BIHAR'S AGRICULTURE DEVELOPMENT: OPPORTUNITIES & CHALLENGES

A REPORT OF THE SPECIAL TASK FORCE ON BIHAR

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Chairman

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EXECUTIVE SUMMARY & RECOMMENDATIONS

A. Executive Summary

The State of Bihar with a geographical area of 94.2 thousand square km is divided by river Ganges into two parts, the north Bihar with an area of 53.3 thousand square km, and the south Bihar having an area of 40.9 thousand square km.Based on soil characterization, rainfall, temperature and terrain, three main agro-climatic zones in Bihar have been identified. These are: Zone – I (North West Alluvial Plain), Zone – II (North East Alluvial Plain), and Zone-III (South Bihar Alluvial Plain), each with its own potential and prospects. All these zones have Chaur, Maund, Tal and Diara lands, which are submerged during the rainy season.

The percentage of population employed in agricultural production system in Bihar is estimated to be 81%, which is much higher than the national average. Nearly 42 per cent of GDP of the state (2004-05) has been from agriculture sector (including forestry and fishing). High concentration of population, largely dependent on agriculture coupled with low yields of the major cereal crops, is main reason for high poverty ratio in the state. Consequently, about 42 % of the State population is below poverty line as against national average of 26%. As urbanization in the state is still very poor, nearly 90 per cent of the population lives in rural areas. The State of Bihar is also lagging behind the national average On all socio-economic indicators like per capita income, average size of operational holding, per capita cultivated land, percentage of villages electrified, road length per thousand sq km, per capita deposit, per capita bank credit, credit-deposit ratio, male-female literacy , and life expectancy etc. Bihar is considered to be at the bottom.

The gross and net sown area in the State is estimated at 80.26 lakh ha and 56.38 lakh ha., respectively. The intensity of cropping is 1.42%. The principal crops are paddy, wheat, pulses, maize, potato, sugarcane, oil seeds, tobacco, and jute. Rice, wheat and maize are the major crops. The average yields of rice and wheat are 1.45 and 2.19 t/ha, respectively, as against the production potential (experimental yields at research farm as well as realized in frontline demonstration) of 4.5-5.0 t/ha. Similarly, the average maize yield of the State is about 2.38 t/ha as against its yield potential of 6 t/ha. Winter maize is a success story, where the farmers have realized yield level of 6-8 tonnes/ha. Similarly, Boro Rice (summer rice) has the realization of 6-8 tonnes/hec. Even though the State is rich in soil and water resources, its average yields of Rice, Wheat, Maize and Sugarcane in the state are only about 32, 44, 40 and 38 percents of the potential yields, respectively. Sugarcane production and sugar industry hold great potential in Bihar. The state's share in the country's production is 4 to 4.5 percent and ranks 10th among the sugarcane producing states. However, Bihar has the lowest sugar recovery rate in the country at

9% against the national average of 10.36%. Thus, there is considerable scope to increase the productivity of these most important crops in Bihar. All these clearly reveal that Bihar has great potential to be a rich State.

Although, horticulture (Fruits, vegetables including tuber and mushroom, spices, honey, medicinal and aromatic plants) occupies 15 per cent of land area but income generated from horticulture is much higher. The state has a monopoly in production of litchi and makhana and continues to grow various fruits, vegetables, spices and, floriculture is catching the imagination of people, reflected in their growing interest, across the state, in diversification of horticulture. Over-viewing the current status, constraints and potentiality, it is evident that there is ample opportunity for development of horticulture in the state.

Bihar has a long tortuous history of chronically unprofitable state-owned companies and their unpaid staff. But Sudha, a dairy cooperative, is a shinning exception and one of the most successful enterprise of its kind in India. It has more than 6,000 outlets covering 84 towns and more than 260 villages. But the health of animal and their productivity are cause of concern. Among livestock, cow and buffalo are more important for value addition. Goatary and poultry have also much potential. Effective health management, breed management and institutional support would be of great value to the people and the State.

The State with the abundance of water bodies has very high potential for fisheries and aquaculture. But it has not been fully realized. In past, effort was made to establish infrastructure through World Bank assisted project but without much success. Main factors responsible for this are non-availability of finger links, scientific production system and policies. The State should bring the necessary Aquarian reforms (granting rights of water bodies to fisher folks) and modernize its aquaculture industry through establishing competitive production and internationally accepted hygienic supply chains.

Despite the strength of the agriculture sector, it is a paradox that this sector is much below the potential. Agriculture productivity in Bihar was much better, compared to other states in fifties, which is now much below the national average. In last two years, there has been an appreciable growth, due to improved seeds, technologies and inputs, but the miles state has to go to achieve responsive agriculture. This would need infrastructure, technology and inputs. R&D has a vital role to play. There is inequitable distribution of water for irrigation, inadequate number of shallow tube-wells, ineffective use of rain water, and lack of conjunctive use of different irrigation waters, which are the issues of concern.

There is almost non-existence of the system of organic farming, which has tremendous prospects towards accelerated agricultural productivity. Urgent attention is needed in it. Moreover,

the Tal and Diara lands can only be irrigated by overhead sprinklers, but the farmers in Bihar do not own overhead sprinklers on account of their poor economic status. The quantity and quality of the use of inputs, such as fertilizers and seeds, in the State is also far below the desired level. Considering that quality seed is fundamental to the establishment of a productive system, the highly unsatisfactory status of availability of quality seed (seeds, quality planting material, finger links and semen) to the farmers is one of the most serious concerns in Bihar. Moreover, institutional support in terms of hassle-free, timely and adequate credit and agricultural insurance are equally much below the requirement. A large number of small and marginal farmers are not part of the institutional farm credit system. This needs to be given urgent attention. The farm gate price of most of the commodities is low which means farmers do not get remunerative prices. Departments of Agriculture, Floriculture, Animal Husbandry, Fisheries, Sugarcane are not geared up to take technologies to field. Similarly, Agriculture University in the State is not well equipped to address these issues. Overall institutional arrangements and the entire farm related delivery mechanism are very weak and needs urgent attention.

Agriculture is the single largest private sector occupation in Bihar and can be considered the riskiest business. Hence, the goal of the agricultural production system should be to maximize income of land owning and landless rural populace to improve their livelihoods. The vulnerability to income and consumption shocks makes it imperative to develop formal agricultural insurance mechanisms to cope with such risks. The traditional yield insurance schemes have failed in managing the risks of the poor farmers as evident from their historically high payouts and poor penetration rates. There is a need to develop effective risk management strategies to cover potential losses in yield and hence incomes.

To achieve the desired levels of productivity, immediate steps are needed to improve infrastructure – such as power, rural roads and marketing in particular and, arrange for the supply of quality seeds, balanced use of fertilizers, adequate machinery, required changes in land policy, a farmer friendly extension service and an effective credit delivery system in keeping with adequate credit absorptive capacity of the farmers in Bihar. All these could provide a bright future for Bihari farmers.

B. Recommendations

Given the low average yields of most commodities, the huge gaps between the demonstrated and generally realized yields, the low farmers' income and widespread rural poverty on one hand, and the richness of the natural resources and the socio-political expediency to liberate the people of Bihar from the poverty and hunger trap on the other, the business as usual will not yield the desired results. A holistic system based approach is needed to simultaneously enhance productivity, profitability, equity and environmental sustainability through synergistically

integrating crop, cash crop, horticulture, livestock, fisheries, agro forestry, watershed-based soil and water management, social capital formation, agro-processing and marketing in an end-to-end mode. Under a decision support system, the problems and their solutions must be disaggregated as per the location specific resources, needs and aspirations, calling for synergy among research, technology, extension, farmer, community-based organizations, markets, and public policy. All these would turn Bihar's challenges into opportunities and help Bihar to emerge as 'Granary of India". Bihar's aim must be to realise 5-6% of annual agricultural growth in order to sustain its overall economy.

The Key Recommendations for Accelerated Agricultural Development in Bihar are as follows:-

(i) Bridging the Existing Yield Gaps

Gap between the state average productivity and potential is very high owing to technology adoption and inputs. Therefore, bridging the existing yield gaps by making adequate availability of quality seeds and other technical inputs to farmers would be the first and foremost requirement for improvement of crop productivity. Crop specific and zone specific strategies should be adopted at farmer level to derive maximum benefit. Bihar needs specific development strategies for North and South region of the State.

There should be a specific programme to multiply the best quality breeder seeds and distribute them to farmers. Seed Corporation should be revamped and other agency on the pattern of Tarai seed, 'Pusa Beej' should be started. This will not only help the availability of seeds to the farmers but, seed sector could one of the enterprises. Seed village concept should also be encouraged by providing breeder seed and technological inputs. Successful experiments have been conducted in Bihar under Zero Tillage, Bed Planting, System of Rice Intensification (SRI) and Site Specific Nutrient Management Systems. Besides, efforts should be made to promote contract farming in maize, and certain horticultural crops for which the State has huge potential. Dairy Cooperatives being a success in Bihar needs further support expansion and to enhance the health and productivity of livestock. There should be further expansion and revitalization fisheries and poultry sectors, which hold high potential particularly in the light of changing consumption pattern.

(ii) Efficient Use of Modern Inputs and Balanced Use of Fertilizer

An efficient and optimum use of modern inputs like quality seeds, chemical fertilizers and other macro and micro nutrients, is the key to productivity improvement on a sustainable basis. Therefore, farmers should be enabled to access and use modern farm inputs in an optimal and efficient manner. Large scale demonstration, use of nutrient and water based soil and tissue test

should receive major emphasis. There are soil testing technology but do not have capacity to function. Revamping the laboratory for efficient delivery system is essential. Efforts should be made to promote organic production technology including use of bio-fertilizers & bio-pesticides.

(iii) Development and Maintenance of Rural Infrastructure

Rural connectivity in the key to raise farmers' productivity and income. Therefore, utmost priority should be given to improve infrastructure in various aspects. Aim should be to target the key constraints like poor water management, rural power supply, easy credit availability, and market access. Steps should also be taken to encourage renewable sources of energy. The State has highest potential for small hydropower projects, wind energy, bagasse based co-generation power from the existing and proposed sugar factories, Jatropha on waste lands, and rice husk based biomass gasification, biogas and solar energy.

(iv) Flood Control, Drainage, Water Management and Mitigating Drought

Lack of efficient on-farm water management is considered as one of the major constraints for low productivity and poor economic status of the farmers of Bihar. About forty one percent of the total cropped area in the state is flood prone and there is not much scope for improvement in yield due to water logging, poor drainage and water management. In such areas, it would be absolutely essential for the state to make large scale investment in drainage and also utilization for fisheries. Flood control will also need attention for desilting of rivers, and strengthening of embankment. As far as the drought prone areas are concerned, there is a need for water conservation and improving water use efficiency through rainwater harvesting, education of farmers and use of modern methods of irrigation. Rainwater harvesting should be a major strategy to meet irrigation needs of the crops. However, the State has abundant groundwater resource which could optimize the potentiality. Shallow tube wells are the quickest means of tapping the groundwater. This is now possible by Goverments's dynamic efforts on village electrification.

(v) Human Capital Formation and Strengthening of Agricultural Extension Services

Twenty-first century agriculture is knowledge and technology based and human capital development is a must. Approach to knowledge and technology adoption by the farmers are directly related to the level of their education. Dilapidated condition of human development institutions and weak institutional structure are a road block in the overall development of Bihar. Education and health should, therefore, be given the first priority for Bihar's farm population. Besides, strengthening of agricultural research & development, appropriate to Bihar's topology and crop profile should be an integral part of agriculture development strategy. There should be

proper coordination among different agriculture extension institutions like Krishi Vigyan Kendra, Agriculture Technology Management Agency (ATMA),Rajendra Agriculture University, Kisan Call Centres , State government, financial institutions, farming community at large. Training programmes for farmers at panchayat and block levels should be organized on a regular basis for adopting modern technologies more effectively.

(vi) Effective R & D Support

Efficient R & D is a building block for responsive agriculture. It has been experienced that investment on agricultural education and research has been most productive. The state has one Agricultural University with 5 major campuses and has done excellently well in last few years in terms of human resource development and research output. However, the University has not got the focus it deserves. Headquarters of the University, Pusa, is a heritage for agriculture research and education. Therefore, this University should get the status of National University, which should not only meet the needs of the state but also contribute to national agriculture. The University needs support for modernization of its infrastructure as well as research facilitation for scientists. Considering the size of the State's agriculture, consideration be given for opening one or two more agricultural universities in Bihar. Sabour Agricultural College meets all the basic pre-requisites for conversion into a university.

(vii) Market Oriented Agriculture

Bihar produces large quantities of fruits, vegetables and livestock products, but does not have appropriate infrastructure for value addition and marketing. The state should develop commodity specific agro-export zones and give necessary support to their marketization. As a matter of fact, with proper development of markets, cooling arrangements in storage and transportation, processing and maintenance of quality, through grading, standardization, packaging, etc., products like litchi, mango, makhana and banana and a few vegetables can be exported to other states and even beyond the country, which will help improve farmers' income. In order to provide a level playing field for private participation in marketing, infrastructure and policy support be provided.

Bihar is the first state, which has taken bold step for the reform of marketing by repealing the APMC Act, which was not conducive in modern competitive agriculture. However, there is a need for developing alternative model. The proposal of the Committee headed by Shri R.C.A. Jain be accepted to upgrade marketing of produce. A suitable model of contract farming specific to crops can be adopted to solve the problems of small and marginal farmers.

(viii) Strategic Agricultural Diversification

Traditional crop farming alone cannot provide adequate employment and income to a growing rural population. Already the pressure of population on land is quite high. Therefore, the state should develop location specific plans for accelerated and diversified growth. Diversification could be for crop varieties as well as other produce. More areas could be brought under pulses, oilseeds, maize and diversification to horticulture, livestock and fisheries should find greater role.

Horticultural diversification should cover fruits, vegetable, mushroom, flower, medicinal and aromatic plants. There is a scope for coconut, oil palm and cashew in the state. This would involve not only proper planning activities, but also the creation of necessary infrastructure, institution and policy support.

Fisheries and poultry, the two most important areas having a high potential, need special attention. Districts with high productivity of gram and oilseeds call for urgent action to increase the area under these crops. Government can provide support either directly or indirectly through incentives to the private sector for supply of seed/planting material, marketing, processing, etc. This is one area which is most suitable for contract farming. The contract farming is now a well accepted institutional arrangement to realize economies of scale, promote technology adoption, and supply of needed quality inputs. The establishment of a Horticulture College at Nalanda in this respect is a welcome decision.

(ix) Revival and Revitalisation of Sugar Mills

Sugarcane is an important cash crop for farmers in North Bihar. In addition to providing additional employment, they are an important source of surplus power. Of the 27 mills established, only a few are in operation. Most sugar mills in the state are almost sick and, therefore, the farmers do not get a fair deal from them. With proper policy support, these mills can be revitalized to provide the necessary linkages for the growth of sugarcane in the state. The state has nearly 103 thousand hectares of sugarcane area which produces about 4249 thousand tonnes of Sugar cane. In recent months, the Govt. of Bihar has held several rounds of meetings with major players in sugar industry in the country for revival of sugar mills with private sector participation. But not much headway has been made, due to land policy and incentive related issues. Karnataka model can help to solve the problem where under Contract Farming, Shri Renuka Sugar Mills have entered into an agreement with the farmers as shareholders based on the land owned by them. This sector needs urgent policy attention towards the rehabilitation of existing old sugar factories and opening of new sugar factories under the PP mode. This would open new opportunities for North Bihar farmers.

(x) Enhancing Farm Income to Make Agriculture Attractive

Since farmers have small land holdings, the agriculture income growth is highly essential to sustain. Strategic approach is needed to enhance the farm income and to create better on-farm opportunities. Agriculture not only provides pollination support to crops and enhances the yield, but it provides additional income. Vermi-composting has proved to be highly effective in converting the waste into wealth. No one can deny the role of good quality seeds of crops, planting materials, finger links and good semen. This would need special attention. Conservation of agriculture to save the resources and sustain the agriculture in the competitive world is important. Integrated farming having combination of crops, horticulture, livestock, fisheries, apiculture, vermiculture along with multiple use of water is becoming important. Similarly, farm waste, i.e. paddy straw could be used for mushroom culture. Evidently, apiculture, vermiculture, quality seed, conservation agriculture, integrated farming and mushroom culture have proved to be a boon and need promotion by Bihar Govt. in a Mission Mode having integration with value addition and marketing.

(xi) Risk and Disaster Management

Given that more than 80% of Bihar's population is dependent on agriculture and related activities and Bihar happens to be one of the most disaster prone state in India, role of risk financing in hedging agricultural risk from climatic shocks becomes critical. It is imperative to develop sophisticated ways of market and government mechanisms for risk transfer. Pre- Disaster initiatives (ex ante) need to be given more impetus than Post- Disaster (ex post) Events. These initiatives aim to provide hitherto unforeseen resilience to the rural communities and also bring out transparency and efficiency to the whole effort. There should be separate risk management solution for small and marginal farmers to hedge through futures trading and production risk management by way of index based insurance with focus on providing Comprehensive Risk Management for vulnerable groups.

(xii) Bihar as a Granary for India

If proper thrust is placed on technologies, institutional direction, farm level support services, and all delivery mechanisms, following improved farm infrastructure including rural connectivity, Bihar can definitely emerge as the 'Granary'for India. It can also provide the major hubs on fruits, vegetables, and fisheries for both national and global markets. The entire economic growth processes in Bihar depends on the dynamics of agriculture.

There are successful experiments in different parts of the country, which if adopted, can provide an answer to various problems which Bihar is facing in its race to higher productivity

levels. It would be better to avail of the readily available experience with a view to adapt that in keeping with the ground situation in Bihar. If above points are addressed, there is no reason for Bihar not to be able to condense the 30 years of development activity of Punjab to 10 years. It can then surely catch up with the present productivity levels of rice and wheat in Punjab and other cherished goals in maize, pulses, oilseeds, horticulture and livestock production in the next two five year Plans. Fortunately for Bihar, the State has trained agricultural labour from Punjab. The Bihari labour which was responsible for the first Green Revolution of Punjab will now provide the momentum for the Second Green Revolution in their home State. Thus, there is a need for awakening with commitment to convert the weaknesses into opportunities and revamp agriculture which is a sole source of economic development. Bihar also needs to put a special focus on system of organic farming in the light of experiences available in India. This would bring faster results for increased productivity.

(xiii) Financial Implications

Poor rural infrastructure, outdated farm level delivery mechanism and lack of implementation capacity, and a very low level of financial allocations through Five Year Plans have been the main reasons for low farm productivity and general poverty and unemployment in rural Bihar. If Bihar has to prosper, it is only by means of sustained agricultural growth. Therefore, in order to implement the thrust of the proposed strategies and policies, Bihar would require a substantially higher level of financial outlays during next 5-6 years (2008-09 to 2012-13). This is estimated at Rs.27,055 crores. The current plan (11th Five Year) outlays for Bihar's agriculture is Rs.1,698 crores, which is very meager. This would not only help Bihar in emerging a food surplus state but also help India from the emerging crisis of food insecurity. It would then be possible for India to realize its goal of 9-10% annual GDP. Thus, both Bihar and India would move towards the path of sustained economic development.

Preamble

Bihar, as other eastern states of India, characterized by good soil, adequate rainfall, favourable hydrological profile & water resources, and congenial temperature regime, has high agricultural production potential. Yet, its agricultural productivity is one of the lowest in the country, resulting in high poverty, unemployment, and overall deprivation in the State. In fact, this state represents the heart of the great Indo-Gangetic Plains-one of the most fertile plains of the world. But, enigmatically, this plain continues to be “rich State inhabited by poor people”. The untapped production reservoir of the State must, therefore, be harnessed judiciously, not only to liberate the State from its socio-economic and ecological glooms, but also to trigger the process of invigoration of the “Greatest Living Industry” of the nation. The world experience suggests that agriculture sector has been the pre-cursor of economic growth process. Bihar cannot be an exception. Let prosperity be ushered in Bihar by bringing another farm revolution.

CHAPTER - 1

BACKGROUND

1. Bihar is a land-locked state situated on the eastern part of India. It is situated between 83^0-30' to 88^0-00' longitude and 21^0-58' to 27^0-31' latitude. The state is roughly quadrilateral in shape situated on the north east side of India. It share international border with Nepal in its north, Uttar Pradesh on its west, West Bengal in the east and newly carved state of Jharkhand on its south.

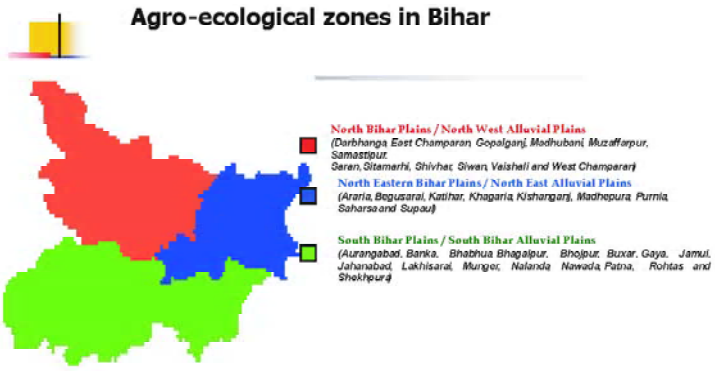
2. The state is divided by river Ganga into two parts , the North Bihar with an area of 53.3 thousand sq. km. and the South Bihar having an area of 40.9 thousand sq. km. Bihar has 14 river basins namely ; (i) Ghaghra , (ii) Gandak , (iii) Burhi Gandak , (iv) Bagmati , (v) Kamla Balan , (vi) Kosi , (vii) Mahananda , (viii) Karmnasa , (ix) Sone (x) Punpun , (xi) Kiul-harhar , (xii) Badua , (xiii) Chandan , and (xiv) the main Ganga stem . All these rivers drain into the main Ganga stem. The six river system, from Karmnasa to Chandan, draining the southern part of Bihar originates primarily from Indian territories in the state of Bihar, Jharkhand and Chhatisgarh. The seven river system from Ghaghra to Mahananda drains North Bihar. Most of these river systems of North Bihar originate in Tibet and Nepal and hence they are international rivers. Any rainfall occurring in Tibet and Nepal directly affects the flow in these river systems and flooding of North Bihar is thus a recurrent phenomenon.

3. Agriculture is the backbone of Bihar's economy, employing 81% of the workforce and generating nearly 42% of the State Domestic Product. The State with geographical area of about 94.2 thousand sq. km., has the natural endowment of fertile soil, good rainfall, plenty of water resources, and agro-climatic conditions suitable for growing three crops a year and almost all types of crops. According to 2001 Census the population of the state is 82.9 million and growing at the rate of more than 2% per annum. It is therefore important to sustain self sufficiency in food grain production with rate of growth of food grain production greater than population growth rate. Agriculture is not only the source of livelihood but also it generates raw material for the agro based industries which has immense potential in the state.

Agro-climatic Zones

4. On the basis of soil characterization, rainfall, temperature, and terrain, Bihar is divided into three main agro-climatic zones. These are : North West Alluvial Plains (Zone – I), North East Alluvial Plains (Zone – II), South Bihar Alluvial Plains (Zone – III)**. (Annexure-I)**

Agro-climatic/Agro-ecological Zones in Bihar



A brief description of these zones is given below:

Zone-I, North West Alluvial Plains

5. This zone comprises the districts of West and East Champaran, Gopalganj, Siwan, Saran, Sitamarhi, Muzaffarpur, Vaishali, Madhubani, Begusarai, Seohar , Darbhanga and Samastipur with an area of 32,665 square km. The average annual rainfall in Zone-I is 1234.7 mm.

Soil and Physiography :

6. The lands of this zone are alluvial plains that slope towards the South east direction with a very low gradient as evident by the stream flow direction along the natural level before they finally meet the Ganga. As a result, there are vast areas that get flooded and become waterlogged during monsoon. Except for the northern portion and portion in west of the zone under the influence of Adhwara system of rivers, the entire zone is under the influence of rivers Gandak, Burhi Gandak, and Ghaghra, all of which originate in the lime rich foot hills of the Himalayas. Thus, the soils under the influence of Gandak, Burhi Gandak, and Ghaghra are mostly calcareous having different amounts of like in them. The soils of Siwan and Gopalganj districts with less rainfall and more pronounced dry seasons have developed salinity as well as alkalinity. Similarly, the soils of the northern part, under the influence of Adhwara group of rivers, are neutral, acidic or saline depending on the local physiography.

Zone-II, North East Alluvial Plains

7. This zone comprises the districts of Purnea, Katihar, Saharsa, Supaul, Arariya, Kishanganj,

Madhepura and Khagaria covers 11.96% (20797.4 km^2) of the total geographical area of Bihar. The average annual rainfall in Zone II is 1382.2 mm.

Soils and Physiography:

8. This zone, the alluvial plains of Kosi, Mahananda and its tributaries and Ganga (narrow strip in the South) is slightly undulating to rolling landscape mixed with long stretches of nearly flat landscape with pockets of area having sub-normal relief. The area is full of s teams with abandoned or dead channels of river Kosi. Its frequent and sudden change of course has left small lakes and shallow marshes. In the south, in between the natural levees of Ganga on the one hand and Kosi and Mahananda on the other, there are vast areas, which remain waterlogged over a considerable part of the year.

Zone-III, South Bihar Alluvial Plains:

9. This zone is located in the south of the river Ganga and comprises the districts of Bhagalpur, Banka, Munger, Jamui, Lakhisarai , Shekhpura, Gaya, Aurangabad, Jahanabad, Nawada, Arwal, Nalanda, Patna, Bhojpur, Buxar, Bhabhua, and Rohtash. The total geographical area is 40,875.5 square km, which represents 25.75% of the total area of the State. The average annual rainfall in Zone III is 1102.1 mm.

Soils and Physiography :

10. This zone comprises of the alluvial plain of river Ganga on its southern side and the plains of all those rivers that flow into Ganga from the south having their origins in the Chotanagpur plateau. The rivers originating from Chotanagpur plateau bring a lot of fine sediments. The courser sediments that they bring are either deposited in their beds or on their bunds and as a consequence the soils are mostly medium to heavy textured throughout the depth of the profile. The general land slope is towards north and east, with gentle slope and moderate to low gradient. There are no marshy lands in the zone.

Tal, Diara and Chaur Lands :

11. In the south of the natural levee of the Ganga, there is a vast stretch of backwaters known as “Tal (low order monsoon stream)” lands extending from Buxar to Pakur where most of the rivers and rivulets coming from the south get lost. The estimated area under “Tals” is about 1.00 lakh ha. In addition to the Tal lands, the state has about 4 lakh ha of ‘Diara lands (saucer shaped flood plain of a river)’ under the flood plains of rivers Ganga and Ghaghara. The state also has about 4 lakh ha of ‘Chaur lands (remnants of river course)’, which are highly suitable for

fish farming. The Tal, Diara and Chaur lands are inundated by water for varying periods, and are difficult to manage.

Land Utilization Pattern

12. About 61.18 % of the newly organized State is under cultivation as per the figures available for the year 2002-03. The percentage of fallow land in the same year is 6.75 %. The corresponding figure for undivided Bihar prior to bifurcation was 42.77 and 16.02 % respectively. Consequent upon bifurcation of the State , forest area has dwindled to a meager 6.65 % from 17.01 %. The forest coverage, thus compares very unfavourably with the national average which stands at around 26 %. The Gross and net sown area in the State is 80.26 lakh ha and 56.38 lakh ha. respectively. The intensity of cropping is 142%.

Particular	Area (lakh ha)
Total geographical area	93.60
Total cropped area	79.57
Net area sown	57.25
Current fallow	4.99
Forest	6.22
Barren and non cultivable Land	4.36
Land put to non agricultural uses	16.43
Cultivable waste land	0.46
Permanent Pasture (Grazing land)	0.18
Miscellaneous crops/groves	2.37
Area sown more than once	22.32

Distribution of Operational Holdings

13. As 77 percent of the states' main workforce is employed in the agricultural sector, the average size of operational holdings in Bihar is only 0.75 hectare as against the national average of 1.41 hectare (Govt. of India, 2005). The share of marginal holdings having less than 1 hectare each are as much as 82.9 percent (**Annexure II)**. Also marginal and small holdings account for about 59.8 percent of the total operated area.

Floods and Droughts

14. Every year, Bihar faces the vagaries of flood and water logging. Total flood prone area of the State is 68.80 lakh hectares which is 73.06 percent of its total geographical area and

17.2 per cent of the total flood prone area in the country. A substantial proportion of the total cropped area (nearly 41 per cent) gets frequently affected by floods. Flood situation is most severe in the northern plains of Bihar. This is because almost all the major rivers in the State enter into Bihar from Nepal in this region. Bed slope of these rivers is very sharp in Nepal and they usually enter the State on plain lands. Because of sudden drop in bed slope, silt brought by the flow of these rivers gets deposited at their base and causes recurring floods. (**Annexure III).**

15. It is a sad story that almost 100 per cent of the gross cropped area in the districts of Araria, Muzaffarpur, Sheohar and 50 to 75 per cent area in Begusarai, Katihar, Sheikhpura and Sitamarhi is flood prone. It has been estimated that during the kharif season, about 23 per cent of paddy area remains waterlogged where the adoption of modern technology is either nil or low and consequently the crop yields are low.

16. Similarly, there are frequent occurrences of drought in the districts of Munger, Nawada, Rohtas, Bhojpur, Aurangabad and Gaya. The extent of irrigated area in these 6 Districts shows that but for district Munger where irrigated area is 26.4 per cent, all the other districts have high percentage of irrigated area. Zone III where these Districts are located has an average of 1104 mm of annual rainfall. With such rainfall in the region and most of the districts having irrigated area higher than the State average, it is a pity that they are still being identified as drought prone. The Planning Commission has already sanctioned water shed development projects for 8 Districts of Southern Bihar – Banka, Jamui, Gaya, Munger, Aurangabad, Rohtas, Bhabua and Nawada. Once implemented there should be no problem of drought in the Southern Zone.

17. It is true that rainfall may be erratic. Bihar can certainly follow the example of Rajasthan where with less than 400 mm rainfall, the State is in a position of having horticulture by rainwater harvesting like Kund Horticulture Project of Rajasthan.

Structure of Agricultural Produce

18. Agriculture is at the core of Bihar's economy. The contribution of agriculture and its allied sector to the state domestic product was 40 per cent in 2003-04. Although this is a reduction from 48.5 per cent in 1980, it remains amongst the highest in the county.

19. During 1980 - 1992, Bihar's agriculture and allied sector grew at 1.6 per cent per annum, compared with the national average of 3.1 per cent. In fact it was the lowest among most of the states. However, since 1993, growth in Bihar's agricultural GSDP has accelerated. While the all-India agricultural GDP grew at 2.2 per cent per annum between 1993 and 2003, the corresponding figure for Bihar was 2.7 per cent which was next only to West Bengal and Andhra Pradesh

among the major Indian states[1)] . A study for the period 1995-96 to 2004-05 not only confirms the above findings but also shows that Bihar went ahead of both these states, though marginally (**Annexure IV)**.

20. It may be stated that with the growing commercialization of agriculture, cropping pattern changes reflect the expectation of net return from the land possessed by the farmers. A bird's eye view of the data in **Annexure V** will reveal that in TE 2001, the total value of farm output including livestock was Rs.3171 million, (the share of livestock being Rs.913 million or about 29 per cent). In food crops, fruits and vegetables accounted for nearly 49.7 per cent of the total value, followed by rice 19.7 per cent, wheat 12.0 per cent, pulses 3.7 per cent, maize 2.9 per cent and other crops 8.7 per cent. Among the livestock products, which accounted for 29 per cent of the total value of agricultural output, milk constituted 49.3 per cent of the total value, followed by meat 24.4 per cent and other products 26.3 per cent?

21. Bihar also produces about 2.6 lakh tonnes of fish annually. There are about 2 lakh hectares of permanent water area and 1.2 lakh hectares of seasonal water area in the state. Besides, about 5 lakh hectares of paddy area are under deep water condition, which can be exploited for fisheries. The fish production constituted about 1.85 per cent to states GSDP in 2004-05 (Government of Bihar, Economic Survey, 2006-07)

22. It may be seen further that per hect. value of output of major crops in Bihar (Rs.3017) is a shade lower than that of all India (Rs.3576). Rice and wheat are the major crops of Kharif and Rabi seasons occupying nearly 3.7 and 2.1 million hectares respectively. In addition, maize is cultivated in about 4-5 lakh ha during Kharif and Rabi seasons respectively. Average yield of rice-wheat cropping system is 1.45-2.19 t/ha. as against the production potential (experimental yields at research farms) of 4.5-5.t/ha. Similarly, the average maize yield of the State is about 2.38 t/ha. as against its yield potential of 6 t/ha. Even though the state is rich in soil and water resources, the average yields of rice, wheat and maize in the State are only about 32, 44 and 40 percent respectively of potential yields. Thus, there is a considerable scope to increase the productivity of rice, wheat and maize in Bihar. The State has the potential for development of horticulture. Intervention for production, processing, post harvest management and marketing in order to avail maximum benefits under the National Horticulture Mission launched in the country, including 16 districts in Bihar, is expected to harness the full potential of this sector.

[1)] The comparison of pre-and post 1993-94 growth performance is influenced mainly by data considerations. Prior to 1993/94 GSDP data are available only for the erstwhile undivided Bihar, but post 1993/94 GSDP series for divided Bihar and Jharkhand are available separately. The 1993-2003 growth rate of agricultural and allied GSDP in undivided Bihar (i.e., sum of Bihar and Jharkhand) was 3.5% per annum, confirming that the acceleration from the 1980s is not simply because of difference in coverage between the pre-and post - 1993/94 GSDP series.

23. The aforesaid information adequately describes the poverty and low crop yields in Bihar. Hence, the goal of the agricultural production system is to maximize income of land owning and landless rural populace to improve their livelihoods. It could be tackled by increasing income of the land owning and landless rural population through increased production by enhancing productivity and intensity of farming, and by generating more employment in agriculture and other rural based production activities . While doing so, care should be taken to preserve the health of land, water and other natural resources, so that the agricultural production system remains ever productive and sustainable. Area under fallow land will be progressively reduced as more and more area will be brought under assured irrigation. Special attention will be given to Tal, Diara, Chaur and saline areas. These areas will be gainfully utilized for crop production, horticulture, fisheries etc.

CHAPTER - 2

FEATURES AND PRESENT POSITION

A. Crop Husbandry

24. Agriculture is the mainstay of the state's economy. Nearly 60% area under cultivation in Bihar is rainfed. A wide variety of crops viz. Cereals, oilseeds, pulses, fruits and vegetables are grown in Bihar. Principal Crops in Bihar are :

Cereals	**:**	Rice, Wheat, Barley, Maize.
Pulses	**:**	Gram, Lentil, Arhar, Khesari, Peas.
Commercial Crops	**:**	Sugarcane, Tobacco, Jute.
Horticultural Crops	**:**	Mango, Litchi, Bannana, Makhana, Jackfruit, Guava, Water Chestnut, Potato, Bettel leaves, Chilly.

Chart 1. Area ('000 Hectares) under major crops in Bihar during 2006-07

25. The major agricultural products of Bihar are cereals, pulses, oilseeds and cash crops. However, cereals dominate the cropping pattern. The rice wheat cropping system occupies more than 70% of the gross cropped area but productivity has remained low despite favourable soil, water and climatic conditions. The yield per hectare of rice is around 1500 kg/ha against the national average of 2100 kg/ha. Rice and Wheat are the staple food of the people of the state. Production of rice has decreased from 5442.6 thousand tones to 3775.4 thousand tones between the period 2000-01 and 2007-08.During the same period productivity has also decreased from 1489 kg/ha to 1143 kg/ha. This decline in the productivity is basically due to replacement of upland rice by higher income generating crops like pulses, oilseeds & maize.

26. Similarly in case of wheat also production has declined from 4438 thousand tones to 3474 thousand tones between the period 2000-01 and 2006-07. Wheat production in the state is suffering with the problems of delayed sowing, increase in cost of production due to rise in cost of petroleum oil, lack of small duration varieties which can be appropriately tailored into rice-wheat system and aberrations in weather conditions.

27. The yield per hectare of maize and pulses are however higher than the all-India average. Production of maize is also very good and Bihar is one of the leading state in Maize production. Maize has multiple uses viz. baby corn, sweet corn, pop corn and green corn. These different varieties are commercially very profitable. Maize is called the industrial crop of 21st century due to versatility in its use as food, animal feed and as raw material for ethanol, starch and corn oil industries. As compared to national average production of Maize is increasing in the state. As the data shows productivity of Maize in Bihar (2541 kg/ha in 2006-07) is greater than that of All-India (1907 kg/ha). This crop is now replacing upland rice in Kharif season and wheat in Rabi season.

28. Autumn maize has the largest share of area under the crop, being 42 to 43 per cent of the total followed by Rabi maize 31 to 32 per cent and summer maize 25 to 26 per cent. Though autumn maize has the largest share in area, it contributes only 30 to 31 per cent of the total production, only marginally higher than that of summer maize which has a share of 29 to 30 per cent. Rabi maize has better yield rate than that of autumn maize and thus produces nearly 40 to 41 per cent of the crop in the state. The crop is now replacing upland rice in Kharif season and wheat in rabi season in Bihar. Although maize is produced practically in all the districts of Bihar, major maize producing Districts are Begusarai (10.5 per cent), Samsatipur (7.6 per cent) Bhagalpur (7.6 per cent), Khagaria (7.4 per cent) and Purnea (6.8 per cent). With rich water resources and available irrigation in the winter and summer season, irrigated area under maize increased and so did the yields. Both traditional and hybrid maize are grown in all the three seasons. Percentage shares of area under hybrid maize in the total maize crop of autumn and summer seasons are 40 to 43 per cent and 70 to 73 per cent respectively and the production of hybrid maize in these two seasons constitute nearly 43 to 45 per cent and 71 to 72 per cent respectively. However, the break-up of area and production in respect of hybrid and traditional varieties for rabi season is not available.

29. There is a good scope for pulses industry also. In case of Pulses, productivity in the state is greater than All-India. In the year 2006-07 , in case of Bihar it is 735 kg/ha while in case of India it is 616 kg/ha. Gram, Tur and Lentil are the major pulses grown in the State.

30. Oilseeds cover less than 2 per cent of the gross cropped area of the state. The state's position in the country in area and production is insignificant being less than 1 per cent each. Rapeseed and mustard is the major oilseeds crop in the state followed by linseed which is

generally used as the cooking medium. The crop is grown in all the 38 districts and the produce is consumed mainly within the state itself as the consumers of the state prefer mustard oil to other edible oils. Major producing districts are West Champaran, Samastipur, Begusarai, Muzaffupur, Khagaria and Rohtas. These six districts together shared an area of 45 and 46 per cent during the years 2004-05 and 2005-06 respectively. Jute & mesta are the only fibre crop grown in the state and the state's position in area and production in the country is a distant second only after West Bengal.

31. Among other commercial crops, sugarcane is important in the state. The state's share in the country's production is 4 to 4.5 percent and ranks 10th among the sugarcane producing states. Sugarcane production and sugar industry hold great potential in Bihar. In case of Sugarcane, production as well as productivity both increased between the period 2000-01 and 2006-07. In the year 2000-01 its production in Bihar is 3987.6 thousand tones and productivity is 42,648 kg/ha , while in case of all India the same is 295956.2 thousand tones and 68577 kg/ha. However, in the year 2006-07, in Bihar, production has increased to 4249.0 thousand tones and productivity has increased to 41252 kg/ha .While in case of India production and productivity has increased to 283404 thousand tones and 64615 kg/ha respectively. Area under sugarcane cultivation has also increased considerably in the State. (**Annexure VI)**

32. The Sugar industry is the largest agro based industry in Bihar. It generates considerable employment in the farm sector directly as well as through ancillary industries and related activities. According to the estimate of 2006-07 the area under sugarcane cultivation is 117.2 thousand hectares, production accounts for 5338.8 thousand tones and productivity is 45552 kg/ ha against the national average of 70469 kg/ha. Bihar has the lowest sugar recovery rate in the country at 9% against the national average of 10.36%.

B. Horticulture

33. The country recorded an impressive achievement in agriculture after green revolution in the late sixties, which enabled the country to overcome widespread hunger and starvation, achieve the self sufficiency in food; reduce poverty and transformation in millions of families. The happened, despite the fact that India is a home of 16.8 per cent global human population with 4.2 per cent water and 2.3 per cent of global land. Most important changes now being noticed in agriculture at national level are diversification, modernization, market orientation and commercialization, involving introduction of new crops, and varieties increased share of horticulture in cropping pattern, diversion in processing and export oriented production. Growing importance of horticultural produce could be attributed to increasing demand due to the growth of health conscious population and enhanced income. Thus, the task before the state of Bihar is to harness the opportunity by converting weakness into strength, which will need a paradigm shift in thoughts and approaches from traditional system to knowledge based and technology driven system having efficiency as a central point evolving farmers in planning and execution.

34. The agro-climatic diversity in the State with its high rainfall distributed over a five-month monsoon and a reasonably long and moderate winter allows for a variety of horticultural crops to be grown. The agro-climatic conditions are eminently suitable for whole range of vegetables; a variety of roots and tubers crops; perennial fruit crops like mango, litchi, guava, and limes; annual fruit crops like banana, pineapple and papaya and spices like ginger, turmeric and chilly, of late, floriculture is also showing excellent prospects. The state thus has possibilities for growing a diversified basket of vegetables, fruits, spices, tubers and flowers and medicinal and aromatic plants.

Fruits

35. Major fruits grown in the state are Mango, Litchi, Guava, Pineapple, Citrus, Banana, Papaya and Ber. Mango is grown all over the state, main growing areas are Muzaffarpur, Vaishali, Bhagalpur, Darbhanga, Madhubani, Sitamarhi, Patna and West Champaran. Litchi is mainly grown in Muzaffarpur, Vaishali, Sitamarhi, East and West Champaran and Darbhanga of North Bihar region. Pineapple is grown in north- eastern part of the state particularly in Kishanganj, Purnea, Araria, Katihar and Saharsa districts. (**Annexure VII & VIII)**

Vegetables

36. Bihar ranks 3rd in vegetable production in the country and produces a variety of traditional and non-traditional vegetables. Climatic and soil conditions of the state are congenial for production of different types of vegetables in the state. However, it lacks the basic infrastructure for storage, packaging, transportation, organized marketing system and post harvest handling facilities. Seed is the most important input which influences the output of vegetables crops. Vegetable production programme could be strengthened only if its seed production programme is strengthened. Thus, seed production programme should be strengthened to give a boost to vegetable production. (**Annexure IX & X)**

Spices

37. A variety of spices are produced in Bihar. At present Bihar produces about 20 thousand tonnes of spices annually from an area of nearly 15, 081 ha. The important spices are Ginger, Turmeric, Chilly, Coriander, and Garlic. Chilli accounts for 47.6 percent of the area under spices and 39.5 per cent of the production followed by turmeric, which occupies 26.3 per cent of the area under spices and accounts for 36.4 per cent of the production in the state.

Area and Production of Spices in Bihar

Spice crops	Area (ha)	Area (% to total spices)	Production (tonnes)	Production (% to total spices)
Turmeric	3,968	26.31	7,326	36.35
Ginger	942	6.25	1,327	6.58
Garlic	2,972	19.71	3,533	17.53
Chilli	7,181	47.62	7,967	39.53
Total spices	15,081	100.00	20,153	100.00

Floriculture

38. In India many states like, Karnataka, Tamilnadu, Maharashtra, U.P., West Bengal and Delhi are producing flowers on a large scale and also involved in export of some commercial flowers but the state like Bihar does not play any role neither in export nor in domestic market. The area under loose flower production in the year 2001–02 was 44 ha which has increased to 95 ha in the year 2002-03. Also the production has reached to 1757 MT. in the year 2002-03. Although during the year 2004-05 the production of flowers increased tremendously after the adoption of Field Demonstration/ Training programmes in the state under Macro mode Management

/ National Horticulture Board sponsored programme, but there is still need to give more emphasis to exploit the potentiality of the state.

Apiculture

39. Bihar is one of the leading honey producing states in India. The main regions in which beekeeping are done are the districts of Muzaffarpur, Vaishali, Sitamarhi, East & West Champaran, Madhepura, Katihar and Begusarai. Approximately 3,900 MT of honey was produced in the state out of the total country's production of 8,400 MT in 2002. Bihar is the only state producing litchi honey on commercial scale, and it should rank at par with some of the premium honey in world market such as the Block Forest Honey of Germany and the Spanish Orange Honey in terms of its uniqueness and quality. Honey yield with the Italian honeybee species is the highest in Bihar as compared to other states with a production rate of 40 and 60 kg honey/hive/year under stationary and migratory bee keeping respectively. The processing industry has not kept pace with the increase in beekeeping in the state with no large processing unit within the state. There are a handful of processing units in the organised sector with most of the processing happening in the unorganised sector with the main being the processing plant run by Mirzanagar Gramodyog Samiti.

Potential of Beekeeping in the State

40. Beekeeping has a tremendous potential in Bihar. Taking the acreage of Litchi as about 24, 000 ha, Bihar can support 2,40,000 bee colonies on Litchi alone. The crops of Mango, Guava, Mustard, and Rapeseed can help the bee colonies develop for the Litchi honey flow. Though the crops of rapeseed of over 100, 000 ha can support around 10 lakh bee colonies, these crops normally just help to build up the bee colonies after the severe monsoon and help them increase in population for the summer honey flows on Litchi and Karanj. In the world market the demand for honey is around one million tonne. There is an immense possibility for India to increase its export share from 7,000 tonne to three lakh tonne and Bihar can lead the way to capture this market as it has shown with the increase in productivity. At a conservative estimate, given the various cropping pattern and area under different crops suitable for bee keeping, Bihar has the potential to produce about 40,000 MT of honey with an estimated value of Rs 200 crore annually and creation of more than 6,00,000 employments.

Plantation Crops

41. Among the plantation crops, coconut has expanded to about 10,000 ha in north Bihar. Tea plantation has also come up in Purnea and adjoining district. Tehre is a potential for extending area under the cashew nut in Jamui, Rohtas and Nawada district.

Fruit and Vegetable Processing

42. There are only 45 licensed fruit and vegetable processing units in the state. Most of these units are engaged in the manufacture of fruit juices, fruit pulps excluding frozen), squashes, pickles, tomato ketchup/sauce, tomato juice, tomato puree, tomato paste, jam/jelly/marmalades, squashes/crushes/cordials, barley waters, fruit beverages, chutneys, fruit juice concentrate (except tamarind), etc. There are a few more units along similar lines in the unorganised sector also which are involved in minimal processing. However, the industry estimates that only about 2–3 per cent of the total produce is processed.

43. Farm level pre-processing facilities such as pre-cooling facilities, cooling facilities, collection centers, grading and sorting systems, washing and cleaning facilities and pack houses, etc., are absent. These are critical to preserve quality and prevent temperature shocks immediately after harvest. Warehousing and storage system for fruits and vegetables are absent except for potatoes and a few for onions. The entire produce after harvest is immediately transported to the markets within and outside state and some to the processing units mainly for fruits.

44. The fruit and vegetable processing segment is marked by a complete absence of cold chain along the value chain resulting in quality deterioration and degradation of raw materials. Similarly, even after processing, the products are kept under minimal refrigeration or no refrigeration. A large number of these units are working on work-order basis for larger chains and as such find that the operating margins being thin leave no scope of either technology up gradation or expansion. Fruits and vegetables have been shown to earn 20–30 times more foreign exchange per unit area than cereals due to higher yields and higher price available in the international market (Planning Commission study in 2003).

National Horticulture Mission

45. The National Horticulture Mission has been launched from 2005-06 for holistic development of horticulture sector. The objective of the scheme is to improve the production and productivity of horticulture crops by harnessing the potential of the region. Special emphasis is to be given to “Low Volume, High Value, and Less Perishable Horticulture Crops”. Through this Mission, a horticulture based farming system is to be developed, thereby providing viable and ample opportunities for employment, especially for women, besides improving the productivity of land. The programme in the state of Bihar is being implemented by State Horticulture Department. Initially 16 districts were identified. Hon’ble Chief Minister also sanctioned the programme of the mission in remaining districts of the state. This provides ample opportunity, but its implementation in the state need catalyzing efforts. Crops identified for implementation under mission are Mango, Litchi, Guava, Banana, Pineapple and Vegetable seed production. Districts and Clusters identified for different Horticultural crops are given in (**Annexure- XI).**

46. Number of constraints has been observed in the way of organized development of Horticulture sector in the State. Poor extension service is perceived to be one of the main reasons. Farmers are not adequately guided on the socio-economic importance of various horticulture crops / activities, system of cultivation, linkages and facilities available from various agencies, marketing etc. Quality planting materials of selected crops and improved crop varieties are reported to be not readily available at a competitive price in many districts. Improper functioning due to lack of infrastructure like water and skilled man power in the government nurseries are the reasons quoted for poor production and supply. There are no organized market centers in the State, to facilitate convenient marketing of perishables by the farmers at a competitive price. Wastage of fruit and vegetables persists due to lack of post - harvest facilities. It is estimated that this leads to a colossal loss of more than Rs.50, 000 crore per annum – nearly 30 per cent of the country's production.

C. Animal Husbandry & Dairy

47. Animal Husbandry & Dairy is the subsidiary income generating activity for the rural poor of Bihar. It is an important source of income and employment for millions of landless poor in the state. Therefore, the progress in this sector will result in more balanced development in the rural economy. The main objective of this sector is to increase the livestock production through controlled breeding programmes, strengthen the infrastructural facilities and to ensure animal health cover. Livestock sector consists of Bovines, small ruminants and piggery. Poultry is different from these categories. Livestock and poultry are gaining importance in recent times because income elasticity of demand is high for these products. The sector contributes more than 20% to the net domestic product from agriculture. The bovine sector has a dual role of producing milk and supplying drought animal power to agriculture. In resource poor regions, where bovine sector faces severe constraints, small ruminant production becomes important as these animals can survive even in harsh climate. The dairy development activities in the State are taken care of by the Dairy Development Directorate and the Bihar State Co-operative Milk Producers' Federation (COMFED) in the non-operation flood and operation flood regions, respectively. The Dairy Development Directorate is the implementing agency for the Integrated Dairy Development Programme in the State. Apart from this it is also implementing a Special Component Programme for clean milk production under which training and inputs are provided to the farmers. The Bihar State Cooperative Milk Federation Ltd. has been extraordinarily successful and has improved the lives of many thousands of families. The Bihar State Co-operative Milk Federation (COMFED) which is operating on the Anand (Gujarat) pattern in the State has five affiliated milk producers' co-operative unions, namely Vaishali- Patliputra Milk Union, Patna; Barauni Milk Union, Barauni; Tirhut Milk Union, Muzaffarpur; Mithila Milk Union, Samastipur and Shahabad Milk Union Arra. These five milk unions cover 6500 villages in 24 districts of the State.

Trends in Livestock Population

48. Bihar is rich in livestock resources. The State has a livestock population of 42.90 million of which 25.47 million are Bovine, 1.06 million are Sheep, 1.78 million are Pigs and 14.52 million are Goat. There is an increase in the crossbred cattle in the state between 16th and 17th livestock census by 512.1% but there is a decrease of 30.4% in the indigenous cattle population during the same period. The overall cattle population has decreased by 25.3%. The buffaloes have increased by 20.5 %, sheep and goat has decreased by 45.7 % and 28.2 % respectively. Sheep, goat and pigs are being reared by farmers in the State in view of the low investment, reduced risk, capacity to use local feeds and easy management by family members. The total livestock in the state has decreased from 53.742 million to 42.990 million between 1997 and 2003 showing a decrease of 20%. (**Annexure XII)**

49. The state has made significant strides in milk production between the periods from 2001-02 to 2005-06. Within this 5 year period milk production has increased by 92 per cent from 2632 thousand tonnes in 2001-02 to 5060 thousand tonnes in 2005-06 **(Annexure XIII).** However, milk productivity level in the State is still very low. This may be attributed to poor percentage of crossbred and other improved varieties of bovine population. This calls for introduction of more crossbred varieties for increasing milk production as demand within the State is increasing rapidly with growing urbanization and increase in per capita income. Moreover, increased milk production is needed to generate additional income to the marginal and landless households. Needless to say, dairy farming provides additional employment to the rural women workforce.

Poultry population

50. Poultry –primarily relating to egg production has just 1.6 per cent share in the livestock value of the state. There is an increase in the fowl population in the state during the period from 1997 to 2003. The fowl population has increased by around 58.3 % and the population of Duck etc. has decreased by 37.5% during the period. The total Poultry has increased by 42.5% during the period. **(Annexure XIV)**

51. Eggs are available both from fowls and ducks. Over the years egg production in the state also recorded a significant increase from 740 million nos. in 2001-02 to 1000 million nos. in 2005-06, over 35 per cent increase, this was when the average yield of an improved layer was below 190 eggs per annum against a potential of over 350 eggs. On the other hand, productivity level of 'deshi' birds is less than 90 per bird per annum. It is estimated that only 10 per cent of the requirement in the state is met by the production within the state. Although the demand for table eggs in the state is very high, the farmers are not very keen in commercial poultry development mainly due to longer gestation period, high feed cost, high overhead expenses due to smaller

size of units and poor infrastructure like power and transport. Lack of awareness on scientific management of poultry birds as well as perception of high risk in the activity by the bankers is also a serious constraint for the development of the sector. It is, however, encouraging noting that of late, the State Government is focusing on promoting layer farming and has accorded agriculture status to poultry farming. Andhra Pradesh and Maharashtra are the two major states which have made commendable progress in poultry and Bihar should learn from their experience. It is also necessary to develop proper marketing along with storage and transport facilities in the state. (**Annexure XV)** gives details about Egg production by Fowls and Ducks in Bihar State.

Veterinary Services, extension and training

52. The number of institutions providing extension services to the livestock sector has remained stagnant over the years. There are 39 Veterinary hospitals, 814 Veterinary Dispensaries and 29 mobile veterinary dispensaries under the State Animal Husbandry Department. As regards piggery, there is no pig breeding farm or bacon factory in the Government sector. **(Annexure XVI)** As regards Goat, Beetal breed goat farm and sheep breeding farm at Chatra, Black Bengal goat farm at Thaithaitanger, Bolba (Gumla) are now in Jharkhand state and no sheep and goat breeding farm is available in reorganized Bihar state.

D. Fisheries and Aquaculture

53. Bihar is blessed with vast and varied fisheries and aquaculture resources. These resources are in the form of rivers, reservoirs, lakes , mauns , chaurs , irrigation canals, ponds and community tanks. However, despite such natural resources and fish as highly preferred food item, aquaculture and openwater fisheries resource remain highly underutilized. It is high time for the state to make use of these resources for providing sustainable livelihoods to millions of poor rural communities. The major schemes taken up include production and supply of fish seed , development of Maun / Chaur besides centrally sponsored schemes for development of aquaculture and welfare of fishers .The total fish production in the state is about 2.66 lakh tones with average productivity of about 2.2 tones per ha per annum . However, the annual consumption of fish within the state is about 4.5 lakh tones. The underutilization of aquaculture resources, unscientific management of water bodies and lack of entrepreneurship are some of the most obvious reasons for the gap between demand and supply.

Current state of fisheries and aquaculture

54. Bihar occupies third position in inland fish production (2.66 lakh tones) after West Bengal (9.88 lakh tones) and Andhra Pradesh (6.80 lakh tones) as in 2003-04. It contributes about 1.6 % of Bihar GDP. Bihar has bountiful natural resources of water in the form of 69,000 hectare of

ponds and tanks , 90,000 hectare of ox-bow lakes , 35,000 hectare of water logged area and many major rivers with total length of 3200 km. The present fish production is about 2.675 lakh tones. The state produces 350 million fry against its current requirement of 2000 million. Similarly, the State requires about 4.5 lakh metric tones of fish for local consumption and as such there is a wide gap between the production and demand of fish.

55. The current state of disappointing fisheries and aquaculture development in the State are attributed mainly to poor institutional setup, almost non-existence extension services, lack of adequate resources and infrastructure facilities, devoid of conducive policy environment, defunct fisheries cooperative, lack of professionalism among fisheries personnel, fragmented social setup, poverty and illiteracy among the primary producers etc.

56. The challenge is how to negotiate with these impediments, where many of them do not fall under the purview of the department of fisheries, and employ a practical and effective management strategy for utilization of available resources. We need to work hard for exploring appropriate approaches and develop field tested models to make this food production sector play a greater role in poverty reduction, food and nutritional security, sustainable rural livelihood development, government revenue and overall contribution towards betterment of the socio-economic conditions of farmers and fishers.

57. Given the strength and opportunities outlined in the proceeding paragraph, it is high time that we set a goal for managing and developing the fisheries sector in Bihar, so that eventually Bihar becomes a model for sustainable fisheries development within next ten years. **(Annexure XVII & XVIII)** Apart from these, there are numerous ponds and tanks having water area of less than 0.5 ha, with a total water area of 15,000 ha suitable for fish culture.

Major Rivers

58. Ganga, Kosi, Sone, Burhi Gandak, Gandak, Punpun, Kamla Balan, Kareh are the major rivers flowing through the State.

Major Reservoirs

59. Reservoir fisheries potential is relatively poor compared to neighboring States of UP and Jharkhand. The total number of Reservoirs in Bihar is 29. All the reservoirs of the State are of either small or medium category. Some important reservoirs are Badua **,** Chandan, Orhni, Phulwari, Nagi.

Fish Hatcheries

60. There are a total of 29 hatcheries in the state, out of which two are in corporate sector, 1 under the Government and 26 under private ownership. Besides there are 121 Government fish seed farms and 33 FEDA supported farms**. (Annexure XIX)**

61. During 2004-05, the total fish production of the State was 2.675 lakh tones. The overall increase in fish production during the past four years from 2000-01 to 2003-04 was in the order of about 44,000 tonnes. A conservative estimate of fish requirement in the State is about 4.56 lakh tones (as per WHO, consumption requirement @ 11 kg/capita/annum) and it will reach to over 8 lakh tones by 2020. The annual per capita fish consumption in the state is one of the lowest in the country, less than 1 kg/yr for nutritional security. To promote fisheries, the department of fisheries has 121 fish seed farms, out of which only 10% are in working condition. Presently, there are 29 fish seed hatcheries in Bihar of which 2 are under the corporate sector, and 26 in the private sector. In order to bridge the gap in the fish seed demand and supply, government of Bihar has announced to set up one hatchery in each District of the State.

Aquaculture

62. Bihar is blessed with aquaculture resources in the form of freshwater tanks and ponds which cover water area of over 69,000 hectares. Freshwater aquaculture in the State is being promoted through District level Fish Farmers Development agencies(FFDAs) which provides technical , financial and extension support to the fish farmers. The FFDAs have so far brought under scientific fish farming over 26,000 ha in various districts with an average fish productivity of around 2.2 tonnes/ha.

63. The share of aquaculture to the total fish production in Bihar is 40% . Indian major carps and three Chinese carps contribute to almost the entire production from aquaculture. Though no systematic farming of other candidate species is carried out, some of the other species like scampi , act fishes(magur and singhi), different species of murrel, are also being cultured.

64. Bihar has vast potential for commercial scampi farming. In 2003, MPEDA has shown on experimental basis, the production of scampi to the tune of 1500 kg/ha/four months in polyculture with carp. Bihar may be considered as the ‘sleeping jiant’ for fresh water prawn farming. Realizing its importance as a candidate species for culture and export, it can be taken up on large scale, for monoculture or polyculture practices.

Socio-Economic Status of Fisher Population

65. The total fishermen population in Bihar is about 49.59 lakh which is highest among the other state of India. About 50% (23.01 lakh) of the total fisher population is constituted by the children of various age groups. But of this huge population only 37,079 are active fishermen of which 25,503 are male and 11,576 are female. The fishermen population density in state is 52.66 per square km. The data regarding the literacy of fishermen is not available, but it is assumed that the literacy rate is much below the Bihar average of 47.53 %. The total number of fishermen co-operatives in the State was 1125 as in 2000 as per the Co-operative Department, Government of Bihar. However, most of the FCSs are not functional. Most of the fishers' villages in the State lack basic amenities like housing, communication, drinking water, electricity, health and sanitary facilities.

CHAPTER - 3

TECHNOLOGICAL INNOVATIONS IN AGRICULTURE

66. Seeds, fertilizers and irrigation are the major inputs in agricultural production. A sustained increase in agriculture production and productivity is dependent on continuous development of improved varieties of crops and supply of quality seeds to the farmers. Mechanization and agrochemicals are the other major inputs. The spread in modern input application has been much slower in the state as compared to other states in the country. However in recent years Bihar is also moving forward in terms of use of modern agricultural inputs.

A. Use of HYV Seeds & Balanced Use of Fertilizers

Seed

67. One of the major ingredients of the first green revolution in the country was the introduction of new high yielding variety (HYV) seeds, particularly of wheat and rice, along with the usages of proper doses of fertilizers and water with an appropriate price policy as a catalytic agent. Waves of this revolution though belatedly, also hit the Bihar state which would be evident from the fact that within a period of slightly less than 20 years (TE ending 1982 to TE ending 1999), nearly 68 per cent of the rice area, 91 per cent the wheat area and 75 per cent of the maize area were covered by HYV seeds. (**Annexure XX)**.

68. The increase was evident in all the 3 zones of the State, but it was highest in zone III in respect of rice (77) per cent and maize (82) per cent. In wheat, however, the coverage was highest in zone I (72 per cent). Of late, there has been a further progress in the coverage of area under HYV in the state, going up to 92 per cent in case of wheat, over 77 per cent maize and nearly 74 per cent for rice **.(Annexure XXI)**

69. However, the HYV coverage alone is not sufficient to help raise the productivity unless the seeds are of the required quality accompanied by proper doses of fertilizers and assured water. Unfortunately, seed replacement rate for most of the crops in the state is one of the lowest in the country. Seed replacement ratio in the state is very poor as compared to other states in the country. The Seed Replacement Ratio for paddy was 12% in 2005-06. For wheat, this ratio has increased from 8.1% in 2003-04 to 11 % in 2005-06. The ratio for cereals is about 10-12%, and for vegetables the ratio has increased from 20% in 2003-04 to 50% in 2004-05. Seed replacement target for vegetables in 2006-07 is 60%. (**Annexure XXII)**

Fertilizers

70. Fertilizer consumption in Bihar was a mere 22 kg. NPK/ha. in TE 1982 which increased to 63 kg./ ha. in TE 1991 and reached a level of 82 Kg./ha. in TE 1998. Fertilizer consumption increased in all the zones during this period. It may be noted that growth in fertilizer consumption slackened in the 1990s as compared to the 1980s. There was wide variation in the level of its use across zones/districts. It was as high as 104 Kg./ha. in Zone III and 69 kg./ha in Zone I in TE 1998.(**Annexure XXIII).**

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71. Total consumption of chemical fertilizers in Bihar was 731.6 thosand MT during 2004-05 . The level of consumption has increased to 1064.8 thousand MT durind 2006-07 (**Annexure XXIV & Annexure XXV)**

72. But, there is unbalanced use of N, P and K. While the ideal ratio would be 4:2:1, this was 14.7: 7:1 in 2004-05 but improved significantly to 6.8: 3: 1 in 2005-06. (**Annexure XXVI).** It is hoped that this ratio may reach the desired level in the coming years. More farm households use fertilizer, improved seeds, and pesticides in the rabi (winter) season than that in the kharif season. This is primarily due to the availability of irrigation in the winter season. For instance, 43% of farmer households use improved seeds in the rabi season compared to an all India level of 34%. (**Annexure XXVII).**

73. It is interesting to note that per hectare fertilizer (NPK) consumption in a number of districts in the state is quite high and is almost at par with those of the agriculturally advanced states like Punjab and Haryana. For instance, in 2004-05, NPK consumption per hectare was as a high as 282 kgs. in Khagaria, followed by Begusarai (219 kgs.), Patna (215 kgs.) and Bhagalpur (211 kgs.) Even in the districts like Bhojpur, Samastipur, Muzzaffarpur, West Champaran, Vaishali, Purnea and Jamui, consumptions were quite high ranging between 165 kgs. and 176 kgs. Very low consumption per hectare was observed in Sheohar (12 kgs.), Supaul (19 kgs) madhubhani (28 kgs.), Banka (34 kgs), Kishanganj (35kgs) and Gopalganj (37 kgs.)

74. But despite this increase, nutrient consumption per hectare in the state is still lower than the national average. Soil Testing is another area that requires the attention of agricultural scientists and officials, so as farmers use fertilizers judiciously. It is high time for Bihar to learn a lesson from the experience of Punjab where soil health has suffered due to the depletion of micro nutrients and humans. Based on field level studies appropriate remedial steps have to be taken to take care of these problems.

B. Irrigation & Water Management

75. The State of Bihar is fortunate to have ample surface water as well as balance ground water resources. Private investment is taking place in this sector mainly for exploitation of ground water through shallow tubewell, cavity well, bamboo well and also through dugwell and irrigation pond in limited area. All blocks in the State comes under 'safe category'. About 49 percent of the states' total cropped area is irrigated, as against the national average of 40 percent. Nearly 76 percent of the net irrigated area in Zone-1, 85 percent of the net irrigated area in Zone-2 and 45 percent of the net irrigated area in Zone-3 have tubewell as the source, while canal irrigation accounts for about 14 percent in Zone-1, 13 percent in zone-2 and 48 percent in Zone-3. In the state as a whole, tubewell irrigation accounts for 62.5 percent of the net irrigated area, followed by canal 30 percent and other sources 7.5 percent.The availability of ground water in future for irrigation works out to 16.11 lakh ha m which may support approximately 8 lakh new tubewells in the State. Out of which approximately 3 lakh units have been installed leaving a balance potential of approximately 5 lakh units.

Million Shallow Tubewell Programme

76. The Million Shallow Tubewell Programme (MSTP) approved by the Planning Commission, Government of India which is under implementation in the State, envisages utilisation of 697111 diesel tubewells with pumpsets upto the end of Xth plan i.e. March 2007. The financial outlay of the programme is of approximately Rs.2100 crore. The estimated subsidy component of 30% unit cost comes to Rs.635 crore. The loan component is 50% of the project cost and minimum beneficiaries' contribution is 20%. Against the cumulative achievement of 380783 units which is 71% of the cumulative target upto November 2005, the total number of tubewells commissioned is only 169912 units which is only 32% of the cumulative target. The year wise physical target and achievement is given in **Annexure XXVIII.**

77. Reasons for the non-utilisation of irrigation potential would vary for major/medium and minor projects. Major/medium projects consist of canals, branch canals, distributaries, minors, sub minors, and finally field channels. Sometimes there is slow progress of sub- minors /field channels construction where there is a divided responsibility between farmers and government. Even after completion of the project, the problems could be of leveling (a design default), breakages/leakages (normal or farmer created), besides monitoring and supervision problems. This involves canal security, gate operation, canal cleaning, minor repairing etc. From the potential created of 2680 thousand hectare, only 1260 thousand hectare is actual area irrigated according to Land Use Statistics. There is the need to take immediate steps to examine this issue command wise and take remedial steps to bring the potential under full use. As for minor irrigation (over 4.7 million hect.) major part of this being tube wells, the Government is now alive

to the problems of diesel operated tubewells and other issues, which have led to stagnation in irrigated area. They have recently decided to supply diesel to agriculture at Rs.10 per litre. This alone will not be sufficient. Majority of the existing Government tubwells are not working for one or the other reason. A careful study of these non- functional tubewells should be undertaken and remedial measures taken.

C. Farm Mechanisation

78. Farm mechanisation one of the important sub-sectors of agriculture, forms an integral component of the agricultural development strategies. Though farm mechanization is mostly construed as use of tractors & basic tractor drawn implements, all other types of machinery, implements and equipment used in agriculture are covered under this sub-sector.

79. Productivity of the farm depends considerably on the use of farm power derived from efficient farm implements and their judicious utilization. Technological advances in other areas of agriculture also necessitated use of mechanised equipment, instruments and other tools for maximising benefits from the technological advances and for optimizing costs. Farm machinery ensures timeliness of various operations which is important factor affecting crop productivity, particularly wheat. Mechanisation of various farming operations increases the production and productivity of land, reduces the drudgery associated with farm operations and helps in reducing socio-economic disparity among farmers. It encourages better management of farm enterprise, reduces overall cost, provides employment opportunity and encourages entrepreneurship. Mechanisation is not an end in itself, but a means of development.

80. Compared to other states of India, the adoption of farm mechanisation is lagging in Bihar. The availability of power at the farm level in India has increased considerably to 1.231 kw/ha in 2001 from about only 0.25 kw /ha in 1951. However the farm power use is still lower in Bihar (0.35 kw /ha). At present, number of tractors in the state is 111.7 thousand. Number of threshers, stonery engine and sprayer are 300, 250 and 29 thousand respectively. The Tractor density in the state is also low at 4.93 tractors /1000 ha as against 56.20 tractors/1000 ha in Punjab and 12.2 tractors/ 1000 ha in Uttar Pradesh. Presently only 11.24 per cent of the total power requirement for farms is estimated to be met from the available tractors in the State. Therefore considerable potential exists for other farm equipments like power tillers etc since 80 per cent of the total land holdings belong to small and marginal farmers who cannot afford tractors. Accordingly, the potential for other agricultural implements is very high, considering the present status of mechanised farming activities.

D. Agriculture Research & Human Resource Development

81. There are no two opinions that application of science and technology in agriculture leads to productivity growth. In a state like Bihar where nearly 77 percent of the total workforce are dependent on agriculture and where out of 16.4 million land holdings, nearly 92.5 per cent are small and marginal, importance of agricultural research for innovation of commodity-specific and location specific technology and their upgradation along with their extension can hardly be overemphasized. However, only about 0.2 per cent of the SGDP is spent on agricultural research and education as against the national average of 0.4 per cent of the GDP. Further, 95 per cent of this spending is used for salaries and 5 per cent for establishment expenses, thereby leaving no fund for operational expenses. The research – extension – farmers linkage is also extremely poor in the state and there is a complete lack of focus on areas of relevance, opportunity and comparative advantage.

82. Extension services which impart knowledge to the farmers in the application of research findings in their fields for crop production improvement are no longer the monopoly of Government agencies. There is now a mix of both public and private interventions. In Bihar, there exists paraphernalia of officials dealing with agriculture in the Department of Agriculture which is headed by the Agriculture Production Commissioner (APS). At the grass root level, Agriculture Extension Officers (AEOs) and Village Extension Workers (VEWs) are responsible for transfer of technology with direct contact with the farmers. For improvement of production and productivity, the State Government implements various programmes such as distribution of HYV seeds of cereals, minikit of seeds of pulses and oilseeds, fertilizer distribution, procurement, farmer's training, seed/ soil/fertilizer testing, etc.

83. Rajendra Agriculture University has major contribution towards bringing sustainability in agricultural activity of the state. Research undertaken covers all economically important crops grown in the state with focus on rice, wheat, maize, vegetables, fruits, fisheries, animal husbandry, medicinal and aromatic plants and post harvest technology of different crops. Soil testing based fertilizer equation has been developed and tested for achieving targeted yields of different crops. This has however not been implemented fully.

84. Extension reforms programme at the district level ,namely Agricultural Technology Management Agency (ATMA) ,was launched in 1999 with the World Bank assistance on pilot basis. Initially, four districts Madhubani,Munger,Muzaffarpur and rural patna were covered under this programme. The programme is proposed to be scaled up to eleven more districts namely East Champaran, Purnia, Vaishali, Saran, Katihar, Bhagalpur, Bhojpur, Rohtas, Gaya, Begusarai and Saharsa.

85. Linkage with Krishi Vigyan Kendras(KVKs) established in 36 districts of Bihar is another area of importance .Main objectives of these KVKs and Agri-clinics, established at district level , are to carry standard seeds, fertilizers and agricultural knowledge to the rural masses. However, training programmes need to be strengthened to impart knowledge to farmers.

86. Despite all this, the extension machinery in the State is still very weak and inadequately staffed. As the State machinery for supply of seeds, fertilizers, pesticides, etc., is almost crippled, the private agencies have made inroads in the villages and there are often allegations of selling spurious seeds/ pesticides by some of them in the absence of any effective quality control mechanism. Further, markets are unorganized and the farmers are exploited by the unscrupulous traders.

Farmers Club (FC)

87. Number of Farmers' Clubs (FC) functioning in the state till 31st March , 2006 was 748. Another 120 clubs were launched during 2006-07 till November, 2006. The clubs were organized in all the 38 districts of the state. Of these 551 FCs (74%) were in RRB's account, 172 FCs (23 per cent) on CBs account and remaining 25 FCs (3 per cent) were in DCCB's Account. The objective is to establish at least one FC in each of the Rural and Semi-Urban branch of the banks. In order to achieve this objective, at least 1000 FCs are to be promoted. It may be mentioned that participating banks have been advised to identify dormant clubs and initiate remedial measures for their revival/closure as per the guidelines of NABARD.

CHAPTER - 4

PROCUREMENT, STORAGE AND PRICES

A. Procurement & Price Support

88. Agricultural production is a function of technical inputs seed, fertilizers and water etc., In addition to all this remunerative prices are also an equally important adjunct in this production process. It was during 1965 that the Minimum Support Price **(MSP)** Policy was introduced. MSP is announced every year for all the major crops, taking into all the relevant factors including cost of production. It did serve as a catalytic agent in the success of Green Revolution. This price is uniform for the country as a whole. Bihar is in a very peculiar situation. Because of low productivity farming in Bihar is not a very profitable occupation. The net returns per hectare of paddy cultivation in Bihar (based on cash expenses plus imputed value of family labour) worked out to only Rs.3215 in 2003-04 as against Rs.19289 in Punjab. (CACP, 2006) Based on C_2 cost, the net returns from paddy cultivation was in fact negative i.e. – Rs.1263. Thus, even if there is potential for raising the yield level in Bihar, low productivity and low profitability would stand in the way of realizing such potential. In fact, the ratio of gross value of output to A_2F_L was only 1.35 in Bihar, as against 1.99 in Punjab. Similarly in the case of wheat, the net returns per hectare, based on A_2F_L was only Rs.4787 in Bihar as against Rs.15946 in Haryana and 15755 in Punjab. Based on C2 cost, the net returns from wheat cultivation was negative in Bihar, i.e. Rs.177. The ratio of gross value of output to A_2F_L was 1.47 in Bihar, 2.17 in Punjab and 2.10 in Haryana.

89. Unless paddy and wheat cultivation in Bihar is made profitable, farmers may not be induced to invest in land improvement measures for productivity growth and the much desired acreage shift towards paddy and wheat in Bihar at the expense of area loss in Punjab and Haryana may not be forthcoming. Even maize does not seem to be a very promising crop in this regard. The net returns (gross value of output = cash expense plus imputed value of family labour,i.e. minus A_2 + F_L) was only Rs.7625 and based on C_2 cost, it was Rs.4450. The ratio of gross value of output to A_2F_L was 1.80. Even the neighbouring state of Uttar Pradesh has relatively higher net returns from paddy and wheat cultivation. It would be further seen from (**Annexure XXIX)** that in several districts including Darbhanga, Katihar, Muzaffarpur, Nawada, Purnea and Sitamarhi, there was hardly any change in total factor productivity at constant prices during the past three decades.

90. The frequent occurrence of floods and drought as already stated aggravates the problem further. The co-efficient of variation in annual rainfall during 1980-81 to 2002-03 was 32 per cent. Similarly the prices of agricultural commodities fluctuate widely from year to year. The co-efficient

of variation in the farm harvest prices of paddy was as high as 45.4 per cent during 1980-81 to 2002-03. In the case of wheat, it was 44.9 per cent and in maize, it was 38.9 per cent. Thus, crop farming in Bihar is not only unprofitable at present, but also unstable and risky. The coefficients of variation in the yields of rice, wheat and maize were 23.4, 16.4 and 30.3 per cent respectively. It has been further estimated that rainfall and market prices were the main determinants of rice output. About 71 per cent of the variations in output were explained by variations in rainfall, irrigation and farm harvest prices. Since variability in the rainfall and farm harvest prices is high, the production process is quite risky. Along with low profitability, erratic rainfall and fluctuating market prices act as disincentives for the farmers to invest in modernization of agriculture.

91. With around 90 per cent of small/ marginal farmers, marketable surplus is not expected to be very high All the same market arrival of rice and wheat are of the order of 20-25 per cent. But the quantity procured is rather negligible. This serves as one of the biggest disincentive for higher production of major commodities in the state. Since the plan envisages much higher level of production. In a situation like this, there is a need for improvement in the marketing system, density of markets, connectivity of the markets within the producing areas, dissemination of market intelligence and institutional arrangement for procurement of the produce which come to the market. The implementation of minimum support price policy has always been poor in Bihar. Even though some surplus pockets of grains are emerging, Food Corporation of India makes hardly any effective purchases. This has to change and the corporation has to make effective purchase arrangements.

B. Storage & Management of Produce

92. Nearly one third of our horticulture produce, especially fruits and vegetables are wasted mainly on account of poor cold storage facilities. For the same reason the country also experiences fluctuations in prices of horticulture produce, particularly potatoes and onions. The loss of fruits and vegetables and spices due to inadequate post harvest handling, transportation and storage ranged between 25 and 40 per cent of the total production in Bihar.

93. Capital Investment Subsidy Scheme (CISS) for Construction/Expansion / Modernisation of Cold Storage for Horticultural Produce was introduced by the Government of India. The objective is to promote modern cold storage so as to avoid spoilage of perishable horticulture and other items like dairy, meat, fish, chicken etc, provide remunerative price to the farmers and providing business opportunities to cold storage owners through out the year by establishment of multipurpose cold storages.

94. The progress of the scheme has not been very encouraging in Bihar. Considering the annual production of perishable horticulture produce at 152.50 lakh MT in the State during 2002-

03, the existing post harvest handling and cold storage capacity is inadequate. Assuming 30 per cent of the marketable surplus produce to be stored, an additional cold storage capacity for approximately 14 lakh MT is required which translates into 281 additional cold storage units of 5000 MT capacity each, and a capital investment of Rs.562 crore. At present, 27 districts out of 38 are having cold storage facility, which can take care of only about 5 per cent of the total production of fruits and vegetables. Post-harvest handling facilities and cold storage units are required to be established in the remaining 10 districts. Additional facilities may be created in those districts where the number of cold storages and their capacity are inadequate. Rural godowns have also vast potential in the State in view of the fact that majority of the farmers are small and marginal who command little holding capacity. The State Government may identify potential areas and draw up a plan for construction of specialised storage facility for fruits like Litchi, Mango, Banana, etc. and their processed products. This is possible only if an uninterrupted power supply to the Cold Storage units is ensured by the Bihar State Electricity Board.

C. Agricultural Marketing

95. Bihar's agricultural sector has shown an impressive growth compared to other progressive states. However, income growth has not been commensurate with this trend and the challenges ahead are (i) ensure that more value is added to production and (ii) that some of the extra value is channeled to farmers. Currently, value tends to be added outside the state, and there is a general lack of marketing mechanisms to respond to farmers' needs. Marketing is crucial for a successful diversification and commercialization of Bihar agriculture and accelerated farmer income growth. Further income generation from Bihar's agriculture and food sector will require addressing product quality, delivery and pricing, despite some technical, institutional and organizational barriers.

96. A very small share of local production finds its way to the regulated markets in Bihar. Just as for other Indian states, Bihar has 95 regulated markets (mandis), 67 principal market yards, and 855 rural haats that handle some of the marketing of major agricultural commodities in the state. They are supervised and controlled by the state Agriculture Produce Marketing Board under the provisions of the Bihar state Agriculture Produce Marketing Act (1960). Data on market arrivals indicate that a very small share of agricultural production finds its way to the markets.This is because (a) the amount and quality of market infrastructure and support services is poor, and (b) the transportation costs and informal transaction costs discourage farmers from going to the markets.

97. A recent study shows that the quality and quantity of marketing outlets in Bihar is among the worst in the country. Furthermore, a World Bank analysis of some commodity supply chains has shown that up to 40 per cent of the margins along with value chains are lost to wastage and transportation costs. Crop diversification, especially into the relatively more perishable fruits and

vegetables, will increase the need for effective marketing linkages supported by modern marketing practices, including introduction of grading, post-harvest management, cold chains, etc.,

98. Standard quality grades for fruits and vegetables are currently not used in Bihar. Few standards are used for milk, fat content, and some other products. Some processing plants are HACP and ISO certified. The Patna (Bihar) laboratory of the Directorate of Marketing and Inspection (responsible for quality certification of agricultural products under the "AgMark" scheme), ceased its operations at the end of 2006 due to the lack of demand for its services. The Directorate (under the Department of Agriculture and Co-operation,Government of India) has 23 Agmark laboratories that processors can approach for voluntary certification of quality and the right to display the AgMark Stamp. Of the 13000 grading units that exist in the country, only 3 are situated in Bihar. The total value of produce that gets graded is negligible, unlike in Maharashtra, Uttar Pradesh and Tamil Nadu, where the share of the value of graded produce is as high as 75 per cent of the national value.

99. There are significant post-harvest losses. Every year, substantial losses are incurred amongst perishable products. It is estimated that as much as 39 per cent of tomatoes produced in the State is wasted. Similarly 39 per cent of mangoes and 22 per cent of litchis production are lost annually due to lack of proper post harvest activities and facilities (World Bank, 2004).

100. It is recognized that a considerable share of agriculture production in Bihar is being produced for home consumption, thus lowering the marketable surplus. There are also some other important factors which prohibit producers from accessing the markets. One of the most important issues in this respect is non-remunerative price structure. As discussed elsewhere in this report, cost of production of various crops is much higher than the Minimum Support Price offered. Added to that is the weak marketing infrastructure. In a recent World Bank study (2004), Bihar ranked third from bottom amongst states in the level and quality of its regulated marketing infrastructure. It also came fourth to the last in the level of farmers' satisfaction with existing market conditions. Bihar's density of markets (per million hectares of sown area) is relatively low. There are 7 principal regulated markets for every million ha of area in Bihar compared to 22 in the neighboring state of Andhra Pradesh.

101. It is encouraging to note that the Bihar Eleventh Plan recognizes the role of private investment to help in the development of marketing infrastructure. This will help promoting contract farming, export of fresh and processed fruits, processing of ethanol, corn oil, in the feed and starch industry, export of baby corn, and to make litchi honey.

102. Finally, the number of wholesale markets in the state is also not adequate and for disposal of agricultural produces, the farmers are required to travel a long distance. Nearly 400 sq. km

area in the state is served by each wholesale market as against 156 sq.km. in Punjab and 318 sq.km. in West Bengal. As many of the small and marginal farmers cannot cover such a long distance, they usually dispose of their produces to the village itinerary traders. To conclude, the Infrastructure Development Index is 80 for Bihar, bench marked against 100 for all India

CHAPTER - 5

ORGANIC AGRICULTURE

103. Increasing awareness about the health hazards caused by excessive use of agro-chemicals has brought a major shift in the customer sensibilities and preference towards food quality in developed countries. In India soil erosion and salinity problems compounded with ever rising cost of cultivation caused by using excessive agrochemicals and irrigation has made the cultivators look for alternative strategies. Globally the demand for safe and healthy food is on the rise. Global consumers are increasingly looking forward to organic food that is considered to be safe and hazard free. The global market for organic food is expected to touch US $ 40 billion by 2010. The demand is ever increasing both in developing as well as developed countries. World wide over 130 countries produce certified organic products in commercial quantities.

Concept of Organic Farming

104. Organic agriculture is primarily defined as a production system which is supportive of the environment. Organic production systems are based on specific standards precisely formulated for food production and aim at achieving systems which are socially and ecologically sustainable. The use of chemical synthetic fertilizers and pesticides is avoided. Focus in organic agriculture is toxin free food for the customer and the farmer growing it using organic inputs. Organic agriculture is a process which imparts sustenance and minimizes ecological foot print.

105. “Organic” denotes a label for products that have been produced in accordance with certain standards during food production, handling, processing, marketing stages and certified by a duly constituted certification body or authority. The organic label is therefore a process claim rather than a product claim. Often the customers feel that the organic foods are healthier and purer. The label des not mean that. It simply means that the products follow defined standard of production and handling. So an organic standard will not exempt producers and processors from compliance with general regularity requirements like food safety regulations, pesticide registrations, general food, nutrition labeling rules etc.

106. To facilitate trade and avoid misleading terms the Codex Alimentarius, a joint body of FAO/ WHO framed certain guidelines for the production, processing, labeling and marketing of organically produced food. It defines organic agriculture as a holistic food production management system which promotes and enhances agro-system health, including biodiversity, biological cycles and soil biological activity. The long-term objective of the FAO Organic Agriculture Programme is to enhance food security, rural development, sustainable livelihoods and environmental integrity by building capacities of member countries in organic production, processing, certification and marketing.

Soil Health Management

107. Soil is a valuable national and natural resource. We depend on it. Soil conservation practices are very useful for Bihar which is ridden with floods and drought. The prime focus of organic agriculture is the management of soil organic matter to enhance the chemical, physical and biological properties of soil. The concept of feeding the soils rather than the plants forms the basis of the sustainable approach. One of the basic principles of soil fertility management in organic system is that the plant nutrition depends on 'biologically derived nutrients'. Instead of using soluble form of nutrients less available forms of nutrients in organic matter are used. The nutrients are released by the activities of soil microbes and soil animals. Improved biological activity and diversity is also known to suppress weeds, pests and diseases.

108. Keeping soils in place is the beginning of conservation but they should also function well. Soil organic matter cannot be increased quickly even when management practices that conserve soil organic matter are adopted. The increased addition of organic matter associated with continuous cropping, and the production of higher crop yields, are accompanied by an increase in the rate of decomposition. Moreover, only a small fraction of crop residues added to soil remains as soil organic matter. After an extended period of time, the return of all crop residues and the use of forages in rotations with cereals and oilseeds may significantly increase soil organic matter, particularly, the "active" fraction.

109. The various forms of organic matter used are animal dung, crop residues, bio-gas slurry green manures, bio-solids from agro-industries food industries and allied industries. Animal dung is used competitively for fuel purposes too. Composting techniques like vermi-composting, phospho-composting, N enriched phospho-composting etc are also used to improve the nutrient quality potential of composts. Vermi-composting is the easiest form of composting which can be initiated on the farmer's field by training and demonstration. The seed bank for earthworms can be set up by the soil testing labs and every gram panchayat can distribute the worms at subsidized costs for preparing vermin-beds on-farm.

110. The decomposition of organic material involves both physical and chemical processes. The decomposition of organic materials into smaller compounds results from the activities and appetites of various invertebrates such as mites, millipedes, beetles, sowbugs, earwigs, earthworms, slugs, and snails. The chemical decomposition of organic compounds results predominately from soil microorganisms. These include bacteria, actinomycetes, fungi, and some protozoans. Under the appropriate conditions, complex organic compounds present in food scraps and yard trimmings are enzymatically degraded into smaller compounds, carbon dioxide, and water. Heat is also generated as a by-product of this oxidative process. Composting continues as long as appropriate microorganisms are present and adequate environmental conditions are maintained. Once the

decay process is completed, the nondegradable organic matter becomes the characteristic humus-like material called compost. Various compost inoculants are available which after creating amenable conditions for composting [C:N ratio of substrate, moisture, aeration] can bring down the time required for composting.

111. **Functions of soil organic matter**

(i) Nutrient cycling
  (a) Increases the nutrient holding capacity of soil (CEC).
  (b) Is a pool of nutrients for plants.
  (c) Chelates (binds) nutrients, preventing them from becoming permanently unavailable to plants.
  (d) Is food for soil organisms from bacteria to worms. These organisms hold on to nutrients and release them in forms available to plants.

(ii) Water dynamics
  (a) Improves water infiltration.
  (b) Decreases evaporation.
  (c) Increases water holding capacity, especially in sandy soils.

(iii) Structure
  (a) Reduces crusting, especially in fine-textured soils.
  (b) Encourages root development.
  (c) Improves aggregation, preventing erosion.
  (d) Prevents compaction.

(iv) Other effects of soil organic matter
  (a) Pesticides break down more quickly and can be “tied-up” by organic matter (and clays).

112. According to a conservative estimate, around 600 to 700 million tons per annum of agricultural wastes is available in our country but most of it is not used properly. Such rich source of fixed carbon can be converted to wealth by mobilizing the bio-mass to feed the soil. So such waste has the potential to be transformed to wealth to feed the starved soils and conserve them effectively. About 1800million tons of animal dung is produced annually in our country. Even if two-thirds of it is used for bio-gas generation, it is expected to yield a bio-gas of not less than 120mm^3 per day and manure of 440 million tons per year which is equivalent to 2.9 mt of N, 2.75 mt of P2O5 and 1.89mt of K2O. As far as possible organic farming systems are closed loop cycles with respect to the nutrient balance. Only nutrients exported are in the form of food for human and animal consumption. Crop burning is avoided. Unscientific storage and loss of nutrients is also avoided. Thus organic agriculture is considered to conserve the micro-ecosystem and is more sustainable than conventional agriculture.

113. **Soil Health - Reducing cost of cultivation is the key for profitability –**

The farmer these days is worried about too many aspects other than production. He has to have an approach and safe inputs which can give him relief from using toxic chemicals without compromising on the productivity. Earlier practice of clean cultivation aims at preventing the growth of all types of life forms near the plant surfaces. So sterile plant surfaces lead to an unbalanced system which increases the chances for pathogens colonizing at alarming rates as there is less or no competition form the native flora. Such systems require extremely high quantity of inputs leading the farmer into a vicious cycle for persistent use of the chemical inputs which increase the costs of production.

114. As organic systems aim primarily at safe inputs at lower cost. Certain Do-it-Your Own technologies like preparing active microbial culture on farm are being used all around the world. They are categorized under aerobic or anaerobic brewing. Effective Microorganisms is also called “EM technology” by the proponents of this concept. “EM technology” is a method to improve soil quality and plant growth using a mixture of microorganisms consisting mainly of lactic acid bacteria, purple bacteria, and yeasts which co-exist for the benefit of whichever environment they are introduced. Using the inoculums concentrate the farmer can prepare EM solution on-field at a meager cost.

115. Lately aerobic extraction of microbes from composts is also being tried world over. Such compost teas as they are called show positive effects on foliar and soil application. They increase the bio-diversity of the microbes, in addition to supplying the useful soluble metabolites from composts. Another Indian technology KREF Solution is being used by Indian farmers to aerobically brew and extract essential nutrients from vermin-compost enriched with useful nitrogen fixing and phosphate solubilizing microbes. KREF Biomanure contains total fermentation solids and soluble of bacteria and fungi extracted from natural organic manure. These units can be set-up at each village by a rural entrepreneur financed by co-operatives or bank.

116. A specialized user friendly brewing vessel is used to aerobically brew the microbes extracted from the vermicompost and added specially using polymeric carbon sources. Such microbes are allowed to grow for 24 hrs aerobically and the resulting KREF solution is used @ 20l per acre as foliar and soil application. As the farmer brews it on his field the costs are low and economical. The beneficial effects of such KREF solution has been tested over 10,000 acres from 2005. On farm brewing of microbes is economical. KREF is boosting organic movement and grass root level entrepreneurship is discussed.

117. Dynamic Blend of Microbes in KREF play a key role during the process by extracting the locked-up nutrients from KREF Compost, by virtue of their enzymatic characteristics. Naturally

occurring fungi in the compost like *Aspergillus, Paecilomyes, Penicillium, Chaetomium, Verticillium, Trichoderma* secrete cellulases, which bring about decomposition of cellulosic residues to simpler carbohydrates. *Aspergillus, Penicillium* and *Chaetomium* are also able to split hemicelluloses. Amylases, which bring about starch decomposition, are secreted by almost all the KREF manure microbes in varying amounts. The key amylase producers are *Aspergillus* and *Bacillus* which grow profusely and exhibit a wide variety of attributes viz solubilization of insoluble phosphate and nucleic acids degradation etc. The enzymatic abilities enable the organisms to utilize the carbon sources efficiently. Thus, the nutrients are brought into the food or nutrient cycle for utilization by other microbes. The fermentation cycle results in thorough extraction of nutrients and microbes from the compost. KREF Biomanure microbes being highly competitive grow profusely and enrich the end product [brew] in terms of nutrients and the microbes.The fungi showing antagonistic ability viz:- *Trichoderma, Aspergillus* and *Chaetomium* also secrete chitinases which restrict growth of unwanted fungi. The yeast [*Saccharomyces*] grow competitively during aeration at all levels of dissolved oxygen. They help in keeping a check on the growth of the anaerobic bacteria after preparation during storage. Process cycle of 24 hours enables the extraction of a plethora of microbes, viz- actinomycetes, fungi, bacteria, protozoa, etc. from the KREF Compost.

118. Post fermentation use for soil and foliar application - The microbes after reaching soil or leaves function in the following manner –

(i) Aid in nutrient cycling- Microbes are responsible for setting wheels of the organic food chain rolling. Their secretive, enzymatic abilities, canalize the available food into the food web. Such web creates a buffer for absorbing the stress and co-ordinates the nutritional requirement of the crops and the whole world beneath.

(ii) Aid in correcting imbalanced or chemical affected soils in combination with use of organic amendments and procedural methods.

(iii) The diversity of microbes helps in minimizing the use of fungicides as there is competition of the freshly brewed active microbes for food and space on the plant surfaces.

(iv) KREF solution also enables addition of fresh microbes at the rate of 20 liters per acre of fresh culture which is teeming with healthy microbes. They start working instantaneously in soils and on leaves thus enabling the farmer to see results within 48 to 72 hours.

Microbes are the wheels of organic farming

119. There are millions of microbes in a gram of soil which are significant because of their prolific activites **(Annexure XXX).** Microbes literally control the process of organic farming since they govern the nutrient cycling reactions in soils. Microbes in the soil process organic matter to provide a balance of minerals and nutrients which are utilized by plants to achieve healthy, vigorous crop growth. Microbes also form a protective cover for the plants and provide a balance

by disallowing any one organism to supersede. They are the basic indicators of soil fertility and are responsible for turning the nutrient cycles.

120. As research identifies additional roles for microorganisms in soil, it is common to find that not all soils will contain organisms appropriate to that function. When new crops are being introduced into a region, or where land damaged by human intervention is being revegetated, it will often be necessary to add specific organisms to the soil. Commercially cultured micro-organisms for use as agricultural inoculants have now been available for more than 100 years, and have had a major impact in agriculture. Organisms used as inoculants in agricultural settings are shown in **(Annexure XXXI)**. The great majority of the inoculants sold, and most of the methods developed are for use with legume inoculation.

The demand for microbial inputs for nutrition –

(i) nitrogen fixation,
(ii) P solubilization,
(iii) plant growth promotion,
(iv) release of locked up nutrients in organic matter etc

121. Microbial products for seed dressing are increasingly sought after for dry seed dressing of seeds. These can be used by conventional and a must for the organic growers. The root dip sprays for rice can substantially increase the production as has been proved by many field experiments by Universities. Soil broadcasting of microbial products for N fixation and P solubilization and foliar sprays of microbes producing plant growth promoting substances can be used at growth and reproductive phases of plant growth. These bring about substantial increase in growth together with reduction in cost of cultivation. All microbial products come under safe inputs for organic farming provided they have been certified for use.

Pest and Disease management in organic farming

122. Many organic farmers and research has substantiated that use of synthetic fertilizers and pesticides increase the crop susceptibility to pests. Plant susceptibility to insect herbivory has been shown in numerous studies to be associated with high plant N levels related to high inputs of chemical fertilizers. Free amino acids, associated with high soluble N applications, have been reported to increase pest attack. Organic crops are more tolerant and resistant to pest attack. Organic rice is reported to have thicker cell walls and lower levels of free amino acids than conventional rice.

123. Cultural controls are very important in organic farming. So pest control begins by making sensible choices of choosing crops that are naturally resistant to the pests and diseases or

choosing optimum sowing times that prevent pest attack. Careful management of time and spacing also gives a chance for the natural predators to establish themselves and keep the pest population in check. Other methods employed are as follows-

(i) improving soil health to resist soil pathogens – by recycling wastes or organic matter
(ii) rotation of crops to break the life-cycle of pests – crop rotations with green manure crops like
(iii) Encourage natural biological agents and natural enemies of pests for control of diseases, insects and weeds.
(iv) Using pheromone attractants to trap pests - light traps, delta sticky traps,[bright yellow, light blue]
(v) Use of herbal products and biopesticides

124. Soil borne root diseases are generally less severe on organic farms than conventional farms, while there were no consistent differences in foliar diseases between the systems. The successful control of root diseases in organic systems is likely to be related to use of long and diverse crop rotations and regular organic amendments. There have been many reports on the possible mechanisms that can shift the soil microbiological equilibrium, following the addition of microbial inoculants and organic amendments. A brief mention of these is relevant to the subject.

(i) Antibiosis. Production of antibiotics by non-pathogenic microorganisms that can induce biostasis and biocidal effects on others.
(ii) Competition. Competition by microorganisms for substrates, space and growth.
(iii) Parasitism. Direct parasitic attack on soilborne plant pathogens by non-pathogens.
(iv) Detoxification. Metabolism of toxic substances by specific microorganisms.
(v) Inhibition. Production of compounds by microorganisms that can inhibit specific metabolic pathways in others.

125. Biopesticdes are increasingly sought after for managing the pests of crops. Some farmers now use biopesticides rather than their chemical pesticides to grow the organic crops that have become so popular in recent years. The Environmental Protection Agency defines a biopesticide as “certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.” They fall into three major classes.

The Three Classes of Biopesticides:
(i) Microbial pesticides: These consist of microorganisms such as a fungus, virus or bacteria which are used to control fungal, insect, nematodes or weeds**.(Annexure XXXII)**
(ii) Plant-Incorporated-Protectants (PIPs): These are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take

the gene for the Bt pesticidal protein, and introduce the gene into the plants own genetic material. Then the plant instead of the Bt bacterium, manufactures the substance that destroys the pest. [This increases crop yields and reduces the amount of money spent on pesticides] However, such genetically modified microbes or plants are not allowed in organic agriculture.

(iii) Biochemical Pesticides: These are naturally occurring substances that control pests by non-toxic mechanism...These include substances, such as insect sex pheromones, that interfere with mating, as well as various scented plant extracts that attract insect pests to traps.

126. Biopesticides can be incorporated in the package of practices right from sowing to harvesting. They can even be used to stop the post-harvest losses of crops due to spoilage by fungal diseases. Several herbal pesticides can be prepared as aqueous extacts at village level of the plants available in the specific area. [neem, chilli, tobacco, custard apple, ginger, garlic etc] Cow- urine also provides potent relief against many diseases.

127. The best strategis for pest management are based on ensuring optimal conditions for plant growth - soil rich in organic matter, balanced nutrition, diversity of plants repelling harmful insects and promoting pests of all kinds. Application of methods on farm and environment can promote or control pest incidence. Only if we fully understand the ecology of pests and diseases can we live in harmony with them instead of fighting them.

128. Organic certification is an important aspect of adding value to the default organic or converted system. Certified farms ca n explore different domestic and export markets for fetching better price. APEDA should be consulted for setting up base with a newly formed proposed Bihar Institute of Organic Agriculture BIOA. BIOA can be involved for training and demonstration of package of practices for organic agriculture and capacity building of the farmers. The soil testing labs of the state can be the extension arms of BIOA. Several models from production to harvesting to vaue chain management can be created for establishing the Bihar Organic brand.

129. Organic agriculture can generate a whole new class of village level entrepreneurs who can be trained to manage their own eco-system. Allied technologies for

i. Inputs for farming – composting, herbal extracts, rearing of beneficial insects, manure solutions etc
ii. Inputs for livestock – silage inoculants, Azolla cultivation, Spirulina cultivation
iii. Harmonious technologies for value addition – mushroom products on rice straw, insect zoos, nursery of medicinal plants, forestation etc can be established in the state through BIOA.

130. The benefits of organic agriculture is of relevance to both developed [environmental protection, biodiversity enhancement, reduced energy use and CO2 emission] as well as developing countries. [Sustainable resource use, increased crop yields without over-reliance on costly external inputs, protection of biodiversity]. There is definitely a surge in demand for organic food globally. So the customer demand is fuelling much interest in organic agriculture which has the potential to be on par with the conventional agriculture with respect to productivity of soils. Organic agriculture has come a long way from it being tied to the traditional low productivity agriculture initially, as the approach was a passive one with respect to not using synthetic chemicals and pesticides. It is now pro-active and knowledge intensive with definite inputs for nutrient and pest management. The certification bodies are playing a vital role in categorizing the inputs for organic farming. Nutrient management with microbial products for efficient composting, N and P supplementation and pest management with soft herbal products and biopesticides is increasing sought after. Dry microbial functional seed dressing is the need of the hour as a cost effective way to bring about improvement in root growth resulting in yield increase.New discoveries for understanding the natural silent wok-force i.e. microbes and other organisms for nutrient and pest management and effective use of organic methodologies will make this agriculture more and more lucrative for the farmer. As after all in organic agriculture the focus is on the health of the soil, farmer and customer. So in times to come the present and future of agriculture and the health of the society lies in “organic” methods only they are sustainable.

CREDIT FACILITIES

131. Credit is a critical input for the development of agriculture and allied activities. The key task is to ensure a convergence among credit availability, effective credit delivery system in keeping with adequate credit absorptive capacity of the farmer. Mere availability of credit does not ensure its productive use and increased production/value addition. This is more important in the case of small/ marginal farmer who is quite often left out because of the clout of the influential farmers.

132. Though over the years there has been a significant improvement in the availability of institutional credit in the agriculture sector in the state, it is still considered to be inadequate and inefficient. As a result, farmers in Bihar even now are heavily dependent on informal sources of credit at exorbitantly high rate of interest. The state of Bihar, which has a per capita income of Rs. 5,772 vis-à-vis national per capita income Rs. 23,222, is the poorest state of India. Out of the total braches of banks, 65% of the branches were in rural areas. Bank wise rural branches are--Commercial Banks 59.6 %, RRBs- 86.5 %, and Co-op Banks – 17.66 % of the total. There is a gross inadequate density of financial service access points in Bihar. Bihar has a total of 45,103 villages, this translates to one branch in every 13 villages based on the total branch estimates of 2006. This indicates that even to provide basic access to financial services this is clearly insufficient. **(Annexure-XXXIII)**

133. In addition to the low density of branch presence, there is the added issue of the nature of services provided by the banking system as a whole. The extreme poverty level of the state are reflected in the aggregate deposit base. The average deposit per individual is only Rs. 55,000 against the national average of Rs. 1,95,000. The situation of advances is even worse for Regional Rural Banks and Cooperative Banks where total amount of advances for the year 2005-06 is only Rs. 22,250 and 5,950 respectively. However, this trend is moving in a positive direction over the years. The Credit Deposit ratio in the state is also very poor as compared to the national average. In case of Commercial banks and Regional Rural Banks the CD Ratio in Bihar is 31 and 36 respectively. The performance of Primary Agricultural Credit Society (PACS) also reflects a similar state. While there are almost 6,000 PACS in Bihar only 19 % of them posted a profit in the year 2004-05 as compared to the national average of 43 %.

Credit Deposit Ratio as on March 31, 2006 (Percentage)

Banks	Bihar	National
Commercial Banks	31	70
Regional Rural Banks	36	54
Cooperative Banks	77	100
Total	**32**	**73**

134. Kisan Credit Card (KCC) is another important medium for increasing agricultural credit. At present, there are 1.04 crore landholdings in the State, but till 2005-06, only 14.5 lakh KCCs have been distributed against the target of 30.5 lakhs. To meet the target of crop loans of Rs.10042 crore in 2006-07, KCCs have to play a very important role. Although total disbursement under KCC has increased almost 2.5 times, from Rs. 342 crore in 2002- 03 to Rs. 815 crore in 2005-06, it still channels only a miniscule proportion of the total credit volume for crop loans.

135. In the area of micro-finance, more than 17,000 Self-Help Groups had been financed by banks upto 2005 through their priority lending schemes in 38 districts. The target for 2006-07 is to raise the number to 24,000 SHGs and advance Rs. 48 crore through the scheme. As on March 31,2007, a cumulative number of 72638 SHGs were credit linked to banks and the total credit flow to these SHGs worked out to Rs. 202.98 crore.

136. The flow of credit for agriculture in the state from the institutional sources from 2003-04 till 2005-06 **(Annexure XXXIV)** shows that total institutional credit in the agricultural sector in the state recorded an increase by almost 82 per cent over the period. The main reason for the improvement in agricultural credit disbursement in Bihar since 2003-04 may be attributed to the following developments:-

1. Kisan Credit Card package - effective instrument to the Commercial Banks and the RRBs to enter the crop loans segment
2. Million Shallow Tubewells Programme (MSTP) - a convenient platform for the CBs and the RRBs for increasing investment credit
3. Growing agriculture sector since the late 1990s supported financing for Farm Mechanization in Bihar.

137. Despite this improvement in absolute term, the availability of credit is far short of requirement. As mentioned in Economic Survey (2006-07), Government of Bihar, the agricultural credit need was estimated to be Rs. 11341.22 crore for Bihar in 2006-07. However, the credit target for agriculture set by banks for 2006-07 was only Rs 3732 crore which was much lower than the requirement. This gap between the target and actual disbursement of agricultural credit need to be narrowed down, so that agriculture does not suffer for want of credit, ceteris paribus, and no such unfortunate event like farmers' suicide and other misery may take place.

138. Some 83 percent of Bihar farmers operating around 41 per cent of the land own less than 1 ha. each. Even at the all India level, the share of Institutional credit during 2002 was only 61 per cent. Various surveys show that a majority of marginal farmers have no access to institutional credit and have to depend primarily on non institutional sources.

*- Household durables and purchase of land.
Source:- Sukhpal Singh & M.S Toor, Indian Journal of Agricultural Economics, Conference Number – Volume 60,No.3.

139. Appreciating this problem, Report of Dr. Sen Committee on Agriculture Production in Eastern India 1987, made a specific recommendation for a 'minikit' programme for the marginal and small farmers for the Eastern region. The idea is that the small/marginal farmers are given

free a small kit which contains the required quantity of seed, fertilizer and even pesticide for specific farm size along with instructions for use in local language. The programme was taken up earnestly by West Bengal for summer rice during late eighties and early nineties with very successful results. Under present Bihar conditions, introduction of this programme both for rice and wheat is recommended.

140. Commercial cultivation of medicinal and aromatic plants is already in vogue in the state of Bihar. Some of the important species include Periwinkle (Catharanthus), Gloriosa, Coleus, Phyllanthus, Aswagandha, annota, Citronella, Palmarosa and Geranium. A majority of these crops are being exported in bulk form. During X Plan, Medicinal and Aromatic plants received focus with the setting up of National Medicinal Plant Board and constituent State Medicinal Plant Boards.

141. Mushroom cultivation in Bihar is not very popular as yet. There are, however, scattered examples of individual entreprenures having achieved success and others are following them in and around Patna. Because of its profitability; particularly for landless and small marginal households, there is an urgent need to encourage its cultivation and marketing on commercial lines.

142. India produces a variety of silks called mulberry, ' tassar' 'muga' and 'eri' based on the feeding habit of the cocoons. Bihar is known for 'tassar' Silk produced in Bhagalpur area. This District offers great potential for silk development intervention through DIPP/VSE schemes which could provide the needed help. Since Bihar is more or less a new entrant, it should adopt the latest technology so as to be the leader in silk production. The producers will need technological, marketing and credit support.

CHAPTER - 7

REPLICATION OF SUCCESSFUL FARM PRACTICES

1. Hisar Experiment – Wheat Technology

143 During 2005 – 06, as much as 203 thousand hectares of land in Hisar district was brought under wheat cultivation. A total of 7.52 lakh metric tonnes of wheat at the rate of 37.04 quintals per hectare was produced. The challenge, therefore, was to increase wheat production so that the farmer rediscovers agriculture as a remunerative occupation and then continues to contribute to the central food pool. Scientists involved with the project pointed out that during the successive years wheat sowing was getting delayed due to a number of factors resulting in the wheat grains getting affected by the effects of the rise in the day temperature when they were just about maturing. As a result the grains remained shriveled and weak and even when it appeared that the crop was satisfactory, the end result fell much too short of the expectations. The State and farmer bodies decided to involve local communities and educate them about the issues like timely sowing, following a set cropping pattern, etc., For this a campaign was designed to involve rural schools as it was felt that most students in such schools are fully aware of the cycles of crops and boosting their knowledge about how and what to do to get maximum production. Nukkar Sabhas were held all over the district where panchayats were also involved. For the first time all the members of the village community were engaged in one way or another in educating the farmers about – the proper and timely application of technology to get increased yield from the fields. The result of the campaign was extremely encouraging. During the year 2006-07 a record 44.85 quintals of yield per hectare has been obtained. Same Experiment is being replicated in other wheat producing districts. [1]

2. Agriculture Extension Services[*] (Help line for Farmers in Barabanki District of Uttar Pradesh)

144. For the farmers in Barabanki district of Uttar Pradesh, the new helpline is the best thing to have happened in several years. The help line has been set up by private telecom player Airtel in partnership with the Indian Farmers Fertilisers Cooperative Ltd., (IFFCO). While a pilot project was launched on April 2 (2006) at the Danyalpur and Mubarakpur IFFCO Societies in Barabanki, the third helpline was set up in Sitapur district in May. When a farmer in Barabanki calls Lucknow, his query is registered and the call is routed to the IFFCO center in Delhi. Experts come up with

[1] The Tribune 6/6/07.

[*] Times of India, May 10, 2007.

the solution, which is then explained to the farmer through a customized voice message. The farmer does not have to pay long-distance charges. As part of the scheme, farmers get five free voice messages a day. The messages update farmers on mandi prices, weather forecast and fertiliser availability Similar helplines will be set up in other parts of eastern UP before the model is replicated across the country.

3. Farm Mechanisation

Micro-Management Mode (MMM) Scheme- Sirsa District, Haryana [*]

145. One of the major problem which stands in the way of the spread of mechanization is the inability of the small/marginal farmer to make an economic use of the machinery. To popularize mechanization, the Government of Haryana has introduced a modified Micro-Management Mode (**MMM**) scheme of Agricultural Mechanisation. MMM provides for subsidies and other benefits to farmers for farm mechanization. MMM was a failure initially as farmers viewed it with skepticism due to the cumbersome procedures that were required to be followed to avail benefits for mechanization of farms. Things improved after changes were made in the MMM, keeping in mind the practical difficulties to the farmers in 2006-07. This has led to the tremendous rise in adoption rate for this scheme among farmers. A study conducted by the Department of Agriculture in Sirsa district shows that just one little change has made Haryana farms more mechanized. The last few months have seen the sale of 217 straw reapers, 110 cotton seed drill and 102 tractor mounted spray pumps, indicating a sudden spurt in buying because of the small change. The study indicates that more and more farmers are now going in for farm mechanization under the MMM scheme. They are willing to adopt new technologies. We have realized that the farmer needs to be assured that he will be purchasing not only a quality assured product but also the sole beneficiary of the subsidy that has been offered to him by the government.

'Prevent Farmer Suicide' Mission – Pune, Maharashtra

146. Here we also quote the example of another simple religious minded person – a trader from Pune. He launched his own 'Prevent Farmer Suicide' Mission. He bought a tractor for Rs.50,000/- from the personal savings of his wife. His mission involves locating poorest of the poor farmers and ploughs their land free of cost. The farmer had to bear only the fuel cost and the driver's wages which came to Rs.150 a day. He has set simple rules for lending his tractor. The smaller the farm, the higher the priority. Special concessions are given to poor peasants; those who cannot afford to pay for the driver's fee, are trained and he pays for the driving school and license fees. So far, 50-odd small farmers from the area have benefited, resulting in nearly

[*] The Tribune

100 acres of fallow land getting transformed into cultivable land. Add to that another 50 acres elsewhere in Pune district and the results of this initiative becomes apparent.

147. The effort of this unique mission to cut down the cultivation cost of small farmers, certainly addresses the issue in right perspective. This pattern coupled with micro credit, if replicated across the country with the aid of government and private industry, can possibly go a long way towards improving the fate of agricultural families.

4. Agro-Processing Units

Punjab Model (Fruit & Vegetable Processing Plant at Hoshiarpur)

148. A fruit and vegetable processing plant at Hoshiarpur built at a cost of Rs.38 crore, is the only plant in the world, which can process all types of fruits and vegetables produced in India. The plant has the capability to switch from processing of one fruit to another within four hours. Meanwhile, the government's move to usher in contract farming in the state got a boost with 5,500 farmers opting for the scheme.

149. The government approved a blue print for setting up a network of agri-processing infrastructure on a scale capable of eventually turning the state into the biggest producer and exporter of processed fruit and vegetable products in the world. Under the scheme, farmers who lease out their land for setting up fruit orchids would get a lease amount of Rs, 8,000-12000 per acre with a 2 per cent hike every year. The owners of the land and the horticulture development council the organizers of the project - will have a 50-50 profits and risks sharing arrangement after five years. The land, with an established orchard, will be handed over to the farmer after 12 years if they so like. Otherwise they can continue with the existing arrangement. The orchid will have a life span of 30 years.

Maize Processing – Karnataka Experience

150. In 1995, a little known company, Ridhi Sidhi joined hands with farmers near Gokak in Karnataka, the largest corn growers in India, for direct supply and cut surplus costs to increase productivity. Soon, the Gokak unit became India's largest corn refining installation. There was no looking back thereafter. Today, his clinet list includes all major brands like Cadbury, Nestle and Perfetti for chocolate making concentrates. In addition, most pharma and paper majors buy starch from Riddhi Siddhhi to manufacture their product categories.

151. The company has surpassed the likes of Sayaji Industries and Anil Starch in terms of revenues. Another big moment for RSGB came when it acquired a functional biopolyment unit at Pondicherry from HLL in 2005 for a consideration of Rs.6.5 crore. Through the acquisition, the

company received an economical share of high-end starch, advanced R & D facilities and product technologies. By then the company's turnover was Rs.240 crore.. In 2006, Roquette Freres, a leading starch producer, picked up 14.95per cent stake in Riddhi Siddhi for Rs.31.7 crore. The deal helped the company get a much required global exposure. The $50 billion global starch industry is growing at close to 10 per cent year –on-year. The Indian starch industry pegged at Rs.15000-crore is growing at more than 30 per cent a year. Riddhi Siddhi contributes about a quarter of the Indian starch market.

5. Agriculture Credit

Rythu Mitra Groups (RMGs) In Andhra Pradesh

152. NABARD in partnership with the Andhra Pradesh State Government facilitated a pilot project for promotion and financing of Rythu Mitra Groups(RMGs) during 2004-05. RMGs brings out holistic development in the lives of small, marginal, and tenant farmers through collective action. RMGs besides accessing loans from banks are expected to serve as a conduit for technology transfer facilitates access to market information and market, assist in carrying out activities, etc. for its members. During 2005-06, 4437 RMGs were financed by 18 commercial banks, 9 RRBs and 9 DCCBs involving ground level credit flow of Rs. 28.11 crore. About 62,000 farmers have been assisted under the pilot project.

Joint Liability Group approach

153. A joint Liability Group (JLG) is an informal group comprising 4 to 10 individuals coming together for the purposes of availing bank loan either singly or through the group mechanism against a mutual guarantee. NABARD had piloted this project during 2004-05 in 8 states of the country through 13 RRBs. The JLG members offer an undertaking to the bank that enables them to avail loans. Unlike SHGs, which are more process oriented, the management of the JLG experiment with select banks have demonstrated that banking system can reach clients like tenant farmers, share croppers, oral lessees, farmers with small holdings without proper land records through the joint liability approach. As on March 2006, the participating banks promoted 870 JLGs and extended finance aggregating Rs.10,88 crore to 494 JLGs. Based on the successful experience NABARD has finalized the guidelines for mainstreaming the programme with commercial banks on an all-India basis.

6. Menthol in Barabanki (U.P)*

154. India is among the top producers of menthol in the world, with Barabanki district in neighbouring Uttar Pradesh leading the country in menthol farming. Barabanki district in

* Hindustan Times, 15 June, 2007.

neighbouring Uttar Pradesh leading the country in menthol farming. Realising that mint has remained neglected despite its export comprising almost 30 per cent of the total export of spices, Minister of State for Commerce has also announced setting up a mint park in Lucknow.

155. Till a couple of years ago Bihar was nowhere on india's menthol map, Begusarai has achieved the feat despite several odds. Defying the farming of traditional crops in the rest of the state, farmers in Begusarai have taken to large scale cultivation of menthol mint an aromatic commercial crop and a source of menthol oil, which is used in cosmetic and medicinal products. Little wonder then that the district is set to be known as the methol capital of the state. Barabanki's menthol cultivation is spread over 20,000 acres compared to only 8,000 acres in Begusarai. Hopefully, Begusarai will catch up with Barabanki in a few years. State Bank of India is extending credit to these farmers and is also working to provide buyers for the farmers. There are 200 farmers who have taken to menthol in Bakhri sub-division alone. This is no mean achievement given the odds. Bihar has neither a market nor a buyer for menthol oil. After extracting the oil in distillation plants set up by them, the farmers carry it 600 km away to Barabanki by booking the containers in trains from Barauni, and sell it for Rs.500-600 per litre. Barabanki houses an industry that makes menthol crystals and also has a mandi for the oil. Bihar also lacks an institute to educate the farmers on the cultivation of aromatic plants.

156. As per an estimate, farmers earn Rs.30,000-40,000 a year. It is this profit that is driving the farmers to go for menthol .The impact of commercial farming on the agrarian economy of the state is already visible in the region. Besides uplifting the economic status of farmers, it has affected the migration of labour in the region decreasing by at least 20 cent. Menthol is a labour intensive crop. Every day 20-25 labourer are needed on a small farm and during harvesting there is the need for at least 100 of them. The best part is that, it is grown during the lean agricultural season which in turn reduces the flight of labour.

7. Kund Horticulture Project-Rajasthan*

157. The Rajasthan government has envisaged a Rs. 22.43 crore Kund horticulture project for 358 common interest groups (CIG) across the state. The project, under the District Poverty Initiative Programme (DPIP), would benefit 3,120 below poverty line farmer families of Churu, Raigarh, Ratangarh, Sardarshahar, Sujangarh, Tara Nagar and Dungarpur districts. The project is targeted at poor farmers who have land but lack irrigation facilities. In Churu district itself, they plan to plant 2.5 lakh fruit bearing crops like amla, ber and karana interspersed with plants needing less irrigation like chana, aradu, moth and gwar in the gaps.

* Indian Express, 5 April, 2007.

158. According to estimates, a farmer would be able to earn Rs.3,000-5,000 per month after one year of implementation of the project and Rs.15,000-20,000 per month after three years of implementation. Under the programme, each CIG member would get a 30,000 litre water kund constructed on an acre of land. A plastic tank of 2,000 litre would be mounted 5-6 feet above the ground. The plastic tank would be filled with water through a mechanical hand pump, which would draw water from the kund. As many as 80 fruit-bearing plants and 30 shady plants like neem, ber, sheesham, etc., would be planted at a gap of 6 x 6 metres. These plants would be irrigated through a pipeline connected to the water tank due to gravity. A plant can get 10 litres of water in an hour through this scientific technique, which keeps a check on wastage of water and ensures equal distribution among plants. The construction of a tank is expected to cost Rs.42,000 while the total cost including training and barb wiring of the area works out to be Rs.70,122 per member. The project has shown good results in Churu district. The payback period is of 25 years and it is expected that this technique will not only reduce wastage of water, but increase the yield by optimizing irrigation facilities.

8. Azolla - An Alternative Feed for Cattle[**]

159. Fodder is an important requirement for cattle. Even if the animals are fed with commercial feeds from the market, fresh green grass or dry fodder availability greatly reduces the expenditure on commercial feeds. The success of a dairy plant depends largely on increasing milk production without escalation in feeding cost growing fodder grass is a good option. Another is azolla cultivation.

160. Azolla is a floating fern which resembles algae. It is rich in proteins, amino acids, vitamins and minerals. Experiments conducted by the Vivekananda Kendra – Natural Resources Development Project (VK-NARDEP), Kanyakumari district, Tamil Nadu have proved that the quantity and quality of milk yield of cattle went up when they were fed with azolla. Fresh azolla can be mixed with commercial feed in the ratio 1:1 or given directly to livestock. It was found that the milk production in cattle increased by 10-12 per cent when they were fed with azolla and there was 20-25 per cent saving on buying commercial feeds. Azolla can also be fed to poultry birds. It was observed that the birds grew faster and there was 10-12 per cent increase in their total body weight compared to the birds which were given only normal diet. The egg yolk increased and the egg shell colour became glossy in appearance. In addition the azolla bed acts as a rain harvesting station and live mulch for the fields. About 2 kg. of soil in the azolla bed is almost equal to about 1 kg.of commercial NPK fertilser after six months

[**] The Hindu, September 20, 2007.

9. Disaster Risk Insurance: Some International experiences

161. The world over, the concept of risk hedging frameworks has gained importance in the recent past. The examples for regions where the risk of natural disaster is calculated and hedged to a fair degree are in countries of **Peru** and **Vietnam**. The model developed for these geographies have been successful in using Insurance as an effective risk hedging mechanism. One interesting example is the Vietnam experience. Northern parts of Peru as well as the Mekong delta are flooded due to the effects of El Nino. Credit provisions are the most vulnerable in this situation due to increased default rates and higher liquidity risk (Skees and Barnett 2006)[2]. To reduce the risk of default due to natural hazard an index-based flood insurance product was developed and piloted in Vietnam by the national government in collaboration with the World Bank. The following are the important examples across the globe where Index based risk transfer mechanisms have been implemented in severely disaster prone geographies.

(i) **Vietnam: Early flooding in the Mekong Delta that is brought on by heavy rains upstream**. In Vietnam, past practices of debt forgiveness following natural disasters have become unsustainable and recent changes to banking regulations are likely to lead to responses more similar to those in Bihar. The use of correlations between variables likes natural phenomena and cultural helped in the development of the index (Barnett and Mahul 2007)[3] The target population are the agri-lenders and the contract payment structure involves linear payment rate based on levels of water exceeding 250 cm at the prime river station (Tan Chau) with back up measures from stations upstream.

(ii) **Peru: Catastrophic flooding in the northern regions brought on by El Niño.** Peru where severe credit rationing has emerged as a mechanism banks employ to limit their financial exposure to correlated risk. The target group is the government and the entry of a reinsurer has spelt the lowering of risk on part of the insurer. The model uses the ENSO data and correlates the losses for the agricultural produce. The government acts as the medium for the risk transfer and relief distribution.

(iii) **Mongolia: Catastrophic Risk Insurance against severe winter (*Dzud*).** An Index-based livestock insurance scheme that has hedged the risk of the rural people against the loss of livestock in times of extreme weather events like *dzud.* This approach uses the mortality rates based on species and geographical areas.

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[2] Skees, J. R., and B. J. Barnett. 2006. "Enhancing Micro Finance Using Index-Based Risk Transfer Products." *Agricultural Finance Review* 66: 235–250.

[3] Barnett, B. J. and O. Mahul. 2007. "Weather Index Insurance for Agriculture and Rural Areas in Lower Income Countries." *American Journal of Agricultural Economics,* in press.

CHAPTER - 8

MAJOR ISSUES RELATED TO AGRICULTURE SECTOR

162. Agriculture is the core competence of the state. However, agriculture has performed badly, declining in the early 1990s by 2 % per annum and growing by less than 1% per annum since 1994-95. Crop productivity trends have been below the Indian average for most crops and far below their potential yield, given Bihar's fertile land and abundant water resources.

163. The critical production constraint to rice-wheat production system in Bihar is delay in seedling raising and transplanting of rice, and late sowing of wheat due to dependence of rice nursery raising and transplanting on rain water or canal water (wherever available), and inadequate conjunctive use of ground water, canal water, and rain water. Even when a farmer owns a tube-well, he is reluctant to pump ground water for nursery raising and transplanting of rice because of excessive cost of pumping associated with the diesel engine operated pumping sets. Major production constraints are:

Low Seed Replacement Rate

164. Seeds of high yielding varieties have been critical in increasing crop production, Dwarfing gene of rice and wheat did wonders in the 60s as these varieties were short stature and could respond well to fertilizer, irrigation and other management practices. Development of hybrid varieties in many crops opened yet another opportunity to further increase crop production and productivity. Due to lack of assured supply of quality seed, crop productivity has suffered in the State.

Low Level of Fertilizer Use

165. Fertilizers are the critical input in modern agriculture. The present level of fertilizer application is not only inadequate but also far from its balanced use. The present level of fertilizer application in the State is 98 kg/ha whereas it is more than 175 kg/ha in Punjab and higher applications in other States.

Lack of Mechanization

166. In Punjab there are 68 tractors /1000 ha whereas it is only 17/1000 ha in Bihar. Lack of proper and adequate mechanization hinders timely completion of agronomic operations. Therefore, it is important to promote farm mechanization from the point of view of better and timely land preparation and cultivation practices.

Low Level of Credit Availability

167. Modern agriculture is capital intensive. Lack of institutional credit hinders the process of technology adoption. There are 104 lakh farm holdings whereas the number of Kisan Credit Card is only 20 lakh which is very low. A large number of farmers in Bihar are isolated from institutional credit sources. Even if some sources are available, the amount is inadequate and availability not in time. This constraints farmer's adoption of technological practices.

Small & Fragmented Holding

168. Land holdings in Bihar are predominantly marginal farms with a high level of fragmentation. Of all the holdings more than 90 percent are small and marginal farmers. Tiny and fragmented holdings play a deterrent to adoption of modern technology. This affects economy of scale as well in adoption of improved farm practices.

Diesel Based Irrigation which Increases the Cost of Production

169. Irrigation is mostly dependent on diesel operated tube wells. The high operational cost of diesel engine pump sets, forces the farmers to practice deficit irrigation of cereal crops. As a result, the yields of all crops are much lower than their potential yields.

Lack of Effective System for Transfer of Technology

170. Extension system as it exists now is very weak both structurally and in its capacity to absorb and disseminate modern technology. Since independence many extension systems have been tried but most of them ……over the long run. A rationalization of the system is therefore required. Another major lacuna has been inadequacy of research supported extension system. Agriculture University in Bihar has failed to develop and promote research which could support farm extension services.

Risk Arising out of the Flood & Drought

171. Agriculture in the State is prone to natural calamity. Whereas the North Bihar districts are affected by the recurrent flood the south Bihar districts are prone to lack of rainfall. Almost 41 percent of the geographical area of the State is flood prone. On the other hand 40 percent of the geographical area of the south Bihar is drought prone. This affects improved and modern farm practices and accelerated technology adoption leading to lower level of farm productivity and farmers income.

Rural Power Supply

172. Power generation and availability rates are the lowest in Bihar in the country. Compared to an all India average annual electricity consumption level of 334 kWh and 895 kWh of Punjab, the average per capita consumption of electricity in Bihar was only 55 kWh. All efforts are being made to help improve the power supply to rural Bihar.

Land Records, Tenancy and Reforms

173. The entire process of tenancy reforms in Bihar has been derailed-with consequent impact on agricultural stagnation and farmers' misery in terms of acute poverty. The process of obtaining records of ownership rights of land is a cumbersome process and is reported to involve very high transaction costs. Unrecorded oral tenancy is prevalent with very weak tenant security. Tenancy in Bihar overwhelmingly consists of leasing-in by small and marginal farmers. The computerization of land records, protection of tenancy and fixation of rent are of prime importance for development of agriculture sector in Bihar. Attention is now being paid towards these deficiencies.

Rural Infrastructure

174. Bihar's agricultural stagnation has been caused by por rural infrastructure connectivity. The total surface length of roads per lakh of population is only 43.89 Kms as opposed to national average of 151.27 Km (1999-2000). Although 32 percent of the villages in the State are connected by roads but due the lack of maintenance it is reported that most of the village roads provide only seasonal connectivity. This has been a matter of prime concern to the present government and attempts are being made to bring drastic improvements in rural infrastructure.

Lack of Procurement

175. Rice, Wheat procurement has largely been limited to a few states of the country. Public procurement in Bihar has remained very low over the decade-having implications for farmers' misery. The farmers of Bihar have to resort to distress sale in a season of plenty. Farmers are deprived of remunerative price for their produce. Therefore, the farmers of the State need to be assured to get a minimum assured price. Adequate procurement centers need to be opened. Also it is imperative that the procurement of Maize is made operative, as maize production has gained high momentum. Several districts of Bihar have shown best performance in increased maize production in recent years.

Inadequate Storage

176. There is a major inadequacy in storage facilities in Bihar. It is assessed that there is a need of 25 lakh MT storage capacity, whereas the created capacity is only 12 lakh MT. Besides, there

is a need of creating proper storage infrastructure at the primary level. Lack of storage capacity leads to huge losses (sometimes to the extent of 50%)-leading to erosion in farm income.

Inadequate Processing & Marketing:

177. Climatological and edaphical factors allow for cultivation of a variety of crops in Bihar. However, farmers get discouraged as they do not get adequate price for their produce. It is a common understanding that the comparative advantage in production is lost because of the inadequate marketing and processing facilities. In Maharashtra, 40% of the produce is used for processing whereas it is less than 2% in Bihar. This is due to poor marketing infrastructure in the State.

CHAPTER - 9

INTEGRATED AGRICULTURAL RISK MANAGEMENT

Need for Integrated Risk Management in Agriculture

178. Agriculture is the single largest private sector occupation in Bihar and can be considered the riskiest business. The vulnerability to income and consumption shocks makes it imperative to develop formal agricultural insurance mechanisms to cope with such risks. The traditional yield insurance schemes have failed in managing the risks of the poor farmers as evident from their historically high payouts and poor penetration rates. Such schemes like the erstwhile Comprehensive Crop Insurance Scheme (CCIS) which finally took the form of the present National Agricultural Insurance Scheme (NAIS) suffer from several deficiencies[4].

(i) The 'area approach' followed is based on the results of crop-cutting experiments where the insured farmers receives indemnity based upon the difference between the threshold yield and the yield of the crop-cutting experiments in their area. Since crop yields vary over a small area, situations exist in which farmers do not get compensated for their loss under the NAIS and farmers without insurable losses would receive payments.

(ii) Crop insurance is mandatory for farmers who take crop loans which dampens innovation. Farmers with adequate risk management capabilities should not be forced to purchase crop insurance in order to receive a loan. Problems are faced especially when the loan is paid up and there is a lack of understanding of the benefits of agricultural insurance which leads to a fall in the demand for insurance.

(iii) There are long delays in payment of claims to farmers due to the time-consuming crop-cutting experiments by the agriculture department which causes an erosion of income for farmers.

(iv) Physical verification of the losses proved to be very costly and often gave way to fraud as it allows for an opportunity of collusion for the assessor and the client. Hence moral hazard and adverse selection are inherent in the design. (**Annexure XXXV and XXXVI** show the performance of the NAIS in Bihar compared to other Indian states and an overview of its cumulative performance).

[4] The Agricultural Insurance Company of India Ltd's Varsha Bima and Weather Based Crop Insurance Scheme (WBCIS) aim at overcoming the problems with NAIS or the Rashtriya Krishi Bima Yojana (RKBY) which is mandatory for the loanee farmers. It is voluntary for the non-loanee farmers and reaching out the non-loanee farmers is a larger challenge, beyond the immediate need for product and process innovations.

In view of these deficiencies and the unsustainable role the State in subsidizing crop insurance which could crowd-out the role of the private sector, **index based weather insurance** models could be a more efficient means to deal with risks faced in agriculture.

179. Nearly 60% area under cultivation in Bihar is rain fed. The co-efficient of variation in annual rainfall during 1980-81 to 2002-03 was 32 per cent. The monsoons play a critical role in sub-continent as it determines whether the harvest will be bountiful, average, or poor in a given year. About 49 percent of the states' total cropped area is irrigated, as against the national average of 40 percent. Nearly 76 percent of the net irrigated area in Zone-1, 85 percent of the net irrigated area in Zone-2 and 45 percent of the net irrigated area in Zone-3 have tube well as the source, while canal irrigation accounts for about 14 percent in Zone-1, 13 percent in zone-2 and 48 percent in Zone-3[5]. Farmers could purchase rainfall contracts and if the rainfall in an area varies from a pre-defined level, varying levels of payment would be compensated to the respective farmers based upon the level of shortfall of rainfall. This alternate approach as compared to the NAIS would be an effective in reducing moral hazard and transaction costs. Innovations in the form of Index-based weather insurance has come up in the past few years to explore possibilities of overcoming some of the deficiencies and are being improved on the basis of the feedback from product pilots.

180. The three main agro-climatic zones on the basis of soil characterization, rainfall, temperature, and terrain, North West Alluvial Plains (Zone – I) North East Alluvial Plains (Zone – II), South Bihar Alluvial Plains (Zone – III) have different average precipitation levels and the variations in weather phenomena are wide enough to substantiate the need for relevant interventions in the space of agri- risk management across the three zones.

Managing Production Risks and Price Risks

181. Given the status of agricultural risk management in the state, there is a need to focus on the critical areas of **Price risk** and **Production risk** management.

182. Production risks refer to the high variability of production outcomes due to the unpredictable nature of the weather, seasonal fluctuations, and pest infestation, diseases which result in yield loss and revenue loss for the farmer. Insurance can play a pivotal role in covering production risks which would help reduce the vulnerability of the farmers to economic losses. Developing appropriate products based on the needs of a particular geography to manage risks associated with agricultural production is the need of the hour.

183. Price Risk refers to the input and output price volatility which producers are exposed to as the markets for inputs and outputs in the agricultural sector is subject to instability. The fluctuations in

[5] Background Note from the 'Bihar Agricultural Development- A Roadmap'- A Report of the Special Task Force on Bihar, GOI, March 2007

price are largely owed to the seasonal fluctuations in demand, lack of information about market prices, lack of alternative market avenues, inability to hold tradable surpluses until the producer entails a better price, national policy level changes and volatility in the global market. This volatility in price, places producers in a precarious situation as they witness unforeseen losses due to fall in output prices or are faced with increased cost of cultivation due to higher input prices.

184. The large vulnerable groups like landless labourers and sharecroppers face a variety of risks which have a bearing on their steady flow of income and their ability to build income generating assets. The main risks identified for the population dependent on agriculture are; Price risks, Production risks, Institutional risks, Personal Risks, Enterprise Risk and Business Risks. Bihar is not an exception and these risks become ever more prominent given the importance of agriculture in the state and the gross linkages to livelihoods and industries.

185. Prices of agricultural commodities fluctuate widely from year to year.

- The co-efficient of variation in the farm harvest prices of paddy was as high as 45.4 per cent during 1980-81 to 2002-03. In the case of wheat, it was 44.9 per cent and in maize, it was 38.9 per cent.
- The coefficients of variation in the yields of rice, wheat and maize were 23.4, 16.4 and 30.3 per cent respectively.

Thus, crop farming in Bihar is not only unprofitable at present, but also unstable and risky. About 71 per cent of the variations in output were explained by variations in rainfall, irrigation and farm harvest prices

Since variability in the rainfall and farm harvest prices is high, the production process is quite risky. Along with low profitability, erratic rainfall and fluctuating market prices act as disincentives for the farmers to invest in modernization of agriculture.

186. In the absence of availability and access to formal risk management mechanisms in a rural environment, the asset poor households seek to manage risks through various informal strategies (diversify their crops, store grain, engage in informal savings and credit, favor traditional techniques over modern technology and enter into share-cropping arrangements). Informal risk management provides only a partial coverage in case of systemic losses, leaving poor producers vulnerable to extreme poverty, malnutrition and also dampens long term agricultural growth. There also seems to be a trade off between market based risk management solutions and public or State sponsored schemes. A more formalized management of Production Risk in agriculture necessitates a risk pooling mechanism like insurance whereas in Price Risk management, it is done by accessing commodity derivative markets.

Natural Hazards in Bihar

187. Given that more than 80%[6] of Bihar's population is dependent on agriculture and related activities and happens to be one of the most disaster prone state in India, role of risk financing in the context of hedging agricultural risk from climatic shocks becomes critical. It is imperative to develop sophisticated ways of market and government mechanisms for risk transfer. Pre- Disaster initiatives (ex ante) need to be given more impetus than Post- Disaster (ex post) Events. These initiatives aim to provide hitherto unforeseen resilience to the rural communities and also bring out transparency and efficiency to the whole effort.

188. The disaster profile of the state further compounds the situation. While the northern parts experience frequent floods, southern parts are affected by drought. The possibility of floods and the resultant state wide construction of flood control mechanisms like embankments have been the mandate of successive administrations[7]. However, these mechanisms have had mostly post-disaster safeguards and while the need for a pre-disaster (ex ante) has been long felt, there is little that has been done in this regard. In the recent past, within the space of disaster safeguards, there is a valuable shift in focus from only ex post to also include ex ante frameworks.

189. In the light of the above context, it is essential for the state machinery to develop a holistic risk hedging framework for the natural catastrophes affecting households' dependant on agriculture and related activities.

Risk Transfer for Natural Disasters – Administration's Mandate

190. Ushering in a paradigm shift, the Government of India has invested in disaster mitigation and preparedness strategies like Early Warning Systems. However, Public Financing is not always sufficient for relief measures.

- The assistance amount demanded by states during the period 1995-98 was around Rs.24,000 Crores, while the total corpus was barely Rs.700 Crores[8]
- Similarly, during 1998-2002, the states sought assistance of Rs. 60,000 crores, while the amount released through NFCR and NCCF was just Rs. 9000 Crores[9]

[6] Bihar Agriculture Note
[7] Ganga Flood Control Commission-GFCC
[8] http://www.indiastat.com
[9] ibid

191. In addition to a **Relief, Rehabilitation and Reconstruction** strategy, inclusion of risk transfer mechanisms could build substantial efficiency to the disaster management strategy for severe, low probability events. We expect the risk transfer mechanisms to bring in the following efficiencies:

(i) Improvement in response time to disaster relief payouts

(ii) Efficient Ex-ante (Pre-Disaster) Financing complementing the corpus fund drawn from public finances

(iii) Efficient and greater transparency in targeting of relief for people affected by calamities like floods or droughts

192. Such a product delivery would require technical demonstration of the feasibility of quantifying flood risk, through geophysical and statistical modeling. Mapping using geo-information technology and remote sensing is essential for development of the natural hazard risk insurance and also helps demonstrate how this risk can be transferred through insurance. Also, identification of the Below Poverty Line Communities and their exposure to the risk would help in developing a transparent pre-defined index based risk management product.

193. The risk transfer design could also include operational aspects of relief and rehabilitation. For example, the flood risk hedging could be designed such that flood relief & rehabilitation operations would be carried out by Village Disaster Preparedness Committees (VDPCs) who are closer to the community.

194. This infrastructure has multiple utilities - the mapping and targeting activities if done in an effective manner would help in timely delivery of relief, ensuring efficient targeting. Rehabilitation activities could be done more effectively through this operational design of the risk transfer.

195. Also, the availability of the risk transfer mechanisms would help in proper infrastructure and reconstruction for disaster affected geographies. For example, an earthquake causes huge losses to property supporting economies dependant on agriculture, livestock or fishery. The higher the losses, the concomitant payouts are higher. So, the insurers have an incentive to spend more on investing in building earthquake-resistant structures.

196. Although traditional insurance mechanisms are in place throughout the country, some risks are too large to be easily mitigated or self-insured at the farm/household level. When insurance services are available to transfer such non-diversifiable risks, farmers are able to avoid other more costly risk management strategies and have resources available to recover should the

insured event occur without the need to liquidate productive resources for consumption smoothing. (Dercon, 2005[10]; Zimmerman and Carter, 2003[11]).

197. Also, designing and implementing a risk transfer mechanism for individuals for 'extreme weather' events would involve operational challenges in the nature of huge transaction and administration costs for settlement of claims. Also, considering the lower probability of such events, individual households ignore the need of hedging for such low probability events. In contrast, delivering to aggregators substantially cuts down on the transaction cost.

198. The above are some of the reasons which justify the aggregation of systemic 'extreme weather' risk cover at the state level. As a pilot this aggregation could be done at Local Government level.

Inferences for Agricultural Risk Initiatives

199. With adequate provision of well designed production and price risk management products and systems, the existing gaps can be reduced and higher sustainability needs be induced consequent upon the following facts[12] :

(i) The rice wheat cropping system occupies more than 70% of the gross cropped area but productivity has remained low despite favorable soil, water and climatic conditions.

(ii) This decline in the productivity is basically due to replacement of upland rice by higher income generating crops like pulses, oilseeds & maize.

(iii) Wheat production in the state is suffering with the problems of delayed sowing, increase in cost of production due to rise in cost of petroleum oil, lack of small duration varieties which can be appropriately tailored into rice-wheat system and aberrations in weather conditions.

(iv) The yield per hectare of maize and pulses are however higher than the all-India average. Production of maize is also very good and Bihar is one of the leading states in Maize production. Maize has multiple uses viz. baby corn, sweet corn, pop corn and green corn. These different varieties are commercially very profitable. Maize is called the industrial crop of 21st century due to versatility in its use. This crop is now replacing upland rice in Kharif season and wheat in Rabi season.

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[10] Dercon, S., ed. 2005. "Risk, Insurance, and Poverty: A Review." Chapter 1 in *Insurance against Poverty.* Oxford: Oxford University Press.

[11] Zimmerman, F. J., and M. R. Carter. 2003. "Asset Smoothing, Consumption Smoothing, and the Reproduction in Inequality under Risk and Subsistence Constraints." *Journal of Development Economics* 71:233–260.

[12] *ibid*

(v) The Sugar industry is the largest agro based industry in Bihar. It generates considerable employment in the farm sector directly as well as through ancillary industries and related activities. According to the estimates of 2006-07 the area under sugarcane cultivation is 117.2 thousand hectares, production accounts for 5338.8 thousand tones and productivity is 45552 kg/ha against the national average of 70469 kg/ha. Bihar has the lowest sugar recovery rate in the country at 9% against the national average of 10.36%.

(vi) The potential of commercial horticulture and Apiculture are also huge

Additional Avenues to Insure farm incomes:

(i) As identified in the background document, given the role of livestock and fisheries as a potential livelihood transforming avenue, there is an urgent need to develop innovative productivity and life insurance covers in these sectors.

(ii) Given the huge gaps in credit requirements and actual disbursements, an effort in delivering the developed insurance products through the channels of Self-Help Groups (SHGs), Farmer Clubs (FCs), ATMAs, extension system and other distribution channels in the rural markets of the state.

200. Even if there is potential for raising the yield level in Bihar, low productivity and low profitability would stand in the way of realizing such potential. Unless paddy and wheat cultivation in Bihar is made profitable, farmers may not be induced to invest in land improvement measures for productivity growth and the much desired acreage shift towards paddy and wheat in Bihar at the expense of area loss in Punjab and Haryana may not be forthcoming. Even maize does not seem to be a very promising crop in this regard. With around 90 per cent of small/ marginal farmers, marketable surplus is not expected to be very high All the same market arrival of rice and wheat are of the order of 20-25 per cent. But the quantity procured is rather negligible. This serves as one of the biggest disincentive for higher production of major commodities in the state. Since the plan envisages much higher level of production. In a situation like this, there is a need for improvement in the marketing system, density of markets, connectivity of the markets within the producing areas, dissemination of market intelligence and institutional arrangement for procurement of the produce which come to the market. Add insurance and risk management to this and it indeed becomes a win-win strategy for the development of agriculture and for sustaining the livelihoods of the farmers of Bihar.

CHAPTER-10

DEVELOPMENTAL STRATEGIES, POLICIES & INSTITUTIONAL DIRECTIONS

201. Given the low average yields of most commodities, the huge gaps between the demonstrated and generally realized yields, the low farmers' income and widespread rural poverty on one hand, and the richness of the natural resources and the socio-political expediency to liberate the people of Bihar from the poverty and hunger trap on the other hand, a focused strategy and policy direction needs to be adopted on a priority basis. A holistic system based approach, is therefore, needed to simultaneously enhance productivity, profitability, equity and environmental sustainability through synergistically integrating crop, horticulture, livestock, fisheries, agro forestry, watershed-based soil and water management, social capital formation, agro-processing and marketing infrastructure.

202. The core of the new strategy would be to address problems crop wise and area wise. The focus in the proposed strategy would be primarily two fold: (i) how Bihar to emerge as granary of India, and (ii) how Bihar emerge as a major hub for both national and international hub for horticultural products and fisheries for both national and international market. It is also realised that in the light of geophysical characteristics, there should be a distinct development strategy for flood-prone and draught-prone areas of Bihar.

Following basic strategies and policy directions are proposed for agriculture and allied sector.

A. Strategy for Crop Husbandry

Adoption of Crop-wise Strategy

203. In order to emerge as 'Granary' of India, to provide balanced nutrition to the rising population and also to generate sufficient surplus for agro-based industries, food grain production growth rate of 5-6 % has to be attained in next 10 years. Present level of food grain production of 119 lakh MT will increase to 195 lakh MT at the turn of the year 2015.Major part of the increase in food grain production will come from maize, rice and pulses. Rice, pulses & maize being the thrust crop, area specific and crop specific strategies will be adopted. Crop wise strategies as proposed are as follows:

Strategy for Rice:

204. The state has about 3.2 million ha under rice cultivation, which is mostly rainfed covering both uplands and shallow lowland ecosystems. The area has decreased from 3.66 to 3.22 million

ha during the last six years. The state average productivity is about 1 tonne/ha. The State's average per hectare productivity potential is in the range of 5-6 tonnes.The major constraints in production are flash floods and submergence, drought in uplands, zinc deficiency and bacterial blight. Appropriate technological interventions and strategies are:

(i) Cultivation of short duration and drought tolerant varieties Vandana, Tulasi, Rajashree.

(ii) Cultivation of varieties like ARRH 2 , DRRH 2 in normal situation and Rajendra Mahsuri, Rajendra Sweta and Swarna in flood prone and submergence areas.

(iii) Cultivation of bacterial blight resistant varieties such as Ajaya,IR 64.

(iv) Application of zinc sulphate in zinc-deficient areas.

(v) Propagation of system of rice intensification (SRI) Technology.

(vi) Propagation of hybrid varieties.

(vii) Propagation of Boro rice in the non rainy season as the productivity is very high due to absence of disease, pests and weeds, but it requires committed irrigation. Further, it should also be supported by Strong seed programme and fine/scented variety for raising income.

(viii) Propagation of Replacement of long duration varieties with short and medium duration varieties.

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Strategy for Wheat:

205. Bihar is potentially an important wheat growing state that contributes 5.7% towards national production from 8% of wheat growing area of the country with a low productivity of 1.9 tonnes/ha. The yield gap between farmers' fields and frontline demonstration is about 1.2 tonnes/ ha. The area, production and productivity, averaged over last five years are 2.1 million ha, 4 million tonnes and 1.9 tonnes/ha, respectively. The average per hectare productivity of Wheat can be around 4-5 tonnes by adoption of technological means. Bihar possesses high potential for it in the light of favourable geo-climatic and soil conditions. The major constraints in production are low seed replacement rates, late sowing, low farm mechanization and foliar blight disease. Suitable technological interventions are:

(i) Timely sowing and harvesting

(ii) Development of short and medium duration varieties

(iii) Site specific nutrient management.

(iv) Mechanization (Combine Harvesting & Zero Tillage Sowing).

(v) Growing salinity/alkalinity tolerant varieties KRL 19 and KRL 1.

(vi) Resource conservation technologies such as zero tillage, FIRBS and laser land levelling

(vii) Use of improved varieties like:
Irrigated timely sown: K 0307, HD 2824, HD 2733, HP 1761, PBW443, HUW 468, K9107, NW 1012.
Irrigated !ate sown: *DBW* 14, NW 2036, HW 2045, NW 1014, HD 643, HP 1744
Rainfed timely sown: K 8962, K 8027, MACS 6145, HD 2888

Strategy for Maize:

206. Maize occupies 6.49 lakh ha with production of 13.60 lakh tonnes and productivity of 2.1 tonnes /ha. Winter maize is popular in Bihar due to its high yield potential, and the area, predominantly under hybrid cultivation, is on increase. The productivity of winter maize decreased from 3,094 kg/ha in 2004-05 to 2,641 kg/ha in. 2005-06. The low productivity is mainly due to non—availability of adequate quantity of seeds of high-yielding hybrids. During *kharif,* maize suffers from water logging and floods, while in autumn, crop suffers from moisture stress. In the frontline demonstrations, average productivity of 6 tonnes/ha has been realised, with levels up to 8 tonnes/ha also recorded in farmers' fields. In view of this, proposed interventions for enhancing productivity are:

(i) Seed production of QPM hybrids within the state

(ii) Cultivation of QPM hybrids HQPM-1,Shaktiman-1,Shaktiman-2 and Shaktiman-3, Shaktiman 4; and normal grain single cross hybrids DHM 115, JH 3851, Prakash, HM 5; and HM 4 for baby corn.

(iii) Winter maize as a better alternative to wheat under rice-wheat system due to rising temperature

(iv) Intercropping with potato, pea (for green pod) and vegetables in winter maize for additional income of Rs 6,000—12,000 per ha.

(v) Promotion of maize based processing industry (animal feed, corn oil, starch, ethanol etc).

Strategy for Pulses:

207. Bihar can play a major role in meeting India's shortage in pulses.Its productivity in the state is greater than All-India average. In the year 2006-07 , in case of Bihar it was 901 kg/ha while in case of India it was 473 kg/ha. Following strategies are proposed to further enhance its productivity.

(i) Large rice fallow areas can be brought under Urad , Moong and other pulses in order to increase farmers' income.

(ii) Popularization of High yielding varieties supported by strong seed programme

(ii) Rehabilitation of gram in Agro-climatic Zone-I after harvest of medium and late rice

(iv) Use of bio-fertilizer including Rhizobium.

(v) Improving farm drainage to mitigate problem of water logging

Strategy for Rapeseed-Mustard:

208. Cooking oil is one of the major components in Indian dietary system. Unfortunately this has been in shortage. Fortunately, Bihar is in a position to supplement this shortage if proper strategy is adopted. Currently, the acreage under rapeseed-mustard in Bihar did not vary much during last five years. Area, production and productivity in Bihar presently are 0.82 lakh ha, 0.76 lakh tonnes and 926 kg/ha, respectively. The major constraints in production are use of traditional varieties, inadequate moisture availability at sowing and late sowing of mustard particularly in rice-fallow areas, broadcasting method of sowing and use of high seed rate, and aphid, Bihar hairy caterpillar, *Alternaria* blight, white rust and downy mildew. These issues could be tackled by suitable interventions. This would include:

(i) Use of improved varieties of Indian mustard:

Early/timely sown: Sej 2, Pusa Mahak and Pusa Bold;

Late sown: Rajendra Rai Pichheti, Rajendra Anukool, Ashirvad; Toria: RAUTS 17, Panchali; and Yellow Sarson: Rajendra Sarson 1, Ragini, Benoy

(ii) Moisture conservation strategy and rainwater harvesting to ensure irrigation

(iii) Plant protection measures for controlling *Alternaria* blight, Bihar hairy caterpillar and aphid

(iv) Production enhances by apiary boxes in mustard fields

(v) Bee-keeping as pollinizer and also for additional income

(vi) Use of filler crops such as guava and custard apple and leguminous vegetables, turmeric, elephant foot yam as intercrop

(vii) High density planting (200-225 plants/ha)

Optimum Dates of Nursery Raising & Transplanting of Rice, and Sowing of Wheat and other Rabi Crops

209. Traditionally, rice was cultivated in high rainfall areas where water was abundantly available. In regions receiving 800 mm to 1200 mm rainfall, short duration rice was cultivated in midlands and long duration rice only in low lands. Even though the farmers did not develop water resources for regular irrigation of the rice crop, they did utilize accumulated run off water in ponds, lakes, rivulets, or any other local depressions for irrigating the rice fields either for field preparation or to protect the crop from withering during prolonged dry spells. The income associated with the adoption of high yielding rice cultivars encouraged the farmers to cultivate rice in low to medium rainfall areas having assured irrigation supply. Thus, with the development of water resources for irrigation, rice cultivation spread to medium to low rainfall areas as well. However, high yields of rice could be obtained only by eliminating moisture stress through assured irrigation and better utilization of rain water.

Efficient use of Modern Inputs

210. An efficient and optimum use of modern inputs like quality seeds, chemical fertilizers and other macro and micro nutrients, is the key to productivity improvement on sustainable basis. Therefore, farmers should be enabled to access and use modern farm inputs in an optimal and efficient manner. A mini kit programme is recommended for small and marginal farmers to enable them to increase productivity levels through the use of modern quality inputs. Government can take advantage of available funds under Food Security Mission and procure quality HYV seeds for wheat, hybrid rice and maize for this purpose. The services of progressive farmers may be used to produce quality seeds and also delivery services for the supply of other inputs should be strengthened. Rural credit is another grey area. Small/ marginal farmers are invariably deprived of institutional credit – it is only 29 per cent of total agricultural credit. All possible efforts should be made to provide the required inputs directly under mini kit programme. Linkages with SHG is another successful approach

Popularization of Multi Crop Zero-till Seed drills

211. The Zero-till Seed drills , developed at Pantnagar in 1990s, is being produced by several manufacturers and is getting inducted in rice based cropping system for seeding wheat and other winter (Rabi) crops. As the farmers are accustomed to sow wheat in highly pulverized fields, some times they prefer the use of zero-till seed drill for seeding wheat after one or two tilling by cultivator or country plough. As the soils of harvested rice fields in eastern India contain high moisture, zero tillage technology for sowing wheat, lentil and oil seed crops has been found highly useful in timely seeding, reducing the cost of production, and increasing the crop yields. The tractor owners, however, discourage the use of this machine in order to increase the operating hours of their tractors and the associated benefit from it. There is a need to enhance the pace of adoption of the multi crop zero till seed drill by organizing large scale demonstrations and increasing the sale by subsidizing the cost of the machine.

Intensive Training to Farmers about Modern Crop Production Technologies

212. Scientists from the Department of Agriculture, Krishi Vigyan Kendras, State Agricultural Universities, and ICAR Institutes should be engaged to impart training to farmers in their villages on modern crop production technologies. Retired scientists may also be engaged on this venture. Some specific educational programmes are listed below:

(i) Training to farmers about improved rice production technology including cultivars, seed rate, nursery raising, and plant population at the time of transplanting, field preparation, and balanced use of fertilizers, optimum water regime, and weed and pest management.

(ii) Training to farmers about improved wheat, maize, pulses, oilseeds, and other Rabi crop production technologies including cultivars, and nutrient, weed, water, and pest management.

(iii) Training and demonstration about seed production technologies of different crops.

(iv) Educating farmers about the use of low energy water application (LEWA) and other pressurized irrigation equipment.

(v) Educating farmers about the use of zero till seed drills, planters, reapers, and threshers.

(vi) Training about grain storage systems and value additions.

(vii) Demonstrations of improved Rice, Wheat, Lentil, Bengal Gram, Potato, and vegetable production technologies.

Management of Natural Resources

213. The state has 5.71 million ha of cultivated area, of which 3.43 million ha (61%) has assured irrigation. The soils are deep alluvial, but suffer due to salinity/alkalinity and nutrient deficiencies of sulphur, boron and zinc Occasional flooding and imperfect drainage affect crop growth. Rice, wheat and winter maize are predominant crops of the state. The productivity of different crops in the state is less than the national average. The total food grains production is 7,7 million tonnes. Suggested interventions for natural resource management for agriculture in the state are as follows:

(i) Site-specific nutrient management on 0.5 million ha to produce additional 2.6 million tonnes of food grains

(ii) Introduction of pulses and oilseeds on rice fallows with supplementary irrigation facility

(iii) Zero tillage on 1.5 million ha having excess soil moisture after rice harvest to enhance production by 0.45 million tonnes

(iv) Promotion of quality protein maize having tremendous food and feed potential.

B. Managing Risk: Agriculture and Natural Disaster

(i) Need to develop robust decision support systems and agriculture advisory services

214. With adequate dissemination of weather and price information, it would be possible for small farmers to decide *a priori* on:

(a) The crop to cultivate in a particular season

(b) The price hedging mechanism which would be best suited for the product

(c) The credit or investment required for the growing, holding or transporting the 'right' crop.

215. There is need to develop and deliver bundled risk management solution for small and marginal farmers to hedge through futures trading and production risk management by way of index based insurance in line with the focus on providing Comprehensive Risk Management for vulnerable groups. There is a need to engage in pilot projects to understand the following:

(a) The best channel/medium and infrastructure required to convey the need for a Decision Support System for price risk hedging among poor producers.

(b) The role of formal price risk and weather risk hedging services like National Commodities Derivatives Exchange (NCDEX) in hedging against price risks of small and marginal farmers.

(c) The most efficient mechanism in providing formal production risk hedging mechanisms (index based insurance). The weather insurance being a cover for covariant weather shocks and not idiosyncratic household risks specific to the farmer.

(d) The provision of price risk products through a 'Decision Support System' coupled with an insurance cover could prove to be an ideal risk management strategy for poor households. There is a need to discover the feasibility of its delivery and also quantify the economic benefits to a poor household.

(ii) Need to develop innovative weather risk management products[13] (insurance and derivatives) and price risk management products (commodity futures)

216. As evident from the comparative scenarios described below, integrating Weather Risk Management and Price Risk Management strategies into the scheme of strategies developed for the development of agriculture in the state, provides the much needed cover against the evident risks of weather and price fluctuations and also becomes an incentive for farmers to graduate to more profitable and risky ventures that assure higher returns.

In a scenario without Risk Management:

Optimum Inputs + Better Farm Management and Sustainable Agricultural Practices + Optimum use of technology + Better Storage, Processing and Marketing Infrastructure + Natural Resource Management + Optimum Credit + Crop specific recommended strategies **+ Weather Risk + Price Risk = Risk of Yield loss + Uncertain Cash flows in future**

In a scenario with Risk Management:

Optimum Inputs + Better Farm Management and Sustainable Agricultural Practices + Optimum use of technology + Better Storage, Processing and Marketing Infrastructure + Natural Resource Management + Optimum Credit + Crop specific recommended strategies **+ Weather Insurance/ Weather Derivative Contract + Commodity Futures = Cover for losses due to Yield Loss + Cover for losses due to fall in Prices**

(iii) Need to invest in weather infrastructure

217. There is a need for investment in installing Automatic Weather Stations (AWS) and setting up a network/grid of weather sensors to generate the much needed weather data for the state and develop monitoring systems to accentuate the design of index based weather insurance as well as decision support systems or agriculture advisory services. (The low density of the existing IMD (India Meteorological Department, the unreliable revenue department rain gauges and lack of transparent and updated weather data across multiple parameters like precipitation, relative humidity, temperature etc. is a major constraint in developing reliable weather insurance products.)

(iv) Need to factor Disaster Risk into the broad development paradigm

218. With the increasing frequency and severity of floods in Bihar, emerging risk transfer mechanisms will complement the risk reduction strategies of the Government. There is a definite

[13] ICICI Lombard and the Commodity Risk Management Group (CRMG) at the World Bank developed the first index based deficit rainfall insurance in the pilot project at the district of Mahboobnagar in Andhra Pradesh in 2003 and since then it has been scaled up as a sustainable rainfall insurance cover across many Indian states.

need for factoring in the Risk from natural disasters in to the development policies of the government.

(v) Insurance as a Risk Hedging Mechanism

219. The risk transfer mechanism (insurance) product is part of risk transfer for floods although not being a risk reduction tool; it is bound to complement the risk reduction strategies. The insurance product is a financing mechanism and is not a mechanism to build any physical infrastructures that would help in risk reduction. But the financing mechanism, if implemented properly would lead to building of proper physical infrastructure that would help in mitigating floods.

(vi) Need for Public Investment in Disaster Infrastructure

220. Government is the biggest player who can invest in this infrastructure. Additional investment will help the government in ex-post measures for flood risk reduction. Public Partnership models need to be focused upon and developed for long term strategic development.

C. Strategy for Sustainable Organic Agriculture

(i) Branding the default organic systems to Certified Organic having potential for domestic or export markets. This can be done at the government expense through APEDA. This can attract buyers for exports of its horticultural or crop produce. Mission mode approach to brand the Organic Brand from Bihar [trademark] for Litchi, mango, banana vegetables, makhana etc for urban domestic and export markets. Proper representation at domestic and foreign Organic Trade Shows should be immediately initiated and nurtured

(ii) A rapid action plan for converting the flood prone districts to aquaculture through infrastructural development through private or contract farming operations. Functional clusters to be routed for processing operations for bulk marketing. Farm facilitators [NGO's or GO] can help to tie-up between the farmer clusters and the processor and subsequent exporter.

(iii) Bihar Institute of Organic Agriculture [BIOA] can be set up in the state for training, certification, transferring technologies related to production, packaging, processing and marketing. It may have a PPP for setting up a value chain. BIOA board should have participation of KVK's, Agricultural Universities, APEDA, DOA and executives of certifying agencies.

(iv) BIOA should advocate package of practices for organic cultivation with technical help from Universities. The information should be made easily available to farmers by way of demonstration farms, training programs at Farmer's Field day and audio visual aids. Promoting exposure visits of Bihar to other developed area.

(v) The program to set up soil testing laboratories can be mediated for developing Farm Facilitators through DOA and BIOA. These will further strengthen the development of semi-commercial inputs like compost brews, herbal extracts, parasitoids, predators etc. State level network project through video conferencing can take technology to the farmer's door-step. Soil testing labs to be up-graded to test the residues of pesticides at district level. Block level farmer information and advisory centers being promoted under ATMA can be effectively linked to TOT prospects.

(vi) Low cost microbial seed dressing can be made compulsory on the lines of "Immunization to child" equivalent to "immunization for the seed".

(vii) Methods which destroy the much valuable soil organic matter like burning rice straw and sugarcane trash to be banned. Plough down approach together with economical "No-till" methods should be tested for feasibility.

(viii) Soil Health Cards should be distributed to each farmer involving village panchayats.. Bi-annual soil testing should be made compulsory for village level documentation at a subsidized rate through soil testing laboratories.

(ix) A functional interactive website of making total information available about the buyer meeting the producer cluster should be done for developing confidence for adding value to the market chain.

(x) Private entrepreneurs can be invited to set-up factories for manufacturing inputs for organic agriculture [biofertilizers, biopesticides, mechanized compost machines etc] processing of organic produce [post harvest] etc.

D. Strategy for Horticulture

221. An analysis of horticulture production in Bihar reveals that potential for significant increase in the horticulture production requires investments in all spheres– from institutional to crop management practices. The average fertilizer consumption and seed replacement rate in the state is much below the national average, A marginal increase in fertilizer usage, seed replacement rate along with other inputs and technology back up can boost the yield levels significantly in

almost all the crops. The horticulture in the state of Bihar can be characterized continue to be subsistence cultivation leading to low productivity. Science and technologies in absence of human resource development is much below the national level. Poor institutional support, lack of infrastructure and credit support are some of the constraints which have hampered the technology –led development, although ample opportunity exists.

222. In order to harness the potentiality, horticulture development has to be taken up in mission mode addressing all the links in the chain of production to consumption. Government of India has addressed the development of horticulture through the National Horticulture Mission, with high investment, which is being implemented in the state. Government of Bihar has extended this scheme to other districts which are not covered under the National Horticulture Mission.

223. Proposed strategies and directions for Development of Horticulture are as follows:

Area Expansion/ Crop Diversification under Horticultural Crops

(i) Cluster approach should be adopted for the area expansion. The area under the crop should be increased in near by area of the existing cultivation of these crops which will generate more marketable surplus and will provide economy of scale in marketing of these produce.

(ii) The new orchard should be developed adopting latest technique of high density planting for the better productivity.

(iii) Awareness building through extension and information dissemination on crop possibilities and market demand. The State Horticulture extension machinery as well as private sector extension can play a role in this venture.

(iv) Availability of seed of improved varieties and quality planting material like grafts, air layers, seedlings, micro-propagules needs to be increased for orchard development both through the Govt. machinery as well as through private sector participation.

(v) The choice of crops and varieties should be as per market demand and to the needs of the processing units and exporters

(vi) Technical support services should be made available at the doorstep of farmers to ensure adoption of appropriate crop production and post harvest technologies.

Productivity Enhancement of Horticultural Crops

(i) Improvement in Seed Replacement Rates in annual crops

(ii) Providing better plant nutrition by adopting IPNM strategies for the horticultural crops

(iii) Adoption of IPM and IDM strategies for the management of insect, pest and diseases can play a big role in improving productivity of horticultural crops.

(iv) Adoption of modern agro- techniques of horticulture production is also required.

(v) Demonstrations of modern technologies on farmer's field will help the farmers in understating them in better way and their adoption.

(vi) Rejuvenations of old orchards in fruit crop is required to improve the productivity of existing orchards.

Providing Impetus to Fruit and Vegetable Processing

224. The processing of fruits and vegetables needs much attention. The produce is mostly marketed fresh with negligible processing and value addition. Only a handful of processing facilities and that too mainly in fruits—litchi and mangoes—are present and operational. The most critical interventions need to be in the post-harvest management, aimed at reducing wastages and provide better returns and thereby facilitate increased production of fruits and vegetables for Bihar to become the food hub of the country. It is to be noted that post-harvest management and processing facilities are much more important for fruits and vegetables due to high perishability and thus higher wastage ratio.

(i) Post Harvest Management Infrastructure in the state needs to be improved by giving incentives to both the public and privates sector agencies.

(ii) Facilities for sorting / grading / packaging/ storage and transportation need to be promoted for the improvement in the supply chain, Development of collection centers and transportation from local markets requires to be improved.

(iii) A chain of cold storages and a network of reefer vans need to be promoted at all important centers in the cooperative/private/ public sector.

Interventions Required for Creation of Infrastructure

225. Investment and promoting creation of Infrastructure along the supply chain is the major strategy along with an integrated approach for backward and forward linkage to provide thrust to fruits and vegetable value addition chain.

Farm Level

226. Primary Processing Centre/Rural Agriculture Business Centre (RABCs) will have to play a crucial role in horticulture development. These centres will have facilities for pre-cooling, sorting, grading, cleaning, washing, packing and minimal processing along with provision of mobile pre-

cooling vans for transport of the produce from farm to the RABC and from RABC to retail/ processing units. These will act as rural enterprises centres and the hub for procurement for retail markets and processing units. These will help reduce wastages, improve quality, provide sorted materials for table and processing purposes and result in increased income to farmers. The RABCs, apart from being procurement hubs, will also provide related services to help fuel the growth in the region. It is proposed to establish 100 such RABCs. In the first phase 50 RABCs could be made operational in identified clusters in Muzaffarpur, Vaishali, Darbhanga, Champaran (East & West), Rohtas, Bhojpur, Nalanda, and Patna districts to followed by 25 RABCs in districts like Bhagalpur, Aurangabad, Nawada, Katihar, Purnea, Madhepura, Khagaria and Gaya, and another 25 in the rest of the state in third phase.

District/Division Level

227. **Integrated Food Zones/Mega Food Parks***:* In addition to the primary processing facilities, two integrated food zones/mega food parks are required in the state. These will be fully integrated facilities consisting of sorting/grading yards, state-of-art storage facilities including controlled atmosphere chambers, modified atmosphere chains, cold chain infrastructure to cater to the catchments areas including mobile pre-coolers, reefer vans, etc

227. **Makhana Processing***:* Cluster based interventions need to be undertaken to federate the existing small–unorganized household enterprises and develop common facilities centres including processing. Common facility centres may be created through a Special Purpose Vehicle (SPV) on a PPP basis to leverage technology and investments in the districts of Madhubani, Darbhanga and Saharsa.

State Level

228. Three major interventions are suggested at the state level:

(i) Need to support research on value added products within the processing units with strong focus on developing various value added products from state specific crops like litchi, mango, makhana, etc.

(ii) Promoting market linkage/brand building.

(iii) Strengthening of industry associations

Improvement in Marketing

(i) Since marketing is one of the primary constraining factors in promoting Horticulture, development of marketing infrastructure and market linkages needs to be given

priority. Development of market linkages through promotion of a chain of marketing operators viz. consolidators, traders, and commission agents is required.

(ii) Processors, exporters, super markets, retail chains like Reliance fresh, Wal-mart, ITC, Shubhiksha, etc. needs to be encouraged to set up their processing units, retail stores etc., and source their raw material through contract farming from the state. Their presence in the state will give a big boost to the holistic development of horticulture in the state. The contract farming arrangements will play a great role in supply of quality planting material, inputs, and provision of technical support services along with better market access for their produce.

Improvement in Human Resources

(i) Training of farmers and government field staff on improved cultivation practices and seed/planting material production; and

(ii) Training to rural youth in processing of the horticultural produce and setting up cottage industry in the rural area for fruits and vegetable processing.

Approaches for Development of Floriculture

229. The objectives of the floriculture development in Bihar are:

(i) Strengthening of model floriculture centres in the State with facilities of controlled conditions, post harvest management & training.

(ii) Training on latest technologies of flower production and post harvest management.

(iii) Strengthening of market information system through public sector.

Establishment of Floriculture Gardens

230. At present, the area under floriculture in Bihar is very less as compared to its potentiality. Hence, there is a great need to encourage the farmers to produce flowers in large quantity. Therefore, an innovative approach is required to bring certain areas under specified flowers like Marigold and Chrysanthemum. For promotion of floriculture in Bihar, following four districts can be selected: Patna, Nalanda, Bhagalpur and Siwan. These districts hold great potential for floriculture development.

E. Strategy for Animal Husbandry & Dairy

231. The primary objective of any planning in livestock should be to double the animal protein availability in about a decade and additional increase per year to support the increasing human

population. This can be achieved by using the sustainable production system while maintaining environmental and animal biodiversity. This will also be plank for sustainable rural employment and socio-economic upliftment in rural India. Therefore, the planning / programme should aim at the following at the following objective:

(i) To increase production of milk, egg, chicken and other animal food and increase animal protein in human diet.

(ii) To encourage livestock production through small holders with low input system as the main source of livestock development

(iii) To increase production of quality sheep, goat and poultry meat in the area.

(iv) To encourage conservation of animal bio diversity and protection of indigenous breeds of livestock and poultry.

(v) To augment feed and fodder resources for sustaining livestock for increasing production

(vi) To control and eradicate communicable diseases to increase health cover facilities for optimizing livestock production

Dairy Development, Cattle and Buffalo Breeding

(i) Based on the National Breeding Strategies, a set of breeding policy guidelines should be evolved by the Government. Our mechanism needs to be instituted at a State level to ensure that the breeding policies prescribed are strictly adhered to.

(ii) For semen stations to produce quality semen doses, they need to

  (a) maintain bulls that are obtained from the agencies carrying out genetic improvement programme;

  (b) ensure that all bulls are free from diseases as per OIE guidelines and

  (c) maintain high standards of quality control for processing of semen doses.

(iii) All semen stations need to follow the minimum standards laid down by Government of India.

(iv) A semen certification scheme needs to be introduced and administered to ensure that only certified semen is used in field AI.

(v) The Government must recognize that semen production and genetic improvement programme are highly specialized activities and therefore must ensure that these activities are managed by professionals having specialized skill and knowledge.

(vi) It is important to identify each and every breedable animal and create a data base on their breeding and production performance. As a strategy, each animal artificially inseminated be identified.

(vii) Professional breeding organizations should be encouraged to provide high quality breeding and advisory services to farmers at door step.

(viii) In order to avoid excessive in breeding, periodical import of germ plasm can be considered keeping safety regulations and trace ability in place so as not to introduce undesirable health hazards.

(ix) PFA standards in terms of requirement of minimum fat percentage in milk will be required. Compulsory analysis and recording of total protein and somatic cell count at milk collection points require to be considered.

Development of Small Ruminants

(i) Breeding of sheep and goats should aim at increasing body weight, reproductive efficiency and viability besides improvement in milk yield in goods.

(ii) Germ plasm stations either for AI or for distribution of maize should be set up for each indigenous as well as exotic breeds more in line with bovine semen and bull stations.

(iii) The emphasis in small ruminants should be to improve nutrition, breeding and health cover.

(iv) Financial support for production of nucleus flock for each breed.

Animal Nutrition

(i) Production of densified feed blocks for transporting crop residues from surplus to deficit areas and setting up fodder bank.

(ii) Use of by pass protein supplement, as top feed for growing lactating and pregnant animals.

(iii) Development of bio technology techniques which can develop recombinant microbes to digest straws, neutralized lignin and its by products and release carbohydrates through a solid state fermentation process.

(iv) Strict quality assurance in feed and this requires:

(a) Labeling.

(b) System of Certification on quality of Animal Feed.

(c) Need to set up at least five laboratories in different regions with modern facilities.

(d) The existing testing laboratories should be strengthened.

(v) Feed supplementation with mineral mixture:

(a) Region-wise mapping should be done for mineral status and area specific mineral mixtures need to be formulated.

(b) Use of mineral mixture needs to be popularized through extension activities.

(c) Establishment of mineral mixture plant for the drought prone / fodder deficit areas.

(vi) Total mixed ration and balancing:

(a) Farmers need to be advised to balance the ration of their animals with locally available feed resources.

(b) ICAR institutions, KVKs, SAUs, NDDB offices could be used for training to field resource persons and implementation of ration balancing programme

(vii) Fodder Seed Production:

(a) At least 10% of the total area under fodder production be earmarked for production of improved fodder seeds.

(b) Large scale fodder scale production needs to be assigned to dairy cooperatives, NGOs and private agencies through contract farming.

(viii) An integrated approach for pasture and fodder development in watershed area is absolutely essential

Animal Health

(i) Disease reporting, monitoring and surveillance system should be strengthened. Infectious and contiguous disease reporting should be closely monitored by state animal husbandry departments, dairy and poultry industry, cooperative NGOs, etc.

(ii) Biological production units with marketing network to be encouraged for production and supply of diagnostic kits.

(iii) Manpower – a separate cadre of specialists with appropriate qualification are required to handle the animal health of the State.

(iv) Infectious disease, prevention and control programme needs to be developed and further strengthened.

Poultry Production

(i) Creation of network of diagnostic laboratories exclusively for poultry diseases and prompt disease reporting system.

(ii) Compulsory feed testing through designated laboratories of all commercial feed manufacturers.

(iii) Facilitation of easy finance and easy insurance through NABARD.

(iv) Regulation of contract farming with legal framework.

(v) Enforcing strict bio-security in poultry farms.

(vi) Programme on other avian species like quails, guinea fowls and turkey shall be strengthened to improve per capita availability of egg and meat in the State. The focus shall be to replace the local stock with improved egg and meat type breeds and exploring possibility of introducing emu keeping in view environmental implications.

Backyard Poultry Farming

(i) The focus should be on providing genetic stock and technologies sustainable to rural poultry production.

(ii) Supply of chick of a desired breed. The low input technology birds should be kept in the State Government Poultry Farms to propagate and to multiply. Availability and distribution of these chicks through a supply net work should be established.

(iii) Prevention from infectious diseases – Vaccination or treatment arranged killer diseases or other diseases causing loss in production, body weight gain need to be addressed.

(iv) Adequate shelter - The low cost shelter with easily available material in a local area of production needs to be addressed.

Training and Human Resource Development

(i) Although the State of Bihar is having a collage of Veterinary Science and Animal Husbandry but suffering from resource crunch. There is not adequate staff, laboratories, clinics and other essential teaching tools which are essential for preparing the students of

these professions. There are discontent on the issue of proportional allocation of resources between agricultural sciences and veterinary sciences. Addressing to these issues, a fresh veterinary university in the State of Bihar may be set up to produce the desired manpower with adequate skill.

(ii) There should be some continuing education programme in these professions through regular training courses

(iii) Human resource development should be given a very high priority in livestock development to meet the qualitative and quantitative shortage of manpower. Optimal requirement of human resource to support various programmes need to be worked out and steps be taken to generate the same through involvement of NGOs and private sector also.

F. Strategy for Fisheries & Aquaculture

232. Bihar has rich inland fishery resources in the form of rivers and canals (3,200 km), reservoirs (7,200 ha), floodplain wetlands (5,000 ha of Oxbow Lakes and 48,000 ha of *chaurs)* and ponds (65,000 ha). The average fish production in ponds under FFDA is 2.2 tonnes/ha/ year. The state produces 2,66 lakh tonnes of fish annually, but the constraints for realising higher production levels are access to inputs including seed and feed in production areas, low stocking of floodplain lakes and reservoirs, as also market connectivity. The following strategy is suggested for the state:

Reservoirs Fisheries Development

(i) Bihar's reservoirs account for 0.60 lakh ha. The contribution from reservoir of the State in total fish production is very low, having average productivity level of only 5 kg/ha. The productivity ranged from 1.5 to 7.5 kg/ha. Based on the nutrient status of these reservoirs vis-à-vis scientific technologies available in the country, the production levels of 30 kg/ha in large; 50 kg/ha in medium and 200-1000kg/ha in small reservoirs could easily be achieved by judicious and systematic efforts. There are a few intricate issues , particularly managerial, such as the presence of carnivorous fishes, tree stumps , dense macrophytes, poor fishery management practices , unregulated destructive types of fishing, sick Fisheries Cooperative Societies**(FCS)** ,lack of adequate harvest , post-harvest and market infrastructure facilities ,etc. ,which should be circumvented for raising the production level from these water bodies from abysmally very low levels at present. Some other measures that should be put in place are: strict enforcement of management rules, observance of closed season, providing training and fishing tools to fishermen, intensive extension practices and observing ethics of responsible fisheries.

(ii) Recent policy decisions to declare aquaculture on par with agriculture to avail various subsidies and making aquaculture income tax free are laudable steps. Decisions to privatize the fish seed production infrastructure would further need empowerment of the clients to be able to mortgage the land and buildings for raising funds from financial institutions. For the purpose a series of rules and regulation would need to be implemented.

(iii) Fisheries Cooperative Societies **(FCS)** should be made financially and technically strong for meeting the challenging post-harvest activities and playing a viable role in fish trade and diversification of activities. The present system of auctioning and leasing of the reservoir fisheries rights is highly detrimental on long-term basis and should be replaced by cooperative and SHG system and hence, management of reservoirs by fishermen cooperatives/ SHGs located around the reservoirs should be promoted in order to increase the efficiency and production levels and for improving the socio-economic status of the fisher folk dependent on these resources for their livelihood. Since almost all reservoirs in the State are of small and medium category, it can be used as modified extensive culture system which will enhance/increase the fish production in these water bodies.

(iv) Further, the poor marketing infrastructure has also depleted the incentive and returns of the fishermen. Therefore, a package approach comprising stocking, monitoring, equitable and just royalty arrangements, market intervention through cooperatives/corporations and quick transport/distribution channels, etc., should be evolved. While the irrigation department could continue to manage the head-works and the canals, the management of the water resource for fisheries in terms of stocking, exploitation, conservation, fishing rights etc., should be brought under the exclusive control of State Fisheries Department, if the production and productivity of fisheries in reservoirs is to be raised.

(v) The micro-plan has to be developed for fisheries development in all reservoirs, through which the fish production level of the major reservoirs could easily be raised from present production to a minimum of 50 kg per ha for medium reservoirs and 200kg per ha for small reservoirs by 2020.

Policy Issues for Fisheries and Aquaculture

233. Lack of appropriate leasing policy over the years has been one of the major factors of the ineffective utilization and development of these water bodies for aquaculture. Though certain positive initiatives have been taken by the government in the form of the Bihar Fish Jalkar Management Act 2006 for short and long term leasing of these community water bodies, it needs effective implementation at Gram Panchayat levels. Community approach for integrated development shall aid in the development of aquaculture in these ponds.

(i) For the development of the inland waters, fishing rights must be with the State Fisheries Department. The lease amount should be rationalized with lease duration of 12 years or more and lease rent fixed according to productivity and level of multiple uses. Specific policies should be framed to lease out different sized ponds to fishermen co-operatives, group of fishers or individual fisherman, SHGs, private entrepreneurs in order to have efficient aquaculture management to exploit its full production potential. In addition to this, fisheries graduates can be given preference for taking the pond on lease.

(ii) The policy for promotion and development of aquaculture in the State would include (a) tariff realization in order to give parity with agriculture sector, (b) more vibrant FFDAs, (c) self sufficiency in quality and disease free seed and feed, and (d) a suitable legal framework. The strategy would include (a) scientific stocking , (b) horizontal expansion of farming area, (c) integrated farming , (d) contract farming , e) species diversification,(f) transfer of departmental fish farm to private entrepreneurs,(g) development of approach road to aquaculture clusters, and (h) empowerment of farmers and fisherwomen and utilization of technical expertise of fisheries graduates , and (i) increase in productivity.

234. The main strategy for the future should be the vertical expansion, i.e., improving the production of the existing extensive and semi-intensive area, and horizontal expansion, i.e., bringing un-utilized cultivable area under scientific extensive/semi-intensive farming and creation of new ponds for aquaculture in the State. In the next fifteen years in a phased manner, the entire existing potential fresh water aquaculture resources would be brought under extensive and semi-intensive fish farming with an average production level of 5 tones /ha/annum.This would have far reaching implications for the future of the Fisheries Sector.

Training and Extension Needs

235. Since training and improvement of culture and fishing skills are highly useful, the Government should take a lead role in organizing training and dissemination camps for imparting latest knowledge and technology to fish farmers and fishery entrepreneurs, with the help and active participation of Central Government Organizations like ICAR Institutes such as CIFE, Mumbai and College of Fisheries of RAU in different aspects of fisheries and aquaculture. Even the training of officers and staff of Department of Fisheries of the State through refresher courses, trainers training programmes etc would go a long way in strengthening and empowering of Government machinery through latest technologies in various aspects of fisheries and aquaculture.Through these interventions, the total fish production per year in Bihar can be increased to about 4.5 lakh tonnes, making the state self-sufficient in fisheries and a possible supply to national markets on the pattern of Andhra Pradesh.

CHAPTER – 11

IMPLICATIONS OF PROPOSED STRATEGY

236 There are far reaching implications of the strategy and policy as well as institutional direction proposed in this Report. One of the major implications is a vast financial requirement to implement the proposals during next 5 – 6 years (2008-09 to 012 -13) against the current plan allocation of Rs.1,698 crores (in the 11th Five Year Plan). Total required outlay for this period is estimated at Rs.27,055 crores. (See **Annexure-XXXIX** for details). This level of outlays is fully justified to make Bihar the 'Granary' of India and a major hub of fruits and vegetables for both national and international markets. Recent field study sponsored by the Task Force (through APEDA) has revealed that Bihar has the capability to produce market expected products of fruits (including honey) and vegetables and there is already a demand for such products in U.K., Middle East, and Mauritius. Another major expected impact is on Bihari farmers' income, employment, and general living standards.

237 Once agriculture gets revamped, income shall flow to villagers ensuring livelihood security, employment, and empowerment of women. It is expected that productivity of rice, wheat, maize, pulses, oilseeds, sugarcane would increase from 1.5t/ha to 3.1t/ha, 2.1t/ha to 3.1t/ha, 2.7t/ha to 4.5t/ha, 7.3t/ha to 11.1t/ha, 1.1 to 1.4t/ha and 45.5t/ha to 70.5t/ha, respectively. The recent level of productivity of rice and wheat is shown in **Annexure-XL**. Productivity of fruits and vegetable shall increase from current level of 11.0t/ha to 15t/ha and 16.5 to 20.0t/ha. New area of floricultures, medicinal and aromatic plants and spices shall be appropriately harnessed. Waste land could be effectively utilized and state shall emerge as largest producer of honey and organic produce. The general assessment is that current farm productivity level in Bihar is low in comparison to its potential. Therefore, in order to fully exploit the potential, there would be a need for much higher financial resources.

238 Although Bihar has established a good network for dairy, but health of animals continues to be poor and there is a lot of potential for improvements in animals health and thus scope for addition in animal products and value addition in milk. Similarly, huge water body is not appropriately utilized. The report aims to enhance the health of animals, improve the average milk productivity, establish poultry especially backyard poultry, and promote goatery, piggery and duckiery. Intervention is expected to make livestock production economical – leading to sustainable reward to millions of vulnerable farmers. Further, production of fish is also expected to double in five years in the light of proposed strategy.

239 Implementation of the proposed strategy is expected to create employment of 45,000 million mandays besides making the state to produce surplus food to meet the growing demand

of the nation, as the state has rich land and water resources. This would empower the people and reverse the trend of going out of state for employment. Resultantly, there shall be parity, equality and inclusive growth. This would also help the nation from emerging food insecurity.

240 Particular focus has been placed on human resource development with a substantially enlarged financial outlays. It is believed that quality human resource at all the levels shall be the key to the success of programmes of development. Skill upgradation of officers, extension functionaries and farmers would be required having institutional arrangements. The trainers will also need training in new area of innovations to ensure upgraded skill developments.

241 All these would require considerable efforts on monitoring and evaluation of implementation of various development projects under the proposed strategies and policy direction. Since the proposals are based on ground reality evaluation, which has come out after detailed deliberation with all the stakeholders, there would be a need for developing implementable projects with a time frame, integrating all the efforts together in a 'Mission Mode' to address all the issues identified. Since the state has a poor infrastructure for delivery, it would also need strengthening. Therefore, with mission objectives, an empowered apex organization should be created which shall oversee the development, provide guidance and ensure effective implementation of the programme. The programme shall have mid term appraisal for its impact and midcourse correction.

CHAPTER -12

CONCLUSIONS

242. Bihar agriculture has the potential to grow rapidly so as to meet the existing shortages and assume primacy in the national agricultural economy. The State has immense agricultural resources, to facilitate a Second Green Revolution in the Country. Bihar must aim at an annual agricultural rate of 5-6%. However, despite the strength of the agriculture sector, it is a paradox that this sector is growing at a snail's pace. The rate of growth bas been below its potential. There has been a conspicuous failure to exploit those resources to the desired level. This study has endeavoured to identify the factors behind the dismal performance of the sector.

243. A micro level analysis of the data shows that there are wide productivity differences among different regions in the State. From among the crop sector, yields of maize, gram and sunflower are higher than all India average. But area under all these crops is very small. The country at present suffers from a severe shortage of pulses and oils. Because of the development of poultry, demand for maize is also rising fast. The study has found that due to an appreciable increase in the irrigated area, there is likelihood of an increase of over 2 million hectares in the gross cropped area. If so, a major chunk of this area should be allocated to these crops to meet the national requirements and help bring sustained food security of the country.

244. Productivity levels in Bihar compared with other States and all India average show huge gaps. The low productivity of major crops is to be examined in the light of poor infrastructure and institutional frame work. Add to that various agronomic factors like poor quality of seed, unbalanced and inadequate use of fertilizers, practically no use of micro nutrients, little knowledge of pest management, lack of proper machinery and finally poor extension services. The results are obvious.

245. Available data reveals that country is going to face the challenges of food security in the light of decreasing food production over the last decade. The current overall growth rate of farm production at the level of 2.5-2.0% due to shrinkage in cultivable area and changing global climate, the national and global food stock is expected to be at a comparatively lower level. Fortunately, Bihar is uniquely placed to fill in the gap and provide the major granary for India, if proper strategic and policy directions are set for enhanced farm production. The Road Map in this Report provides this.

246. It needs to be clearly borne in mind that business as usual will not yield the desired result in terms of achieving accelerated agriculture growth in Bihar. If Bihar has to be put on the

mainstream of India's development map, concerted efforts will have to be made on war footing. There is a need for an in-depth study of the factors responsible for low productivity levels in the concerned regions which will provide the key to improve production. Applying new technology - Zero Till, Bed Planting for wheat, System for Rice Intensification (SRI) Technique for rice, Site Specific Nutrient Management for rice and wheat and hybrids for maize, encouraging results have been achieved within Bihar itself on farmers' fields. These need to be developed at a larger scale for making Bihar the 'Granary' of India and help India in maintaining food security.

247. Taking care of these factors along with other local issues as discussed, the emerging production scenario for 2011-12, has been projected **(Annexure XXXVII & Annexure XXXVIII)**. It gives an additional production of 2 million tonnes each of rice and wheat, 3.4 million tonnes of maize, over 4 lakh tonnes of gram and over a million tonnes of oilseeds along with 9 million tonnes of sugarcane. The Government of India has a target of 10 million tonnes of rice, 8 million tonnes of wheat and 2 million tonnes of pulses under the XI Plan (National Food Security Fund). The Government of Bihar should take full advantage of the funds allocated under the Scheme for ensuring of high quality seed, fertilizer and large scale demonstration etc. and can thus become a major partner in this programme.

248. The agro-climatic diversity in the State with its high rainfall distributed over a five-month monsoon and a reasonably long and moderate winter allows for a variety of horticultural crops to be grown. An analysis of horticulture production in Bihar reveals that potential for significant increase in the horticulture production requires investments in all spheres– from institutional to crop management practices. Animal Husbandry and Dairy are the subsidiary income generating activities for the rural poor of Bihar. Therefore, the progress in this sector will result in more balanced development in the rural economy. The main strategy should be to increase the livestock production through controlled breeding programmes, strengthen the infrastructural facilities and to ensure animal health cover.

249. Soil conservation practices are very important for Bihar which are ridden with floods and drought. The prime focus of organic agriculture is the management of soil organic matter to enhance the chemical, physical and biological properties of soil. The concept of feeding the soils rather than the plants forms the basis of the sustainable approach for organic farming in the State.

250. Agriculture is the single largest private sector occupation in the State and can be considered the riskiest business. Increasing income of the land owning and landless rural population through increased production by enhancing productivity[14] and intensity of farming, and by generating more employment in agriculture and other rural based production activities alone is not the solution and there is a need to integrate these endeavours with effective risk management strategies to cover potential losses in yield and hence incomes. This Report covers this aspect.

251. The most important lesson for Bihar is to capitalize on strength and convert weakness into opportunity through creation of infrastructure, adoption of technologies, strengthening of research, agricultural education and market orientation and agricultural enterprises. Success story of other states could also be tried as mode. Crux of the matter is that Bihar has the potentialities of being the forerunner of the Second Green Revolution. But the policy of 'business as usual' will not do. The state has to make efforts on a war footing, intensify their activity and implement the programmes at the ground level. The proper exploitation of opportunities in Bihar would be the opportunity for India to emerge as the economically sound nation in the world. This will be based on a dynamic agriculture sector.

ANNEXURES- I to XL

Salient Features of Agro-Climatic Zones of Bihar

Agro-Climatic Zone	Districts	Area (,000 ha)	Average Rainfall (mm)	Soil and Topography	Main Crops
Zone – I North West Alluvial Plains	Bettiah, Motihari, Gopalganj, Siwan, Vaishali, Seohar, Muzaffarpur, Samastipur, Sitamarhi, Madhubani,Darbhanga, West & East Champaran	Net Cultivated- 2281 Gross Cultivated- 3260	1234.7	Medium acidic, heavy textured , sandy loam to clayed , flood prone . (Large area remains under water called Chaur , Maun & Tal lands)	Rice , Wheat , Maize , Arhar . Horticultural Crop- Litchi , Mango , Makhana , Water Chestnut .
Zone – II North East Alluvial Plains	Purnia, Katihar, Saharsa, Madhepura, Araria, Kishanganj, Supaul, Khagaria, Begusarai .	Net Cultivated- 1147 Gross Cultivated- 1677	1382.2	Light to medium textured , slightly acidic,sandy to silty loam. (large area comprise of Tal and Diara lands)	Maize,Mustard, Jute, Sugarcane. Horticultural Crop- Mango, Bael , Banana , Papaya, Cucurbits , Chilly, Turmeric,Potato.
Zone – III South Bihar Alluvial Plains	Patna , Gaya , Buxar, Jahanabad,Nawada , Nalanda , Rohtas ,Bhojpur , Aurangabad, Kaimur, Banka , Munger , Jammui, Lakhisarai , Shekhpura, Bhagalpur.	Net Cultivated- 241 Gross Cultivated- 3408	1102.1	Old alluviam to sandy loam.	Rice, Gram, Wheat. Horticultural Crop- Mango, Guava , Banana, Bael , Jackfruit, , Onion , Potato , Chillies , Marigold

Distribution of Operational Holdings by Size Class

Size category	% of total number of holdings	% share in total operated area
Less than 1 ha.	82.9	40.8
1-2 ha.	9.6	19.0
2-4 ha.	5.7	23.1
4-10 ha.	1.7	14.3
Above 10 ha.	0.1	2.8
Total	100.0	100.0

Source : Govt. of Bihar, Economic Survey, 2006-07, March 2007, p.13

Extent of Flood affected area in different districts

District	Flood Affected Area	
	Area ('000 ha)	Percentage ofcropped area affected
Araria	255	100.00
Muzafferpur	308	100.00
Sheohar	47	100.00
Katihar	194	70.00
Khagaria	97	74.90
Sitamarhi	123	57.50
Begusarai	99	53.20
Darbhanga	80	40.60
Purnia	119	40.60
Sahrsa	96	44.80
Saran	80	34.00
Sheikhpura	34	56.20
Bhagalpur	51	26.80
Champaran East	100	28.50
Champaran West	105	25.10
Gopalganj	51	20.70
Kishanganj	39	22.80
Lakhisarai	33	38.20
Madhepura	24	10.60
Madhubani	32	11.00
Samastipur	43	17.00
Supaul	38	15.30
Vaishali	32	16.40
Munger	9	13.10
Banka	2	1.00
Total	2199	41.40

Source: Government of Bihar

Agriculture in Bihar and Other states

	Bihar	Orissa	Andhra Pradesh	Uttar Pradesh	West Bengal	All India
Real agriculture & allied sector growth						
1980-1992 (Per cent)	1.6	0.5	2.3	2.7	6.2	3.1
1993-2003 (Per cent)	2.7	0.1	2.8	2.2	5.4	2.2
GSDP/capita (2000) Rs.	3,650	6,278	11,154	6,638	10,757	11,752
Share of agri & allied (2003-04) per cent	39.8	30.0	28.0	33.6	24.7	24.2
Agri & allied /capita Rs.	1,452	1,884	3,121	2,230	2,658	2,847

Source:- World Bank, 2004. Bihar Agriculture Building on Emerging Models of Success.

Structure of Agricultural Production in Bihar (TE 2001)

	Features	Bihar
1.	Total Value of crop output at current prices in 2001 (Lakh Rupees)	2257802.00
2.	Total value of livestock output at current prices in 2001 (Lakh Rupees)	913128.00
3.	Percentage share of crops in the total value of crop output	
	Paddy	19.70
	Wheat	12.00
	Maize	2.90
	Pulses	3.70
	Oilseeds	0.90
	Sugarcane	1.70
	Jute	0.70
	Fruits & Vegetables	49.70
	Others	8.70
4.	Percentage share of major items of livestock products of total value of livestock	
	Milk	49.30
	Eggs	1.60
	Dung	10.30
	Wool	0.10
	Silk worm	0.10
	Increment in stock	14.20
	Meat	24.40

Source: Estimates of Value of Agricultural output, Central Statistical Organization, Government of India

Area, Production & Yield of major crops in Bihar during 2000-01 , 2003- 04 , 2005-06, 2006 -07 and 2007-08*

Area ('000 hectares)
Production ('000 tones)
Yield (Kg./ ha)

	BIHAR			ALL -INDIA		
	Area	Production	Yield	Area	Production	Yield
RICE						
2000-01	3656.3	5442.6	1489	44712.0	84976.6	1901
2003-04	3578.0	5447.8	1523	42592.0	71820.2	2078
2005-06	3222.0	3417.0	1061	43492.0	91039.0	2093
2006-07	3353.5	4996.5	1490	43601.1	92700.0	2127
2007-08*	3301.9	3775.4	1143	-	-	-
WHEAT						
2000-01	2067.8	4438.0	2146	25730.6	69680.9	2708
2003-04	2076.8	3688.9	1776	26594.7	72156.2	2713
2005-06	2038.0	3660.0	1796	26647.0	69481.0	2607
2006-07	2054.5	4292.3	2089	28000.0	74900.0	2671
2007-08*	2049.7	3474.2	1695	-	-	-
MAIZE						
2000-01	620.5	1497.2	2413	6611.3	12043.2	1822
2003-04	616.4	1473.5	2390	7343.4	14984.3	2041
2005-06	622.0	1424.0	2289	7727.0	15091.0	1953
2006-07	798.3	2028.9	2541	7900.0	15000.0	1907
2007-08*	472.8	1076.3	2276	-	-	-
PULSES						
2000-01	717.2	620.7	865	20348.0	11075.6	544
2003-04	691.3	562.6	814	23458.1	14905.2	635
2005-06	655.0	482.0	736	22431.0	13112.0	585
2006-07	606.8	445.9	735	23100.0	14200.0	616
2007-08*	448.6	365.1	814	-	-	-
OILSEEDS						
2000-01	154.7	131.1	847	22770.0	18436.8	810
2003-04	140.6	123.8	881	23662.9	25186.1	1064
2005-06	136.0	119.0	875	27737.0	27731.0	1000
2006-07	140.6	148.7	1057	26100.0	23800.0	917
2007-08*	129.5	116.8	901	-	-	-
SUGARCANE						
2000-01	93.5	3987.6	42648	4315.7	295956.2	68577
2003-04	103.6	4285.9	41370	3938.4	233861.0	59380
2005-06	102.0	4346.0	42608	4245.0	278387.0	65580
2006-07	117.2	5338.8	45552	4900.0	345300.0	70469
2007-08*	-	-	-	-	-	-

*Second advance estimate

Major Fruit Producing Regions in Bihar

Area, production and Yield of major fruits in Bihar vis-à-vis India during 2005-06

Crops	Bihar			India		
	Area (1000'ha)	Production (1000'tones)	Yield (Tone/ha)	Area (1000'ha)	Production (1000'tones)	Yield (Tone/ha)
Banana	28.0	959.3	34.3	565.1	18701.9	33.1
Citrus	16.8	112.3	6.7	748.8	6323.2	8.4
Guava	27.7	199.0	7.2	181.7	1823.3	10.0
Litchi	28.4	200.1	7.0	63.3	381.4	6.0
Mango	140.2	1222.7	8.7	2020.6	12537.9	6.2
Pineapple	4.2	108.0	25.5	85.4	1353.1	15.8

Major Vegetable Producing Regions in Bihar

Area, production and yield of major vegetables in Bihar vis-à-vis India, 2005-06

Crops	Bihar			India		
	Area (1000'ha)	Production (1000'tones)	Yield (Tone/ha)	Area (1000'ha)	Production (1000'tones)	Yield (Tone/ha)
Brinjal	53.7	1031.0	19.2	553.3	9136.4	16.5
Cabbage	33.7	931.6	27.6	267.4	5921.6	22.1
C. Flower	59.8	938.5	15.7	291.8	5260.1	18.0
Okra	56.2	714.1	12.7	376.1	3684.0	9.8
Tomato	46.0	727.2	15.8	534.5	9361.8	17.5
Onion	49.8	1011.7	20.3	695.1	9248.4	13.3
Potato	308.9	5702.5	18.5	1550.2	29093.7	18.8

National Horticulture Mission

Sl. No.	District	Mango	Litchi	Banana	Guava	Pine apple	Veg. Seed Prod.
CLUSTER I							
1.	West Champaran	***	***	***	***		
2.	East Champaran	***	***		***		
3.	Muzaffarpur	***	***				
4.	Samastipur	***		***			
5.	Vaishali	***	***	***	***		***
6.	Darbhanga	***	***	***	***		
CLUSTER II							
7.	Araria					***	
8.	Kishanganj					***	
9.	Purnia		***	***		***	
10.	Katihar			***		***	
CLUSTER III							
11.	Bhagalpur	***	***		***	***	
12.	Banka	***					
13.	Munger	***					
CLUSTER IV							
14.	Patna						***
15.	Gaya						***
16.	Nalanda						***

Livestock Population *('000)

Livestock	1997	2003	% increase/ decrease
Crossbred Cattle	232	1420	512.07
Indigenous Cattle	24366	16968	-30.36
Total Cattle	24598	18388	-25.25
Buffaloes	5879	7087	20.55
Total Bovines	3047	25475	-16.41
Sheep	1956	1062	-45.71
Goats	20229	14521	-28.22
Pigs	924	1780	92.64
Others	156	152	-2.56
Total Livestock	**53742**	**42990**	**-20.01**

Growth rate of Major Livestock Products in Bihar (2001-06)

Sl. No.	Item	Based on 1993 Livestock Census		Based on Census 2003		Growth over the period	
		2001-02	2002-03	2003-04	2004-05	2005-06	%
1	Total milk (in 000, tonnes)	2632	2869	3175	4743	5060	92.25
2	Eggs (in crore nos.)	74	74	78	79	100	35.14
3.	Meat (in 000, tonnes)	156	173	173	176	175	12.18
4.	Wool (in lakh kg.)	4.24	3.62	3.94	3.78	2.2	48.11

Source:- Economic Survey, Government of Bihar, Animal Husbandry and Fisheries Dept. GOB.

Poultry population*(000)

Poultry	1997	2003	% Increase/ Decrease
Fowls	16602	26285	58.32
Ducks etc.	3288	2055	-37.50
Total Poultry	**19890**	**28340**	**42.48**

* including Jharkhand

Source : Agriculture Census Division , Ministry of Agriculture , New Delhi.

Egg Production by Fowls & Ducks in Bihar

(lakh nos.)

		2000-01	2001-02	2002-03	2003-04
Egg Production (Million Nos.)		717.7	741.6	737.0	740.2
Fowls	Deshi	3286	3249	3170	3077
	Improved	3455	3716	3794	3912
	Total	6741	6965	6964	6989
Ducks	Deshi	436	451	406	413
	Improved	-	-	-	-
	Total	436	451	406	413
No. of Layers (000 Nos.)	Deshi	3735.64	3662.00	3643.40	3420.94
	Improved	1855.90	1958.01	2039.6	2129.7
Average yield/Annum	Deshi	87.97	88.71	87.00	89.94
	Improved	186.15	189.80	186.00	183.71
Production (Lakh Nos.)	Deshi	3286	3249	3170	3077
	Improved	3455	3716	3794	3912
No. of Duck (000 Nos.)	Deshi	296	306	310.10	304.53
	Improved	-	-	-	-
Average Yield/ Annum	Deshi	147.10	147.21	135.00	135.55
	Improved	-	-	-	-
Production (Lakh Nos.)	Deshi	436	451	406	413
	Improved	-	-	-	-
Per capita availability (Nos./Annum)		8	9	9	9

Number of Institutions in Animal Husbandry Department

Sl. No.	Item	Based on 1982 Livestock Census 2001-02	Based on 1982 Livestock Census 2002-03	Based on 1982 Livestock Census 2003-04	Based on 2003 Livestock Census 2004-05	Based on 2003 Livestock Census 2005-06	Growth Over the Period (%)
1	No. of Artificial Insemination Institutions	1401	1401	1401	1401	1401	0.00
2	No. of Veterinary Hospitals	39	39	39	39	39	0.00
3	No. of Veterinary Dispensaries	814	814	814	814	814	0.00

Source : Economic Survey (2006-07), Government of Bihar.

Inland Fishery Resources of Bihar

Water Area

Resources	*Extent (ha)*
Ponds and tanks	69,000
Oxbow lakes	9,000
Chaurs (waterlogged areas)	35,000
Rivers and Canals	3,200 kms

Water area as per Satellite Survey done by CIFRI

Size Range	Total Water Spread Area (ha)
Between 0.5 - 10ha	43197.41
Between 10 - 50ha	26862.41
Between50 - 100ha	13275.98
Between 100 - 500ha	24796.72
Between500 - 1000ha	11713.16
Above 1000ha	12229.22
Total water area	132074.49

Fish Hatchery and Seed Farms in Bihar

Ownership	Nos.	Location
Crop hatchery		
Corporate Sector	2	Raghopur (Sitamarhi) Rampatti (Madhubani)
Govt. Sector	1	Kaimur (Nalanda)
Private Sector	26	Scattered in various districts
Fish seed farms		
Government Sector	121	Scattered in various districts
FFDA sponsored	33	In various districts

Trend in Area under HYV in Bihar (HYV area as% of cropped area)

Crop	Year	Area
Rice	TE 1982	24.7
	TE 1990	38.3
	TE 1999	67.9
	TE 2005	73.9
Wheat	TE 1990	76.9
	TE 1999	90.6
	TE 2005	92.0
Maize	TE 1990	62.4
	TE 1999	75.4
	TE 2005	77.1

Source: - Bihar Development Report, October 2006.

Zone-wise Trend in Area under HYV in Bihar (HYV area as % of cropped area)

Crop		Zone I	Zone II	Zone III	Bihar
Rice	TE ending 1982	23.70	30.72	20.55	24.65
	TE ending 1990	24.52	27.11	64.40	38.25
	TE ending 1999	63.31	55.68	77.10	67.93
Wheat	TE ending 1982	77.58	71.93	62.25	70.44
	TE ending 1990	78.99	74.58	75.97	76.95
	TE ending 1999	93.47	85.05	91.68	90.61
Maize	TE ending 1982	56.84	57.09	56.22	56.92
	TE ending 1990	72.77	55.31	60.48	62.38
	TE ending 1999	71.88	76.90	82.38	75.42

Source:- Department of Statistics and Evaluation, Government of Bihar

Seed Replacement Rates of Different Crops

Sl. No.	Name of the crops	2003-04		2004-05		2005-06		2006-07	
		Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
Kharif Crops									
1.	Paddy	8%	6.8%	10%	10%	11%	12%	15%	
2.	Maize	40%	30%	50%	40%	50%	50%	60%	
3.	Pulses	10%	6%	10%	7.5%	10%	8%	14%	
4.	Oilseeds	5%	2%	5%	3%	5%	5%		
Rabi Crops									
1.	Wheat	10%	8.1%	10%	9%	15%	11%	15%	
2.	Maize	-	-	-	-	50%	-	80%	
3.	Pulses	5%	1.2%	10%	7.5%	15%	-	10%	
4.	Oilseeds	25%	20%	30%	25%	30%	-	30%	
5.	Vegetables	25%	20%	60%	50%	60%	-	60%	

Zone –wise Fertilizer consumption in Bihar (Kg.per ha)

	Nitrogen			Phosphorous			Potash			Total (N+P+K)		
	1982	1991	1998	1982	1991	1998	1982	1991	1998	1982	1991	1998
Zone I	17.59	37.76	51.75	4.21	12.10	12.98	2.29	5.19	4.52	24.10	55.04	69.25
Zone II	11.12	29.53	57.13	2.51	14.13	12.40	1.58	6.70	8.71	15.21	50.37	78.24
Zone III	18.67	60.32	87.95	2.99	18.41	13.76	1.48	8.63	2.16	23.15	87.36	103.87
Bihar	16.57	41.56	63.99	3.24	14.60	13.01	1.74	6.69	5.23	21.54	62.84	82.23

Source:- Fertilser Statistics, Fertiliser Association of India (Several Volumes) Year refers to Triennium ending

Consumption of Fertilsiers Season-wise in Bihar During 2003-04 and 2004-05

(`000 tonnes)

Nutrient N	2003-04			2006-07			% increase decrease
	Kharif	Rabi	Total	Kharif	Rabi	Total	
N	302.74	320.84	623.58	333.59	475.12	808.71	+29.7
P2O5	12.34	33.51	45.85	69.56	108.86	178.72	+289.8
K2O	3.45	22.22	25.67	26.76	50.61	77.37	+201.4
Total	318.53	376.57	695.10	430.21	634.59	1064.80	+53.18

Source:- Fertiliser Statistics of India.

Consumption of Fertilizer per Hectare

Year	Nutrient consumption (in Kgs. hect.)
1993-94	61.20
1994-95	62.50
1995-96	65.00
1996-97	68.00
1997-98	69.00
1998-99	72.00
1999-00	78.50
2000-01	85.00
2001-02	94.00
2002-03	96.00
2003-04	87.50
2004-05	92.15
2005-06	110.00
2005-06	125.00

Source:- Economic Survey, Government of India

NPK Consumption Pattern from 1994-1995 onwards

Year	N.P.K Ratio
1995-96	8.4:2.7:1.8
1996-97	12.4:7:2.1
1997-98	11.5:2.8:1
1998-99	13.5:3.3:1
1999-00	11.1:3.2:1
2000-01	12.1:2.9:1
2001-02	12.1:2.3:1
2002-03	23 : 4.2:1
2003-04	24.3:7:1
2004-05	14.7:7:1
2005-06	6.8:3:1

Source: - Economic Survey, Government of Bihar

Use of Modern Farm Inputs in some States in India 2003-04

	Fertiliser Consum-ption Kg./ha.	Percent of farmer households using									
		Fertiliser		Organic manure		Improved Seeds		Pesticides		Vet.Services	
		Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
Orissa	37.07	76	15	65	10	19	10	41	10	31	8
Madhya Pradesh	51.64	59	52	40	39	29	21	28	23	19	14
Bihar	88.02	59	91	32	34	34	43	40	46	19	18
India	88.19	76	54	56	38	46	34	46	31	30	22
West Bengal	114.4	89	72	54	43	63	58	80	65	32	29
Uttar Pradesh	126.7	78	88	48	56	48	53	39	35	26	21
Andhra Pradesh	145.3	81	30	69	28	68	30	71	30	41	30
Punjab	190.13	54	55	36	35	44	46	52	52	66	71

Year-wise Physical Target and Achievement of Million Shallow Tubewell Programme

Sl.No.	Year	Physical Target	Achievement	% Achievement
1	2001-02	33798	4269	12.63
2	2002-03	23313	43445	190.21
3	2003-04	160000	107358	67.1
4	2004-05	160000	172619	107.89
5	2005-06	160000	109119	68.19
6	2006-07*	160000	30212	18.75
	Total	**697111**	**467022**	

Changes in Total Factor Productivity over Time (District-wise) in Bihar

Sl. No.	DISTRICT	YEAR	Index of Value of total crop output at 93-94 prices	Index of Input cost	Index of Total factor productivity
1	Aurangabad	1970	100.00	100.00	100.00
	Aurangabad	2000	645.53	561.31	115.01
2	Begusarai	1970	100.00	100.00	100.00
	Begusarai	2000	913.67	538.10	169.80
3	Bhagalpur	1970	100.00	100.00	100.00
	Bhagalpur	2000	986.26	619.27	159.26
4	Bhojpur	1970	100.00	100.00	100.00
	Bhojpur	2000	520.16	480.35	108.29
5	Champaran (East)	1970	100.00	100.00	100.00
	Champaran (East)	2000	982.49	434.78	225.98
6	Champaran (West)	1970	100.00	100.00	100.00
	Champaran (West)	2000	1106.83	418.47	264.49
7	Darbhanga	1970	100.00	100.00	100.00
	Darbhanga	2000	180.68	153.10	118.01
8	Gaya	1970	100.00	100.00	100.00
	Gaya	2000	477.93	286.57	166.78
9	Gopalganj	1970	100.00	100.00	100.00
	Gopalganj	2000	1455.41	846.56	171.92
10	Katihar	1970	100.00	100.00	100.00
	Katihar	2000	1224.21	1077.52	113.61
11	Madhubani	1970	100.00	100.00	100.00
	Madhubani	2000	640.85	605.03	105.92

Sl. No.	DISTRICT	YEAR	Index of Value of total crop output at 93-94 prices	Index of Input cost	Index of Total factor productivity
12	Monghyr	1970	100.00	100.00	100.00
	Monghyr	2000	770.42	436.41	176.54
13	Muzaffarpur	1970	100.00	100.00	100.00
	Muzaffarpur	2000	423.26	385.88	109.69
14	Nalanda	1970	100.00	100.00	100.00
	Nalanda	2000	899.29	621.39	144.72
15	Nawada	1970	100.00	100.00	100.00
	Nawada	2000	432.65	381.18	113.50
16	Patna	1970	100.00	100.00	100.00
	Patna	2000	525.82	298.99	175.87
17	Purnea	1970	100.00	100.00	100.00
	Purnea	2000	512.82	430.02	119.26
18	Rohtas	1970	100.00	100.00	100.00
	Rohtas	2000	1596.96	572.89	278.76
19	Saharsa	1970	100.00	100.00	100.00
	Saharsa	2000	713.87	561.73	127.09
20	Samastipur	1970	100.00	100.00	100.00
	Samastipur	2000	912.45	632.45	144.27
21	Saran	1970	100.00	100.00	100.00
	Saran	2000	468.94	268.21	174.84
22	Sitamarhi	1970	100.00	100.00	100.00
	Sitamarhi	2000	477.91	610.21	78.32
23	Siwan	1970	100.00	100.00	100.00
	Siwan	2000	678.65	452.63	149.94
24	Vaishali	1970	100	100.00	100.00
	Vaishali	2000	709.60	588.47	120.58

Benefits of Soil conservation by managing soil organic matter

Population and biomass of soil microbes

Microbes	Average number [in lacs] per g of soil	Average biomass [in kg per ha]
Bacteria	1000	500
Fungi	10	1000
Actinomycetes	100	750
Algae	0.01	150

Inoculants used for nutrient management in organic agriculture

Bacteria	Nodulation in legumes or non-legumes	*Bradyrhizobium sp, Rhizobium sp, Frankia, Azotobacer, Azospirillum,*
	Non-symbiotic nitrogen fixation for all crops	
	Phosphate solubilization	*Pseudomonas striata* *Bacillus polymyxa* *Bacillus megaterium* *Pseudomonas*
	Plant growth promoting rhizobacteria or phyllosphere micro-flora	*Serratia* *Azotobacter* *Sea weed extracts* *Protein hydrolysates* *Chelates of minerals with humic or fulvic acids* *Enzymes*
Fungi	Phosphate solubilization	*Aspergillus awamori* *Penicillium di gitatum* *Mycorrhizae*
	Composting	*Trichoderma, Chetomium, Aspergillus, Phanerochaete, Penicillium*
Algae	Biological nitrogen fixation	*Anabaena, Nostoc, Calothrix*
Fern	Nitrogen fixation	*Azolla sp.* *A caroliniana* *A nilotica*

Microbes used for management of pests of crops

Preparations	Active ingredient	Scientific name	Target pest
Bioinsecticides	Viral	NPV Nuclear polyhedrosis virus	*Heliothis l*arva *Spodoptera* larva
	Bacterium	*Bacillus thuringiensis var. kurstaki* *B.t var isaelensis* *Bt var tenebrionis* *Bt aizaawi* *Bacillus popillae*	Lepidopteran larva of many crops Larvae of mosquitoes and black flies Beetles Wax moth caterpillars
	Fungal	*Metarrhizium anisopliae* *Beauverria bassiana* *Verticillium lecanii* *Paecolimyces farinosus*	Grasshoppers and broad spectrum Sucking pests White flies
	Protozoan	*Nosema locustae*	Grasshoppers
	Nematodes	*Steinernema* *Heterorhabditis*	Crickets and weevils in citrus
Biofungicides	Fungi	*Trichoderma viride* *T harzianum* *T virens* *T koningii* *Coniothyrium minitans*	Fungal diseases of root and seeds *Sclerotinia* sp
	Bacteria	*Bacillus subtilis* *B cereus* *Pseudomonas fluorescens*	Foliar fungal diseases And diseases of root
Bionematicides	Fungi	*Verticillium chlamydosporium* *Paecilomyces lilacinus* *Arthrobotrys oligospora* *A conoides*	Soil borne nematode infections of crops Parasite of root knot nematode eggs
	Bacteria	*B penetrans*	Soil borne nematode infections of crops
Bioherbicides	Fungi	*Phytopthera palmivora* *Collectrotrichum gloeosporioides..f.sp aeschynomene* *Alternaria cassiae* *C gloeosporioides f sp malvae*	Milk-weed vine in citrus Cuscuta sp Northern jointvetch Cuscuta Malva pusicola

Trends in Credit and Deposit (In Rs. Crore)

Bank Category	2003-04		2004-05		2005-06	
	Deposits	Advances	Deposits	Advances	Deposits	Advances
Commercial Banks	3,06,405.0	78,296.3	3,40,562.0	96,657.7	3,91,770.0	1,19,880.0
Regional Rural Banks	44,215.4	12,533.7	54,751.5	17,959.9	61,820.0	22,250.0
Cooperative Banks	7,620.8	5,208.6	7,635.3	5,694.4	7,750.0	5,950.0
Total	3,58,241.0	96,038.6	4,02,949.0	1,20,312.0	4,61,340.0	148,080.0

Agency-wise Flow of Credit for Agriculture in Bihar

(Rs Crores)

Year	Commercial Banks	Cooperative Banks	RRBs	Total
2003-04	792.44	199.72	204.87	1197.03
2004-05	1325.06	293.75	431.30	2050.11
2005-06	1489.33	234.61	450.09	2174.03

(Source: SLBC, Bihar)

Nais - Business Statistics of 15 Seasons from Rabi 1999-2000 to Rabi 2006-07 (As on 15-Feb 2007)

Sl. No.	State	Farmers Covered (in Hec.)	Area (in Hec.)	Sum Insured*	Premium*	Subsidy Claims*	Claims Reported*	Claims Paid*	Claims Payable*	Farmers Bene-fited
1	Andhra Pradesh	14439535.00	22177907.86	2029550.59	56350.26	7427.31	174930.64	171815.30	3115.34	3121985
2	Assam	84562	65794.92	7962.36	191.96	28.93	351.88	121.92	229.96	17229
3	**Bihar**	**2047065**	**2367961.16**	**274842.26**	**5924.47**	**753.11**	**51802.83**	**48392.40**	**3410.43**	**821334**
4	Chhattisgarh	4219481	8999604.60	260385.98	6808.21	481.44	17459.11	17459.11	0.00	985180
5	Goa	5758	9084.47	213.01	3.73	1.05	2.25	2.25	0.00	698
6	Gujarat	7517203	18117826.85	1385045.16	60147.33	3939.92	253729.85	243948.75	9781.10	3102048
7	Haryana	388726	434243.72	31342.23	1009.38	29.35	1759.62	1759.62	0.00	58198
8	Himachal Pradesh	133072	90508.43	7523.96	162.81	28.31	596.05	596.05	0.00	70046
9	Jammu & Kashmir	14757	18961.58	1059.08	20.33	1.53	10.22	8.56	1.66	1387
10	Jharkhand	2262090	1076445.59	67729.04	1711.46	102.50	12719.48	12588.07	131.40	747915
11	Karnataka	7198493	11810112.53	778157.57	24813.07	1639.53	122763.37	117123.77	5639.60	3434188
12	Kerala	255866	216242.42	30701.26	642.50	139.58	1506.18	1506.18	0.00	50764
13	Madhya Pradesh	12250827	32633018.61	1054814.60	32121.12	1649.56	49894.52	49893.57	0.95	2625286
14	Maharashtra	17068158	17553935.95	992802.53	36831.62	4393.95	92146.42	91178.19	968.24	5224056
15	Meghalaya	13789	16588.99	1399.10	84.99	19.28	28.88	28.87	0.00	1180
16	Orissa	7361631	7520881.36	684652.50	17185.82	2894.21	42269.64	42269.64	0.00	1461059
17	Rajasthan	6960403	16231058.89	699185.79	19277.08	365.60	67707.25	67707.25	0.00	1628789
18	Sikkim	1408	822.96	146.86	1.61	0.35	1.28	1.28	0.00	86
19	Tamilnadu	1008686	1629907.27	162548.94	3489.77	380.62	15516.10	15247.46	268.64	267397
20	Tripura	9219	5754.81	975.97	29.65	3.64	47.02	47.02	0.00	2600
21	Uttar Pradesh	8678446	12524903.59	866191.75	17623.30	1996.10	42239.62	39311.71	2927.91	2320595
22	Uttaranchal	54912	60725.86	7558.75	125.43	11.08	290.23	290.23	0.00	14839
23	West Bengal	5078479	2617525.17	369264.65	9637.80	1651.98	37769.60	15876.45	21893.15	10752267
24	A & n islands	850	1304.00	98.15	2.29	0.51	0.61	0.61	0.00	56
25	Pondicherry	20045	30275.81	3959.75	75.79	9.88	149.79	149.79	0.00	3854
	Total	**97073461**	**156211397.40**	**9718111.85**	**294271.77**	**27949.32**	**985692.44**	**937324.06**	**48368.38**	**27036036**

***In Rs. Lakh**

National Agriculture Insurance Scheme (NAIS) Overview for Bihar

Year 2006 - 2007

Details	Kharif Season 2006	Rabi Season 2006-07
Crops Covered	Agahani Paddy, Maize, Chilly, Jute	Wheat, Maize, Lentil, Rapeseed & Mustard, Arhar, Bengal Gram, Onion, Sugarcane, Potato
Unit of Insurance	Block(Paddy), District(Others)	Block(Wheat), District(Others)

Business Statistics: (All farmers)

Details	Kharif Season 2006	Rabi Season 2006-07
Farmers Covered	344686	339623
Area Covered (Hectares)	427025.95	411798.32
Sum Insured (Rs. in Lacs)	59133.08	59420.75
Premium (Rs. in Lacs)	1494.47	1030.79
Claims (Rs. in Lacs)	0.00	0.00
Farmers benefited	75880	0.00

Business Statistics (Total) from the inception of the scheme (from Kharif 2000 season to Rabi 2006- 2007 season) (All farmers)

Details	Kharif Season	Rabi Season
Farmers Covered	1238368	808571
Area Covered (Hectares)	1423796.17	943976.55
Sum Insured (Rs. in Lacs)	158430.01	116393.41
Premium (Rs. in Lacs)	4005.89	1918.20
Claims (Rs. in Lacs)	34551.48	9822.18
Farmers benefited	543122	212269

Source: Agricultural Insurance Company of India Ltd.

Crop Potential in Bihar

	Area (million hect.)		Yield/Kg./ hect.		Production (Million tonnes)	
	2005-06	2011-12	2005-06	2011-12	2005-06	2011-12
Wheat	2.0	2.0	1610	2700 (68%)	3.3	5.4
Rice	3.25	3.0	1523	2400 (57.6%)	5.3	7.2
Maize	0.65	1.3	2390	3750 (57%)	1.5	4.9
Gram	0.06	0.4	1000	1200 (20%)	0.06	0.48
Rapeseed & Mustard	0.08	0.4	926	1100 (19%)	0.08	0.44
Sunflower	0.02	0.6	1345	1500 (12%)	0.04	0.9
Sugarcane	0.1	0.2	41370	45000 (8.7%)	4.3	9.0

Note:- Figures in bracket indicate percent increase during the Plan Period

Livestock Potential in Bihar

	2001-02	2003	2004	2005	2006	2011-12
Total Milk (000, tones)	2632	2869	3175	4743	5060	9000
Eggs (millions)	740	740	780	790	1000	1350
Meat (000, tonnes)	156	173	173	176	175	200
Fish (thousand tonnes)	240.4	261.0	266.5	267.5		380
Honey (000, tonnes)					20-25	30

Financial Outlay required to achieve the Developmental Strategies in Bihar

Proposed Area of intervention	Outlay Needed					Total Outlay
	2008-09	2009-10	2010-11	2011-12	2012-13	
Ensuring Quality seeds,infrastructure, assitance for production & breeder seed, foundation seed and certified feed, quality assurance	45.05	112.63	135.15	112.63	45.05	450.50
Ensuring quality planting material and seeds of horticultural crops including seeds and plant health management	66.58	166.45	199.74	166.45	66.58	665.80
Promotion of Honey Bee as polliniser, honey production and quality assurance	36.50	91.25	109.50	91.25	36.50	365.00
Promotion of Organic farming, vermi-composting, bio control system and certification.	175.00	437.50	525.00	437.50	175.00	1750.00
Plant health management,protection against insects,pests and diseases etc.	75.55	188.88	226.65	188.88	75.55	755.50
Soil health management, management of saline soil and water logged soil	126.00	315.00	378.00	315.00	126.00	1260.00
Water levelling and conservation	75.00	187.50	225.00	187.50	75.00	750.00
Integrated farming system approach	25.00	62.50	75.00	62.50	25.00	250.00
Making Backward and Forward market system	127.50	318.75	382.50	318.75	127.50	1275.00
Input delivery system and quality control	95.00	237.50	285.00	237.50	95.00	950.00
Rural infrastructure including godowns, ware houses, waste utilization etc.	185.00	462.50	555.00	462.50	185.00	1850.00
Human resource development and agriculture extension	158.00	395.00	474.00	395.00	158.00	1580.00
Revamping of RAU, as Heritage Agricuture University, Strengthening of research , education and extension . services	315.00	787.50	945.00	787.50	315.00	3150.00
Diversification of agriculture	95.00	237.50	285.00	237.50	95.00	950.00
Conservation Agriculture	55.00	137.50	165.00	137.50	55.00	550.00

On farm water managements,ponds,tubewell and pressurized irrigation system	351.00	877.50	1053.00	877.50	351.00	3510.00
Risk Management	25.00	62.50	75.00	62.50	25.00	250.00
Livestock health management and development	185.00	462.50	555.00	462.50	185.00	1850.00
Dairy development including value addition	95.00	237.50	285.00	237.50	95.00	950.00
Fisheries development including desilting of Ponds,hatcheries etc.	98.80	247.00	296.40	247.00	98.80	988.00
Miscellaneous program to address the linkages	75.50	188.75	226.50	188.75	75.50	755.00
Strengthening of departments	125.00	312.50	375.00	312.50	125.00	1250.00
TOTAL (Farms , animal sheds etc.)	2610.48	6526.21	7831.44	6526.21	2610.48	26104.81
Monitoring , Evaluation and impact assessment	95.00	237.50	285.00	237.50	95.00	950.00
GRAND TOTAL	**2705.48**	**6763.71**	**8116.44**	**6763.71**	**2705.48**	**27054.81**

Agriculture Production & Yield of Wheat & Rice during 2004-05 & 2005-06 in the major States

Sl.No.	State	2005-06				2004-05			
		Wheat		Rice		Wheat		Rice	
		Production (Million Tons)	Yield (Kg./Hectare)	Production (Million Tons)	Yield (Kg./Hectare)	Production (Million Tons)	Yield (Kg./Hectare)	Production (Million Tons)	Yield (Kg./Hectare)
1	*2*	*3*	*4*	*5*	*6*	*3*	*4*	*5*	*6*
1	Bihar	3.24	1617	3.5	1075	3.26	1609	2.47	792
2	Haryana	8.86	3844	3.21	3051	9.06	3901	3.02	2941
3	Punjab	14.49	4179	10.19	3858	14.7	4221	10.44	3943
4	Rajasthan	5.87	2762	-	-	8.32	2839	-	-
5	Maharashtra	1.3	1393	2.7	1779	1.02	1344	2.16	1425
6	Tamil Nadu	-	-	5.22	2546	-	-	5.06	2703
7	**All India**	**69.35**	-	**91.79**	-	**68.64**	-	**83.13**	-

Source: Ministry of Agricuture Govt. of India