	10.29	1730	17802	929
Rajasthan	12611	06.83	1730	11816	-795
Uttar Pradesh	21618	10.93	1730	18909	-2709
		Lentil			
Bihar	10900	07.33	1870	13707	2807
Madhya Pradesh	16130	07.82	1870	14626	-1507
Uttar Pradesh	20924	09.61	1870	17971	-2953
West Bengal	17916	07.50	1870	14025	-3891
		Arhar			
Andhra Pradesh	24172	06.40	2000	12800	-11372
Bihar	14662	09.48	2000	18960	4298
Madhya Pradesh	14205	07.16	2000	14320	115
Tamil Nadu	16205	03.71	2000	7420	-8785
Karnataka	16529	07.47	2000	14940	-1589
Uttar Pradesh	23077	09.83	2000	19660	-3417
		Rape Seed & Mustard			
Bihar	17930	08.57	1800	15426	-2504
Gujarat	19084	11.61	1800	20898	1814
Rajasthan	19260	13.54	1800	24372	5112
Uttar Pradesh	22560	13.57	1800	24426	1866
West Bengal	21479	07.68	1800	13824	-7655

Source: CACP, Ministry of Agriculture, Government of India

Table -3.3: Districtwise Cropping Intensity and Irrigated Area (2007-08)

District	Cropping Intensity (%)	% Irrigated Area	District	Cropping Intensity (%)	% irrigated area
Patna	1.11	56.65	Madhepura	1.73	73.96
Nalanda	1.17	83.31	Purnea	1.33	54.30
Rohtas	1.28	84.61	Araria	1.54	40.95
Kaimur	1.39	48.70	Kishanganj	1.33	26.74
Buxer	1.44	68.21	Katihar	1.54	44.47
Bhojpur	1.24	79.36	Bhagalpur	1.16	30.85
Gaya	1.23	47.59	Banka	1.14	37.81
Aurangabad	1.37	67.94	Munger	1.22	26.44
Jehanabad	1.41	71.50	Lakhisarai	1.28	32.51
Arwal	1.32	76.40	Begusarai	1.45	48.45
Nawada	1.42	50.83	Jamui	1.10	16.65
Saran	1.22	44.42	Khagaria	1.59	55.97
Siwan	1.50	47.88	Sheikhpura	1.59	86.17
Gopalganj	1.51	52.79	Bihar	1.35	54.00
Muzzafarpur	1.56	41.32			
Sitamarhi	1.44	32.29			
Sheohar	1.72	28.75			
West Champaran	1.40	36.50			
East Champaran	1.26	36.03			
Vaishalli	1.53	38.58			
Darbhanga	1.28	40.19			
Samastipur	1.29	42.90			
Madhubani	1.35	39.14			
Saharsa	1.76	57.57			
Supaul	1.64	59.46			

Soruce: Economic Survey, 2010-11, Govt. of Bihar and Directorate of Statistics and Evaluation, Govt. of Bihar.

Table 3.4 Districtwise Flood Affected and Drought Prone Area in Bihar

Districts	Flood Affected Area (000 ha)	% of GCA	Drought Prone Area (000 ha)	% of Gross Cropped Area
Araria	255	100.00		
Aurangabad			330.50	100.00
Banka	2	1.06		
Begusarai	99	53.25		
Bhagalpur	51	26.77		
Bhojpur			397.11	98.00
Darbhanga	80	40.57		
East Champaran	100	28.46		
Gaya			651.00	100.00
Gopalganj	51	20.66		
Katihar	194	69.98		
Khagaria	97	74.86		
Kishanganj	39	22.85		
Lakhisarai	33	38.19		
Madhepura	24	10.58		
Madhubani	32	11.05		
Munger	9	13.14	788.45	100.00
Muzaffarpur	308	100.00		
Nawadaha			249.40	100.00
Purnia	119	40.61		
Rohtas			719.97	98.00
Saharsa	96	44.78		
Samastipur	43	16.97		
Saran	80	34.00		
Sheikhpura	34	56.25		
Sheohar	47	100.00		
Sitamarhi	1.23	57.51		
Supaul	38	15.31		
Vaishali	32	16.44		
West Champaran	105	25.14		
Total	**2199**	**41.38**	**3136.43**	**10.00**

Source: Directorate of Economics & Statistics, Govt. of Bihar

Recent CSD Publications

1. India Social Development Report : 2008, OUP, New Delhi
   - Development and Displacement
2. India Social Development Report : 2010, OUP, New Delhi
   - The Land Question and The Marginalized
3. India Social Development Report : 2012, OUP, New Delhi
   - Minorities at the Margins

Books

1. Balakrishnan Rajiv, **Towards Just and Equitable Development: Durgabai Deshmukh Memorial Lectures**, Konark Publishers, New Delhi, 2012
2. Venugopal K. R. **The Integrated Child Development Services A Flagship Adrift**, Konark Publishers, New Delhi, 2012
3. Ghosh Arun Kumar, Munda Ram Dayal **The Other Side of Development The Tribal Story**, Konark Publishers, New Delhi, 2012
4. Haque T. **Land Policies for Inclusive Growth in India**, Concept Publishing Co., New Delhi, 2011
5. Trivedi Prashant K. **The Globalization Turbulence Emerging Tensions in Indian Society**, Rawat Publication, New Delhi, 2011
6. Saxena K. B., Mohanty Manoranjan and Chakravartty Sumit **A Fistful of Dry Rice: Land, Equity and Democracy; Essays in honour of D. Bandyopadhyay**, Aakar Publishers, New Delhi, 2011
7. Mohanty Manoranjan, Saxena K. B., Sebastian Gilbert and Trivedi Prashant **Weapon of the Oppressed : An Inventory of People's Rights in India**, Daanish Publishers, New Delhi, 2011
8. Mathur, Hari Mohan **Resettling Displaced people : Policy and Practice in India**, Routledge Publishers, New Delhi, 2011
9. Balakrishnan, Rajiv **Demographic Transition: An Asian Perspective**, Konark Publishers, New Delhi, 2011
10. Venkata Ravi R., V Narayana Reddy and D. Sunder Raj **Advancement of India : Attainments and Alternatives**, Kanishka Publishers, New Delhi, 2010
11. Bhaduri, Amit **Critical Essays on the Dynamics of Capitalism: Macroeconomic Theory & Policy**, Setu Prakashani, Kolkata, 2010
12. Saxena, K. B. **Health Policy and Reform: Governance in Primary Health Care**, Aakar Books, New Delhi 2010

Council for Social Development
53, Lodhi Estate,
New Delhi - 110003
Ph.011-24615383, 24611700
Fax No. 011-24616061
Email csdnd@del2.vsnl.net.in, drh@csdindia.org
Website www.csdindia.org