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Agricultural Scenario and Strategies for Development: The Case of Bihar

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Abstract

Agriculture is at the core of Bihar's economy, employing 77 % of the workforce and generating 35 % of the state domestic product. With 88 % of the state's poor living in rural areas, improving agricultural performance and related rural non-farm activity is critical for improving livelihoods and reducing poverty. Major crops grown in Bihar are rice, wheat, maize, gram, red gram, sugarcane, potato & other vegetables. However, the agricultural sector in Bihar is plagued with numerous, and well known, constraints and problems. The present paper discusses the issues plaguing the agricultural sector in Bihar state, India and talks about the possible strategic interventions to make the best use of available resources adopting a multi-pronged strategy of development. It also talks about the area specific problems and suggests ways and means to tackle them.

Key words: India, Bihar, Agricultural sector, Development strategies,

Introduction

Bihar is located between 24⁰20'10" N to 27⁰31'15" N latitude and 83⁰19'50" E to 88⁰17'40" E longitude. It has a geographical area of 9.416 million hectares and a population of 103.8 million (8.6% of all India) with population density of 1102 persons per sq km and literacy rate of 63.82% (male-73.89 and female-53.33) as per 2011 census. The Scheduled Caste (SC) and Scheduled Tribe (ST) population comprised 15.72 and 0.91 percent of total population respectively (2001 census). Area wise, Bihar occupies 12th position in India. The state has 38 districts, having 101 subdivision and 534 blocks. The state falls under agro climatic zone IV (Middle-Gangetic plain region). The state is further divided into 3 agro ecological zones.



Agroclimatic zones of Bihar

Zone-I : North west alluvial plains, Zone-II : North east alluvial plains, Zone-III : South Bihar alluvial plains (further subdivided in to two (IIIA & B))

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Annual normal rainfall is 1176.4 mm with rainy season from June to September. The net area sown and gross cropped area during the year 2007-08 were 5.67 million ha and 7.91 million ha, respectively. Cultivable area is 6.64 m ha. The cropping intensity was 139%. Fertiliser nutrient (N+P₂O₅+K₂O) consumption/ha is 162.8 kg/ha. About 61.1% of net sown area is irrigated. The gross irrigated area during the 2007-08 was 4.79 million ha and net irrigated area is 3.46 m ha. Annual replenishable ground water resource is 29.19 BCM (billion cubic meters) of which draft is 10.77 BCM. Level of ground water development is only 39%.

Agricultural Scenario

Agriculture is at the core of Bihar's economy, employing 77 % of the workforce and generating 35 % of the state domestic product. With 88 % of the state's poor living in rural areas, improving agricultural performance and related rural non-farm activity is critical for improving livelihoods and reducing poverty.

Table 1. Area, production and productivity and percent irrigation of major crops

Crops	Area (m ha)	Productivity (t/ha)	Production (m t)	Percent GCA irrigated
Rice	3.50	1.60	5.60	57
Wheat	2.16	2.04	4.41	92
Maize	0.64	2.68	1.71	60.3
Pulses	0.59	0.80	0.47	3.2
Coarse cereals	0.68	2.58	1.75	56.9
Oilseeds	0.14	1.00	0.14	38.2
Sugarcane	0.11	44.30	4.96	23.7
Jute and mesta	0.15	1.45	1.22	-

Directorate of Econ. & Stat. DAC 2008-09 *figures corresponding to 2007-08

** Million Bales of 180 kg each.

Major crops grown in Bihar are rice, wheat, maize, gram, red gram, sugarcane, potato & other vegetables. Total food grain production in 2008-09 was 12.22 million tones, pulse production 0.47 million tones and oilseeds 0.14 million tones. Area, production, productivity and percentage of gross cropped area irrigated is given in Table 1. Per capita availability of food grains is 322.54 g/day against all India average of 583 g/day.

Total forest area in the state is 0.62 m ha. Bihar is bestowed with meager forest resources and accounts for only 6.6% of the total geographical area of state. The soils of Bihar are mainly alluvial developed from alluvium brought by the various rivers of the state. North Bihar (zone I and II) has young alluvium with less genetic horizon development, whereas south Bihar (zone III) has older alluvial soils with appreciable profile development. Soils have in general neutral to alkaline pH, with less water holding capacity.

However, the agricultural sector in Bihar is plagued with numerous, and well known, constraints and problems. These include:

1. Extremely volatile agricultural output mainly due to shocks from regular monsoon flooding in some parts of the state and periodic drought in others.
2. Low productivity – average yields of rice and wheat the two most widely cultivated crops are 20 – 25 % less than the India average, and less than half of what is obtained in Punjab.

3. Poorly developed rural road infrastructure – less than half of Bihar’s villages are connected -- which limits market access.
4. Floods, water logging, poor drainage, and inadequate public investments on expanding and maintaining surface irrigation systems.
5. Access to electricity is limited to only 5 % of rural households compared to 44 % nationally – lack of rural electrification is a formidable barrier to both farm and non-farm development.
6. Farmers without access to surface irrigation (only 30 % of irrigation is from surface sources) have to rely mainly on diesel, rather than electricity, to tap groundwater sources which raises production costs and affects competitiveness.
7. Land tenancy is illegal but widespread, with field studies indicating around 25 % of cultivated area under short-term oral tenancy – this, together with a moribund organized rural credit system, and small and fragmented farms (average farm size in Bihar of about 0.7 hectare is half the national average), acts as a severe disincentive to private investments on land.
8. Public research and extension services suffer from a variety of familiar ills including lack of strategic focus, thin dispersal of available resources, and inability to effectively utilize available staff due to limited operating budgets.

Horticultural Scenario

Bihar has a total area of 0.2614 million ha area under fruit crops with highest under mango, followed by banana. The average productivity of fruit crops like banana, papaya and pineapple is higher in Bihar compared to that of Eastern region. On an average, Bihar has 19.824% area of Eastern region under fruit crops. Bihar ranks first among all the Eastern states so far in production of fruit crops were concerned. Of the total fruit production, Bihar contributes 25.612%, followed by West Bengal. Table 4 depicts the data on fruit production in Bihar.

Area under vegetable and spices in Bihar has been reported to be 0.6742 million ha, i.e., 20.823% of the Eastern region. Highest area has been recorded under potato, followed by cauliflower. The average productivity of Brinjal, okra, potato, onion and sweet potato is higher in Bihar compared to average productivity of Eastern region. So far in production was concerned, Bihar contributes 23.230% of the total production of Eastern region (Table 3).

Table 2. Production of fruits in Bihar (2009-10)

Crop	Area (m ha)		Productivity (t/ha)		Production (m tonnes)	
	Bihar	ER	Bihar	ER	Bihar	ER
Banana	0.0315	0.1756	45.565	24.923	1.4353	4.3765
Citrus	0.0179	0.0939	7.330	8.796	0.1312	0.8259
Guava	0.0292	0.0939	7.928	10.022	0.2315	0.9411
Litchi	0.0306	0.0558	7.029	7.582	0.2151	0.4231
Mango	0.146	0.5714	6.821	6.825	0.9959	3.8998
Papaya	0.0015	0.0313	23.733	23.578	0.0356	0.738
Pineapple	0.0047	0.0292	26.596	22.267	0.125	0.6502
Arecanut		0.04		1.250		0.05
Coconut		0.04		7.500		0.3
Sapota		0.0075		8.093		0.0607
Cashewnut		0.18		0.611		0.11
Total	0.2614	1.3186	-	-	3.1696	12.3753

Table 3. Production of vegetables and spices in Bihar (2009-10)

Crop	Area (m ha)		Productivity (t/ha)		Production (m tonnes)	
	Bihar	ER	Bihar	ER	Bihar	ER
Brinjal	0.0553	0.4093	21.675	17.563	1.1986	7.1887
Cabbage	0.0387	0.2195	17.827	22.932	0.6899	5.0336
Cauliflower	0.0622	0.2382	17.365	18.988	1.0801	4.5229
Okra	0.0853	0.3002	8.987	10.249	0.7666	3.0766
Peas	0.0093	0.1434	68.280	11.964	0.635	1.7156
Tomato	0.0465	0.2845	22.445	17.551	1.0437	4.9932
Onion	0.053	0.1427	18.340	14.663	0.972	2.0924
Potato	0.3136	1.0434	17.179	19.901	5.3872	20.7651
Sweet potato	0.0003	0.0916	23.333	8.989	0.007	0.8234
Spices	0.01	0.365	1.000	1.485	0.01	0.542
Total	0.6742	3.2378	-	-	11.7901	50.7535

Livestock Scenario

Bihar has a total livestock population of 30.34 million with highest to cattle and lowest in sheep, respectively. Goat occupies the second position in Bihar as depicted in Table 4. In general, Bihar contributes 18.39% of livestock and 6.48% of poultry population, respectively, in eastern region.

Table 4. Total livestock population and its contribution to total livestock in Eastern region

Sl. No.	Species	Bihar (million)	Eastern region (million)	Percent composition in Bihar	Percent composition in Eastern region
1	Total cattle	12.56	80.39	41.49	48.74
2	Buffalo	6.69	21.86	22.10	13.25
3	Goat	10.17	51.02	33.60	30.93
4	Sheep	0.22	5.29	0.73	3.20
5	Pig	0.63	6.11	2.08	3.70
6	Total livestock	30.27	164.95	18.35% of Eastern region	
7	Total poultry	11.42	176.23	6.48% of Eastern region	

Source: Basic Animal Husbandry Statistics, 2010

To sustain the livestock population, there is a total requirement of 25.95 million tonnes of dry and 42.90 million tones of green fodder, however, the availability is far below than the projected requirement (Table 5). Similar is the case for concentrate feed (Table 8).

Table 5. Demand and supply of feed and fodder in Bihar

Eastern States	Dry fodder requirement	Availability (million tonnes)	Deficit (%)	Green fodder requirement (million tonnes)	Availability (million tonnes)	Deficit (%)
Bihar	25.95	15.61	39.83	42.90	1.35	96.85
Eastern Region	150.80	84.03	44.27	213.19	51.77	75.72

Calculated based on 2001 Census data

Table 6. Demand and supply of concentrate in Bihar

State/region	Concentrate requirement (million tonnes)	Availability(million tonnes)	Deficit (%)
Bihar	6.63	1.19	82.05
Eastern region	39.44	6.14	84.43

Calculated data based on 2001 Census

So far in per capita availability of milk, egg and meat etc. is concerned, Bihar has comparatively higher availability of milk, however, meat and egg availability is low compared to eastern region as detailed in Table 9.

Table 7. Total production and per capita availability of milk, egg and meat in Bihar

State/UTs	Total production			Per capita availability		
	Milk (million tonnes)	Meat (million tonnes)	Eggs (million nos.)	Milk (kg/yr)	Meat (kg/yr)	Eggs (Nos./yr)
Bihar	6.124	0.21	1100.20	63.87	2.10	11.00
Eastern India	23.49	0.996	8960.5	57.94	2.46	22.10
All India	112.54	4.017	59843.6	96.00	3.32	51.00

Source: Basic Animal Husbandry Statistics, 2010

Bihar is able to produce 17.27 million tonnes of organic manure, if collected and used in a organized way. The livestock availability is, however, low (0.29 per person) is Bihar than Eastern region as shown in Table 10.

Table 8. Availability of wastes and livestock: human ratio in Bihar

State	Waste (million tonnes-DW basis)	Waste available/Hectare of Net sown area (tonnes)	Livestock: human ratio
Bihar	17.27	3.05	0.29
Region	88.55	2.64	0.46

Calculated on the basis of Population Census, 2011

Fishery Scenario

Bihar has a ample scope of agro-aquaculture production. It has a total of 0.361 million ha area under freshwater culture and produce 0.301 million tonnes of fishes. A detail of fish production, productivity and requirement etc. is shown in Table 9. So far in fish seed is concerned, the state is deficient in fish seed as depicted in Table 10.

Table 9. Freshwater area, fish productivity and per capita availability in Assam

State/region	Total freshwater area (m ha)	Freshwater productivity (t/ha)	Total freshwater production (m tonnes)	Total fish demand (m tonnes)	Per capita fish availability (kg/yr)
Bihar	0.361	0.830	0.301	1.256	2.90
Eastern region	2.922	0.806	2.44	4.640	6.72
India	45.60	0.102	4.67	13.31	6.61

Table 10. Fish seed availability and requirement in Bihar

State/ region	Total fish seed production (million fry)	Total fish seed demand (million fry)	Deficit %
Bihar	300.00	900.00	66.67
Eastern region	6710.0	11881.0	43.52
India	21000.0	39930.0	47.40

Based on the above-mentioned facts and figures, the major constraints identified for agricultural development in the state are given below:

- Complex, Diverse and Risk prone (CDR) agriculture
- Average holding size is < 0.60 ha
- 84% of farmers are under small and marginal category
- Tenant farming is widely prevalent
- Due to undulating topography; soil erosion, loss of soil nutrients and soil moisture is common
- Flash floods causing inundation and intermittent droughts
- Improper water management, resulting in lower water productivity
- Imbalance use of fertilisers, with more urea and less potassium fertiliser
- Low seed replacement rate
- Late transplanting of rice and delay in crop cycle, leading to low productivity
- Low level of farm mechanisation, poor crop diversification
- Lack of rain water harvesting structures (in situ and ex situ)
- Inadequate post harvest infrastructure including processing and value addition
- Inadequate market and credit and infrastructure support

Management Strategies to improve agriculture production are:

- In situ soil & water conservation measures & water harvesting through farm ponds
- Crop diversification using non rice crops like pulses, oilseeds, maize as sole or intercropping in uplands and popularization of agro forestry systems
- Integrated farming system modules covering crop, livestock, poultry, fishery, bee keeping and mushroom cultivation, particularly for small and marginal farmers
- Use of situation specific drought, disease tolerant and pest resistant crops, popularization of hybrids of rice, maize, sunflower and vegetables
- Utilization of rice bunds for growing Arhar & Sesamum (Til)
- Intercropping of Arhar, Moong, Urd with maize and fodder
- Thrust on utilization of diara, tal and chhaur lands
- Popularization of seed village scheme and intensification of seed production programme
- Balanced fertilizer use and integrated nutrient management
- Encourage organic farming in areas, which incidentally are organic by default, development of market for organic products and less stringent certification procedure for domestic market

- Strengthening soil testing services and making provision of soil health card to all farmers owning land
- Efficient application and multiple uses can improve the water productivity from current level (0.46 kg/m³ water)
- Renovate traditional water harvesting structures and minor irrigation projects
- Energizing defunct lift irrigation points, efficient utilization of ground water, popularization of micro irrigation system and involvement of farmers through participatory irrigation management (PIM)
- Farm mechanization for agricultural operations (women friendly drudgery reducing implements), single window delivery system for agricultural inputs
- Non traditional and conventional energy sources may be explored like biomass, wind and solar energy
- Information and services at village level support for storage infrastructure including cold storages/ development of cold chain for value addition and improvement of market yards.

Researchable issues for improved agricultural production in different sectors are:

Crops

- Development of improved cultivar/varieties of cereals, pulses and oilseed for location specific and prevailing climate change situation
- Development of suitable farming systems for different agro-ecological zones
- Screening/development of suitable varieties and production technologies for Direct Seeded Rice (DSR)
- Evaluation of cereal-legume cropping system in uplands for nutritional security
- Screening of jackfruit and drum stick for round the year production
- Hybrid seed production in participatory mode
- Farming systems for small and marginal farmers
- Identification of crop sequences with better water productivity.
- Culture of honeybee for better pollination

Land and water management

- Designing, demonstration and refinement for solar operated lifting system and irrigation methods
- Standardization of bund height for water retention in irrigated rice-wheat cropping system
- Disaster management (Floods, droughts and climate change) in eastern region
- Inventorization of resources (land and water) and its management
- Rainwater harvesting and its judicious utilization
- Promotion and implementation of water and energy efficient technologies
- Groundwater management and conjunctive use (Criteria and decision making)
- Balanced use of micro and macro nutrients to remove deficiency in soil and improved quality of production

Livestock and fisheries

- Conservation of local breeds and Improvement of non-descript breeds
- Diagnostic kits for different diseases for improvement of animal health
- Value addition in livestock products
- Improvement of buffalo
- Residual management through utilization for animal feeding by compaction

- Storage procedure for dry fodder and its nutritional improvement through fortification and feed block making and feed bank in flood and drought prone areas.
- Nutrient management of fodder crops
- Evaluation of brooder stock of fishes collected from different rivers
- Management strategy for tal area for fish production
- Seed production in fish
- Goat development programme

Strategies for addressing the Critical Issues

Lack of good quality agricultural producer organization such as cooperatives, PACS, farmer federation, it is required for more involvement of farmers into planning and implementation of extension and adaptive programs; increased collaboration between line departments with responsibility for agriculture and allied sectors; and Public-Private partnerships with private sector and NGO service providers. Introduction of innovative agricultural, livestock and fisheries production systems should be actively promoted. Research and extension activities should be driven by current and emerging market opportunities; and ; for planning purposes there should be convergence of funds from various sources that are earmarked for extension and adaptive research at the district level. Development of agriculture, horticulture, food processing industries and related rural and peri-urban activities assume greater importance and provide opportunity for economic growth, improving livelihoods and reducing poverty in Bihar.

Agricultural Issues

Important for cereals (Wheat and Maize), the state is major producer of horticultural crops especially fruits and vegetables. A wide variety of crops, horticulture and tree species are grown viz., cereals (rice, maize, wheat), oilseeds (mustard, sesamum), pulses (lentil, gram pigeon pea), fruits (Mango, Banana, Litchi, guava, citrus, pineapple, makhana), vegetable (potato, onion, tomato, okra, parwal, peas, cauliflower, cabbage), aquaculture (fish, singhara, prawn). The state has a total area of 2.81 lakh ha under different fruit crops with a production of 33.8 lakh MT and is the major litchi exporting state of the country. The total area under vegetables including potato and onion is about 8.43 lakh hectares with an estimated production of 86.43 lakh MT. Also, in terms of the gross value of components of agricultural production, fruits and vegetables rank second after cereals having 28.6 percent.

Indo-Gangetic plains have predominantly rice-wheat cropping system, in view of changing scenario, marketability and commercialization, there is a need of diversified crops and land use systems to bring in more integration, wide variety of choice, risk minimization and sustainable agricultural development. Bihar is a leading state in maize production. It has multiple uses. The baby corn, sweet corn, popcorn and green cobs are remunerative enterprises for increased income and profit. In Bihar expansion in area under Quality Protein Maize (QPM) will result in enhanced profitability. Maize based industry producing starch, human food (corn flakes, popcorn, bread, and confectionary), animal and poultry feed etc. can be popularized for better return.

In case of rice, we may concentrate on organic farming of scented rice varieties such as Katarni of Bhagalpur region and Rajendra Basmati, Sugandha in Patna region. However, there is need of introducing rubber rollers of high quality. Parboiling is one of the latest well-developed pre-milling treatments given to paddy to improve its quality. In comparison to raw rice milling, parboiling system has some additional advantages like higher head rice recovery, retaining more protein, vitamin and minerals, greater resistance to insect infestation during storage and leaching loss during cooking. Further, parboiled rice bran contains 30 % oil whereas raw rice bran contains only 15-20 % oil.

In Bihar, parboiling mills are mainly situated in old Shahabad district. These need to be modernized and spread in different regions. The modernized rice mills get higher (68-72 %) total mill yield and about 60-65 % head yield of rice recovery and segregated by byproducts like good quality bran which could be more effectively utilized for extraction of edible bran oil. Apart from this there is great scope of popularization of mills / small scale industries to produce pressed rice as well as puffed rice in the state.

A variety of agricultural produce viz. milk, makhana, mango, litchi, spice, scented rice, pulses oilseeds, vegetables, medicinal and aromatic plants, flowers have immense potential for commercial agriculture and setting up of processing industry in production area. Honey and ornamental fishes have high potential for commercialization. As the pulses are the cheapest source of protein, 15 % milling loss will result in loss of 2 millions tones of pulses. Various types of polishing machines have come up, like leather polishers, rubber polishers, nylon rope polishers and emery roll polishers. Polishing dal surface is done by removing power sticking to its surface, applying water (1-1.5 kg/q), smearing soap stone or Selkhari power (1-1.5 kg/q), or oil 100-200 g/q). Thus there is good scope in dal industry for Bihar to compete with other states of the country. In Bihar there is great scope of instant dal, Parched grain and dal power manufacture, green colored arhar dal sorting etc. Jute and paper industries may prove great promise in the north-east Bihar region. In Kishanganj and Araria districts tea is cultivated in 1600 and 200 ha respectively. If it extends to the potential area of 10,000 ha, there will be prosperity of industrialization in the region.

Area Specific Issues and Strategies

Southern plains

Important for large share in production of rice (41%) and gram (76%) making this sub region granary of Bihar. This region covers the maximum area of the state (40,66,000 ha) having an annual rainfall of 1103 mm. The soil of the region is characterized as old alluvium to sandy loam clayey. The region comprises of districts like Bhojpur, Rohtas, Buxar, Patna, Aurangabad, Gaya, Jahanabad, Banka, Nawada, Nalanda, Munger, Jamui, and Lakhisarai. Metropolitan cities like Calcutta, Delhi well connected from Patna are the potential market.

The main horticultural crops of this region are mango, guava, banana, bael, jackfruit, cole crop, onion, potato, parwal, chilies, marigold etc. However, area under fruit crops in this region is low. Bringing more area under high density planting will help in increasing the production of fruit crops in the region. The region is known for distress sale of fruits like banana in Vaishali district, bael in Gaya, Patna and Lakhisarai districts, mango in Patna, Munger and Jamui districts, potato and Cole crops in Nalanda and Nawada districts. Hence, setting up of post harvest handling facilities for these commodities in the respective region will help in minimizing the post harvest loss of the produce and will be highly remunerative. Setting up of processing facilities of turmeric in Banka and Patna districts may also be highly remunerative.

Promotion of floriculture in areas around Patna, Lakhisarai districts can also provide high dividend. Hajipur region is known for quality production of tropical cauliflower seeds. Intensification of Seed Production of Cole Crops, onion etc will also be highly remunerative. Setting up of potato seed production units in areas like Patna, Nalanda and Nawada districts will also be highly profitable. Apart from this, cultivation of several spices, condiments and medicinal plants like Aswagandha, Sarpagandha, Kalmegh, Vasak, Tinospora etc can be grown effectively in Jamui region.

Northern Plains

The region covers an area of 32,61,000 ha, comprising of districts like Bettiah, Mothari, Gopalganj, Siwan, Chhapra, Vaishali, Muzaffarpur, Samastipur, Sitamarhi, Sheohar, Madhubani, Darbhanga. The average annual rainfall of the region is 1275 mm. Large area in this region remains under water also called, Chaur, Maun & Tal lands. The region is known for quality litchi production. Mango and makhana are other specialty crops of this region. Setting up of cold storage and processing units of litchi at Muzaffarpur and Samastipur districts, and processing units of mango at Madhubani, Muzaffarpur and Darbhanga, and processing units of makhana in Darbhanga district would be highly remunerative ventures.

Setting up of Agri-Export zone for litchi in the Hajipur area has further given fullip to horticulture development in this region. Samastipur region is also known for quality papaya production. Expansion of area under papaya can be effectively carried out in this district. Quality seed production of papaya varieties in the region holds promise. Expansion of more area under makhana and water chestnut will help in proper utilization of the water congested areas and wet lands. The interspaces of old orchards of mango and litchi in this region can be effectively utilized by growing shade-tolerant crops like ginger and turmeric, while intensification of floriculture in Muzaffarpur area can also be taken up .

Northeast Plains

This region covers an area of 19,56,000 ha comprising of districts like Madhepura, Purnea, Katihar, Khagaria, Begusarai, Saharsa, Araria, Kishanganj, Bhagalpur. The Soil is sandy to silty loam, medium to strongly acidic, large area in this region comprise of Tal and Diara Lands. Mango, bael, banana, papaya, cucurbits, chilies, Cole crops and turmeric are the main horticultural crops grown in this region. Expansion of area under high density planting of different fruit crops can be taken up in this region. Setting up of processing facilities of banana, papaya, and mango in Bhagalpur and Saharsa district and for bael in Begusarai region could be highly profitable venture. Quality seed production of papaya and different vegetable crops holds promise in this region. Setting up of nursery for production of quality planting material of different fruit crops can also be a profitable venture.

The natural water bodies can be utilized for production of makhana and water chestnut. Intensification of cucurbit cultivation for vegetable as well as seed in diara lands particularly during spring summer period can also be highly remunerative.

Other Important issues

Seed production and Planting Material

Quality seed is in scarce in Bihar, though seed production is a highly profitable enterprise. Seed village concept including organized systematic method of breeder, foundation, certified and truthful seed will change the face of Bihar Agriculture. Since the region has immense potential for fruit production, ensured supply of quality planting material of different fruit plants has great scope. Ornamental plants can also be propagated and distributed in large scale. Certification and quality control of existing nurseries in the state also need to be done urgently. Production of quality seeds of vegetables particularly onion, cauliflower, French bean, okra, brinjal, tomato, cucurbits, cowpea and pea will be highly remunerative venture for the state. The Hajipur region is known for quality seed production of tropical cauliflower. Efforts should be made for intensification of seed production scientific and organized manner.

Organic Farming

The increasing consciousness among the people towards hazards of synthetic chemicals has given rise to the scope of organic farm produces. There is a great demand of organic foods among the urban rich as well as in the western markets. Agro-inputs like bio-fertilizers, bio pesticides, vermin compost etc. are major components of organic farming system. There is easy availability of raw materials for organic pesticides and manures in the state. Large scale investment in this sector will be a highly remunerative venture.

Agri-Implement Production

Agriculture and allied enterprise can be a business, which may maximize productivity, income and employment. Many improved implements are required for agricultural operations. Most of them can be fabricated on commercial scale at local level with some incentives and support at policy level.

Processing and Value Addition

Most of the agricultural produce can be processed and value added resulting in high demand, more acceptability of consumer and better returns. For example, makhana a prestigious aquatic crop of north Bihar fetches only Rs. 100 per kg at farm and sells at Rs. 800 to 1000 when converted to makhana flacks, kheer, roasted pop or baby food. Similarly potato, fruit crops and many other produce can be processed and value added for beneficial returns and employment generation. Rising farm incomes will generate tremendous demand for consumer goods, equipments, processing and distribution industries stimulating rapid growth in industry and rising job opportunities in both the rural and urban sectors. Commercial agriculture and processing can bring prosperity to Bihar.

Storage and Transportation

Only in horticultural produce, Bihar suffers a staggering loss to the tune of 30 % due to inadequate post harvest management. There is a need to better manage our harvest and prepare maturity indices for different markets, cool chain management, CA storage, transport and logistics. Proper storing facilities and transportation at the production site and processing site will minimize post harvest losses and enhance profitability.

Packing and Brand Development

With the advancement of pre and post harvest technology, proper packaging, handling and brand development is gaining grounds. Scientific and proper packing not only saves the post harvest losses but also increases shelf life and price tag. High aesthetic and technological packing and development of brand of Bihar Agricultural Products will fetch high prices and have a larger share of the market. FPO licenses in Bihar are inadequate its easy availability will go a long way in ensuring quality standards for strong brand development.

Marketing and Export

The marketing and export of agricultural produce needs greater emphasis. Presently farmers don't get any support for marketing and export of their produce. Very few crops are listed in the minimum support price of the government, subjecting farmer to the natural vagaries of the market forces. With the WTO regime in force, our produce needs to become globally competitive, which calls for aggressive marketing strategies and intelligent export mechanism. Market intelligence, marketing infrastructures and simple export procedure will go a long way in the success of commercial agriculture and bloom of processing industries.

Development of Market Infrastructure and Services

Improvement in infrastructure particularly good motorable roads, assured availability of power to the farmer – through solar power; Storage systems in large metric tones capacities ; Food processing plants; Input and output quality assurance centers for seeds and food grains; and marketing centers. Export Promotion Industrial Park has been proposed at Hajipur and Air Cargo Complex to be established at J.P. International Airport. 1.5 Acre of land is already allotted however, additional requirement of 0.35 acre of land, is yet to be handed over. Project is pending for last many years as Airport Authority of India does not find it feasible. Further, international certification of niche products e.g; Makhana, spices, litchi, medicinal herbs, vegetables, mango, etc are also required to be undertaken. Product patenting and standardization, international brand promotion, export market research and rapid of shore support through inland container depot is also required. Establishment of pack houses, cold storage capacity for both vegetables and fruits and Potato graders.

Extension support and HRD

The success of commercial agriculture and processing industry in Bihar will largely depend on continuous and proper human resource development of various stakeholders and operators. Awareness, motivational, technical skill, knowledge development should be the thrust component of the HRD. Specific institutions, Entrepreneurial farm school, etc. may be thought of for Bihar. This will serve as repository of information and knowledge in concern area.

In addition to the above, organizing farmers' days, holding of field demonstrations, cross-farm visits of extension experts and effective use of mass media i.e. print and electronic media for transfer of technology may play a major role in promotion of various resource conservation technologies amongst farming community. Capacity building of farmers to acquire, test and adopt technologies through participatory approach will enable them to seek resource conservation technologies for their farms and thus they can reduce their production cost and combat production constraints. Improvement in coordination among various stakeholders (research, extension service, farmers, service providers, agricultural machinery manufacturers, etc.) for transfer of technologies will play a pivotal role in accelerating adoption of new interventions.

The efforts from extension, research, supply of inputs, development of market channels, for disposal of organic foods are needed to facilitate the successful adoption of organic farming by the farmers. The approach shall be farmer centered and the programmes developed shall create conditions for the conservation and efficient use of locally available resources as inputs in agriculture.

Agricultural Credit

Provision of credit to agriculture sector has been one of the main concerns of policy planners in India since independence. However, an assessment of the situation at ground level indicates that recourse to non-institutional credit continues to dominate as far as rural areas and agriculture sector are concerned. The paper tries to examine the credit policy, crop insurance related issues and the role self help groups can play in overall economic development in the state of Bihar, India.

Animal Husbandry and Dairy Sector

Dairy farmers should also be advised for meeting the requirements of feed by providing desired nutrients through feeding of green fodder which not only reduces intake of concentrates but also helps in reducing the cost of production. Treatment of dry fodder with urea helps in improving its nutritive value, and such technologies may be popularized to make feeding balanced and cost effective. Per capita availability of animal protein in the state is about 58 % in case of milk, 54 % in meat and one-fourth in eggs when compared to their respective availability at national level.

Survey revealed that private practitioners played a major role in maintenance of general health and management of livestock. Public Animal Health Centers were the second most utilized source for health care services, particularly on medium and large farm households. Dairy sector generated annual per household employment of 831 hrs and goatry provided annual employment of 736 hrs for family members.

The private sector has not however shown the same interest in the lagging states (with the exception of few individual initiatives) for various reasons, including poor infrastructure, weak producers' organizations, law and order issues, and other governance concerns. Contract farming has become the dominant mode of production in the broiler industry, while independent enterprises remain dominant in the layer industry.

There has been significant scaling up of production units in both broiler and layer industries, including contract production units. However, the higher degree of specialization and the increased economies of scale and size in poultry production, in addition to the concentration of both the dairy and poultry industries in few states have seriously limited the opportunities for creating wider geographical impact through participation of a larger number of smallholders, especially from the lagging states in the newly developed value chains. Regional inequality in development can stifle the overall development potential of the sector. The dairy value chains can be popularized through the SHG approaches. Improving supply chains and operations will enable stakeholders in India to enhance competitiveness and successfully deploy growth initiatives.

The need is especially acute for small and resource-poor farmers as well as entrepreneurs because of their small operational bases and greater vulnerability to unforeseen shocks. Since this dairying activity is profitable and the demand for milk and milk products is growing rapidly, there is enough scope to upscale milk production activities. The up-scaling would substantially help to enhance the household income of the milk-producing households. Further, the constraints which have been preventing the expansion and intensification of dairying in spite of its profitability need to be identified and ameliorated.

But overall, quality and safety standards in all value chains – dairy, poultry, ruminant meat, hides and skins are in need of improvement in the state, though these issues have been receiving more attention in leading states and within private sector operations. The marketing of livestock products through unorganized channels tends to increase the products' safety risks and reduces its quality. Quality and safety standards in domestic and export value chains are managed through a number of regulations and implementing authorities with little coordination amongst themselves.

From purely commercial perspective, Eastern region is generating less income for its farmers per unit of available land and water. This low water and soil productivity can be overcome by adopting proven modern technologies for soil restoration and water conservation. Thus far farmers and scientists have focused on raising productivity through the application of macronutrients, nitrogen, phosphorus and potassium, while largely ignoring the crucial role of micronutrients in bringing forth the full genetic potential of plant materials. Application of water saving technologies can raise the productivity of water in agriculture by two, three or four times its present level, resulting in higher yields, greater production, higher incomes and more jobs.

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