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Policy Brief

WorldTAP: Accessing Knowledge, Information, and Technologies through Training, Capacity Building, and Networking

MICHIGAN STATE UNIVERSITY

WorldTAP Policy Brief 5 – March 2011

Enhancing Agricultural Production and Food Security in Bihar, India

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Introduction

Located in the eastern part of India, Bihar is a landlocked state comprised of a vast stretch of very fertile land nurtured by the river Ganges. With its total population estimated to exceed 94 million, Bihar places amongst the most populous states in India (Directorate of Economics and Statistics, Bihar 2010). The economy of Bihar is primarily agrarian (including livestock and fisheries). In 2010, the agricultural sector represented about one-fourth of the Gross State Domestic Product (GSDP). The average annual income per capita is approximately Indian Rupees (INR) 9,576 (US $210) (Directorate of Economics and Statistics, Bihar 2010).

The agriculture and allied sectors provide income and employment to more than 75 percent of Bihar's population (Department of Agriculture – Bihar, 2009). In addition, agricultural production inclusive of livestock and fisheries is critical to the food security of the state. Although many people's livelihood and food security depend on the success of agriculture, low productivity coupled with rapid population growth rate (estimated decadal growth rate is in excess of 25 percent) has led to many socio-economic problems related to food insecurity, increased poverty and malnutrition, and out-migrations.

A report by the Tendulkar Committee (Tendulkar, Suresh D.; Radhakrishna, R; Ghaia, R.; Sengupta, S. 2009) assessed that more than 43 percent of urban households and 55 percent of rural households in Bihar are below the poverty line (overall over 54 percent). These figures put Bihar at the very bottom of the poor states with the all India average at around 37 percent.

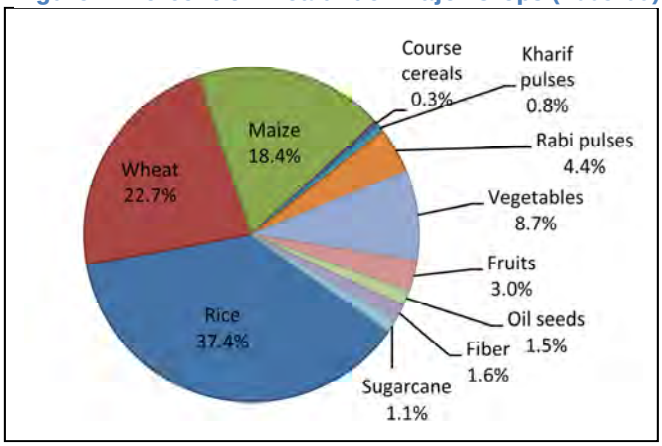
This policy brief presents an overview of the agricultural sector in Bihar and identifies key constraints to crop production. The sustained growth of the agricultural sector is essential to food security in Bihar. While highlighting major implications of low agricultural productivity to the hunger and poverty situation, a key effort by the Government of Bihar to foster revitalization of the agricultural sector is discussed in the latter part of this policy brief. The development and implementation of the Agricultural Roadmap is a remarkable step taken by the Government of Bihar towards the sustainable development of agriculture in the state that could lead to multiple benefits to the farmers and society.

The information presented in this policy brief was gathered using multiple approaches both at macro and micro levels including the review of published information, site visits, and consultations with stakeholders across the food production value-chain in Bihar. As a part of this work, discussions were also carried out with farmers and farmer organizations in Bilap, a farming village near Patna.

Crop Production in Bihar

Endowed by various agro-ecological zones, Bihar has diverse cropping systems. Farmers grow cereals, pulses, vegetables, fruits, tubers, spices, oil seed and sugarcane (Figure 1), and non-food crops such as tobacco, mesta and jute. By the end of 2009, the net sown area totaled over 5.5 million hectares (around 60 percent of the total land area) and is largely composed of marginal and small-holder farmers (Directorate of Economics and Statistics and Department of Agriculture and Cooperation 2010).

Figure 1. Percent of Area under Major Crops (2008-09)



The main cropping season *(Kharif)* in Bihar aligns with the south-west monsoon beginning in July. In addition, tube wells and irrigation canals are abundantly used by farmers for irrigation. Despite the fact that the total irrigated cropping area has increased by about 10 percent over the past decade, only 60 percent of the net cultivated area has irrigation facilities.

Rice and wheat are the most important food staples and dominate the area under cultivation. Rice productivity data indicate an increasing trend towards the national average of 2.13 tons per hectare (Figure 2). However, in the case of wheat, the situation is rather meager where the yield gap has been widening. The multi-seasonal rice production heavily relies on seasonal rains. Wheat is mainly a *rabi* (spring) crop that requires irrigation. Though rice and wheat production areas have remained rather constant, farming patterns indicate a high disposition towards subsistence.

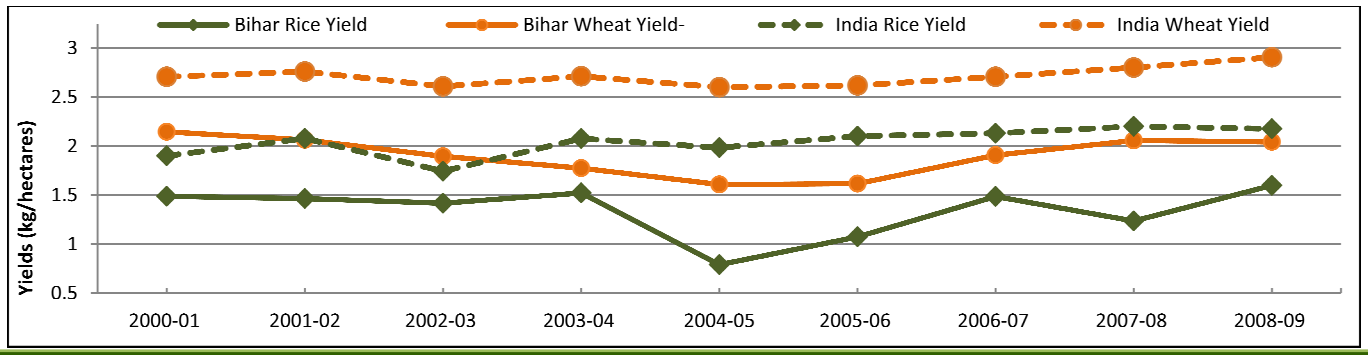
Based on statistics from the Directorate of Economics and Statistics and Department of Agriculture and Cooperation (2010), Bihar is the third largest producer of vegetables and the sixth largest producer of fruits in the country. Major vegetables grown in Bihar are okra, eggplant, cauliflower, gourds and cabbage (National Horticulture Mission, Bihar 2010). Bihar is also a large producer of potatoes and onions for both local and other markets in India. Over 8.5 percent of the net sown area is cultivated with vegetables (0.83 million hectares).

A variety of fruits are also grown. Bihar is the number one producer of litchi in the country (National Horticulture Mission, Bihar 2010). Banana, mango, guava and pineapple are also extensively grown. In the years 2009-10, fruits covered an area of around 0.29 million hectares (3 percent of the net sown area) were under the major fruit crops. Vegetables and fruits generated the greatest revenue per unit weight. With growing demand and attractive revenues, the total area and production of horticultural crops are on an upward trajectory.

Bihar is the largest and only commercial producer of makhana (gorgon nut). Pulses are produced both in the Rabi and *Kharif* seasons. Throughout the past decade, yields of pulse crops in Bihar were always above the national average, nevertheless the cropping area has significantly declined (Directorate of Economics and Statistics and Department of Agriculture and Cooperation 2010). Some of the most commonly grown pulses are lentils, moong, khesari, grams and arhar. Other cash crops such as sugarcane, oilseeds and spices are also produced to some extent and are important to Bihar's economy.

Crop production in Bihar is often affected by natural disasters specially floods and drought. Located on the flood plain, many districts in Bihar are vulnerable to floods each year. The 2009 drought caused huge losses in staple crops and aggravated food insecurity.

Figure 2: Rice and Wheat Yields in Bihar and India



Constraints to Crop Production in Bihar

The agricultural sector in Bihar, especially the crop sub-sector has witnessed a sharp decline and relative stagnation due to over a decade of low investment in agriculture and infrastructure (Banerjee and Iyer, 2005). During the past three to five years, there has been a host of significant political, social, institutional and economic reforms in the state. As a result, the per capita production of food grains increased from 141 Kg in 1993-94 and 167 Kg in 2007-08 (Singh, 2009). However, the yields of major food crops are lower than the national average and high-performing states like Punjab and Haryana (3996 Kg/Ha and 3087 Kg/Ha respectively in 2005 -06) (Figure 2).

Based on observations and interactions with district directors, farmers, consumers and researchers it was evident that food production and availability in Bihar is constrained by a number of factors. The stakeholders brought out different perspectives to different issues, which included the following:

- Land quality and soil fertility
- Lack of irrigation
- Lack of infrastructure (road, electricity, etc.)
- Land holdings and land tenure issues
- Poor access to inputs and advisory/extension services
- Poor training in farming methods
- Low investment in agricultural research and development

The district directors ranked land quality issues to be a less serious issue to food production. However, several farmers responded that they were getting lower yields due to poor soil fertility. Although Bihar is blessed with rich soils, continuous and intensive farming, overuse and misuse of poor quality inputs such as spurious seeds and adulterated fertilizers as well as poor farming practices have undermined soil fertility. It was clear from the interactions with farmers in Bilap village near Patna that farmers misapplied inputs such as fertilizers or used inferior farming methods. This was due to lack of information and knowledge on the use of these inputs and timely availability of fertilizers and other chemical inputs.

When farmers in Bilap were asked about their biggest challenges in present day agriculture when compared to ten years ago, the majority of the farmers responded that it was the drastic change in the rain fall patterns and uneven distribution of rain. Although close to 57 percent of the gross cultivated area is irrigated, the irrigation schemes are highly dependent on the timely arrival of the monsoon as most of the farmers use the surface water.

The problem is that there are not enough rain harvesting systems to store rain water for future use. In the village of Bilap, farmers have constructed small pits to harvest rain water; the pits are very basic and at the time of our visit, they were mostly shallow. Some farmers mentioned that the state tube wells located in the village Bilap were mostly dysfunctional as they were old or did not have a reliable supply of electricity.

Both farmers and district directors identified extension services and transfer of new technologies as the next major constraint. An effective extension system is needed to disseminate technologies and respond to farmers' needs. According to a survey conducted by the National Sample Survey organization (2003), it was revealed that only 5.7 percent of farmers get information on improved agricultural technology from the public extension system, 32.4 percent learn from input dealers and 41.3 percent obtained information from other progressive farmers. Information gathered in Bilap was in line with the results of the national survey. The farmers stated that they had very limited interactions with extension officers and they often learn about new inputs and technologies from other farmers.

Extension requirements vary from place to place based on the requirements of the farmers and available infrastructure. Also, many of the technical positions remain vacant and personnel need to be trained for extension positions. Even at the time of the site visit, 10 to 15 agricultural extension officers were being trained at ICAR on modern farming technologies. The district directors reported during the interviews that the total number of extension officers was less than 3,000 for the entire state. These factors hinder the efficient transfer of technologies and innovations to the grass-root level.

Photo 1: Consultation with Diverse Stakeholders

Since agriculture is the main enterprise in Bihar and the main source of employment for rural people, continuous investment in agricultural research is very important to keep upgrading existing agricultural technologies and services and extending them to the farmers in a timely manner.

Farm productivity can be significantly improved by introducing modern technologies, innovations, and improved farming practices. In recent years the major research institutions in Bihar have become less innovative, mainly due to lack of expertise, funding, and depreciating infrastructure (Department of Finance, Government of Bihar, 2006-07 and ICAR, 2008). In fact, very little applied research is conducted in cereals, pulses, horticulture, animal husbandry and fisheries. The district directors identified lack of investment in agricultural research and development as a serious issue. Investment on agricultural research and extension has been lacking for many years. Only 0.2 percent of agricultural GDP is spent on agricultural research and education compared to the national average of 0.4 percent. Almost 95 percent of this investment is used for salaries and 5 percent for operating costs, thereby leaving hardly any funds for conducting research (Department of Finance, GOB 2006-07). However, they added that the government investment in agricultural research has been gradually increasing, especially during the past three years.

The population of Bihar has been growing steadily over the past decade. With this increasing population comes increasing consumption needs. However, agricultural production has not been able to keep pace with the growth in population in Bihar. Data from the National Sample Survey Office on annual food availability, which includes both food available through domestic production and estimated consumption suggests that Bihar was deficit in total food grain production since the early 1990's (Singh, 2009).

The production, consumption and population for 2012 (the terminal year of the 11th Five Year Plan, 2001-12) were estimated using available secondary data from 2000 to 2009. The average population growth rate was calculated from 2000 to 2009. This rate was assumed to be constant for the next three years (2010 to 2012). The total population of Bihar for 2010 to 2012 was projected using this rate. The normal food requirement for 2012 was calculated by multiplying the per capita food grain requirement for the year by the population. Data on anticipated production assumes that only 50 percent of target production increase set by the Road Map is achieved (Road Map Target: 191 Kg per capita by 2012) provided that all new programs planned for agricultural development are implemented at the grass-roots level.

Although data was limited, a trend line was generated for production and consumption from 2000 to 2012. Figure 2 shows that the yields of major food crops are falling behind the national average. If the current trend continues, Bihar will inevitably be deficit in food grains over the coming years and become reliant on food imports. The erratic yields caused by various limitations pose serious pressure on food security of the people in Bihar and makes the achievement of the production target set by the state more difficult to achieve. Thus, it is essential to understand and address the challenges faced by farmers and implement judiciously planned policies to foster agricultural growth in the state.

Bihar Agricultural Roadmap - a New Strategy for Enhancing Food Production and Food Security in Bihar

A gradual approach to liberate the people of Bihar from the twin traps of hunger and poverty has proven to be inefficient both economically and socially. During the past three years, considerable political, social and economic reforms have taken place in Bihar to curtail poverty, hunger and malnutrition.

Table 1: Five Major Goals of the Roadmap for Improving Agriculture and Allied Sectors in Bihar	
Goal 1	To ensure increase in income of farmers to viable levels, especially considering the small size of holdings.
Goal 2	To ensure food security through increased crop yields combined with profitability.
Goal 3	To foster nutritional security through raising levels of yields, as well as raising living standards of rural societies.
Goal 4	To revitalize farming in order to create gainful employment and to reduce migration.
Goal 5	To ensure agricultural growth with justice through programs focusing on gender and human aspects.

Source: Bihar Roadmap, Government of Bihar, 2010

In 2008, the present Government of Bihar under the leadership of Honorable Chief Minister Nitish Kumar formulated a roadmap for the development of agricultural and allied sectors and proposed to invest more than INR. 61350 million (approx. 136 million dollars) in the Eleventh Five Year Plan. The year 2008 was referred to as the Agricultural Year in Bihar. The road map was presented to renowned scientists and experts, and to more than 2,000 farmers representing all districts of Bihar for their input and feedback.

The roadmap's aim is to trigger "a Rainbow Revolution" in Bihar and thus its objectives go beyond farming. The primary goal of the roadmap is to improve the income and living conditions of the people living in hunger in rural Bihar. The Major Goals of the Roadmap are highlighted in Table 1.

The complete roadmap encompasses – a) Agricultural development; b) Animal husbandry development; c) Dairy development; d) Fisheries development; e) Cooperative sector development; f) Institutional finance; and g) Financing the roadmap. This policy brief only focuses on the agricultural development component.

The roadmap was developed to achieve the major objectives of increasing farm income while assuring food and nutritional security and enhancing agricultural growth with justice. A series of programs are being implemented under the roadmap. The agricultural development programs are focused on various aspects of crop production including seed, horticulture crops, soil health management, crop protection, farm mechanization, transfer of technology, agricultural extension, improved farming models, soil and water conservation technologies, weather stations, micro-irrigation project, agricultural marketing and crop production targets/milestones. These programs cover all aspects of agricultural development from inputs to marketing of final products, and building institutional capacity to better serving farming communities. These programs fall into five major groups:

- Inputs, access, supply and quality
- Transfer of technology and extension
- Income generation schemes
- Marketing
- Capacity building and institutional development

Innovative Approach to Enhance Food Production and Food Security in Bihar

In order to enhance agricultural productivity, the Roadmap proposes a number of interventions and services that need to be improved to better serve the rural farming communities. The key strategies are described below.

Improving access, supply and quality of Agricultural inputs

For enhancing productivity, 23 crops were identified for increased attention in the Roadmap (2008-2012). Input management entails several strategies. Amongst inputs, improved and certified seeds are an important factor that contributes to productivity. Considering very low levels of seed replacement rate, the Roadmap is implementing a crash program to introduce new varieties in the Bihar villages. Other programs include innovative seed programs, production of certified seeds through seed village programs and the agricultural university, distribution of substantial quantities of good quality seeds at subsidized rates, enhancing seed production and seed certification capacity, etc. Similar to field crops, programs are in the process of been implemented for increased availability of quality planting materials and seed production for horticulture crops, as they hold the key for increased income, especially in the case of marginal farmers.

The Roadmap recognizes the importance of chemical fertilizers in increasing productivity. But taking into account the lack of assured availability of fertilizers, the Roadmap identifies the state government to play a more direct role in the import of phosphatic and potassic fertilizers. Considering the constraints in supply of these fertilizers, the Roadmap pushes for a massive program for vermi-compost and green manures. The programs are also designed to warrant the supply of boron, zinc, gypsum and pyrites at subsidized rates, wherever soil conditions so require. Another crucial input is pesticides. A program for rejuvenating existing plant protection centers is an integral part of the Roadmap.

Apart from ensuring supply of inputs and their popularization, the Roadmap also emphasizes quality aspects of the inputs. Tissue culture laboratories for vegetable and fruit crops are been established to assist innovation and improvement of crops. In addition, soil testing laboratories are to be constructed in all the blocks. At district level, the soil testing laboratories are expected to house seed testing wings, bio-control laboratories for rearing natural enemies of pests and pesticide and fertilizer laboratories. An important requirement for increasing productivity is to prepare fields quickly and to reduce the time required between crop cycles. The Roadmap includes a massive farm mechanization program with emphasis on gender-friendly farm tools, equipment and machinery.

Transfer of Technology and Extension

Extension services are the key for the transfer of agricultural technology to farmers at the grass-root level. The Roadmap includes the establishment of 'schools', in farmers' fields. Farmers will be tutored on better farming practices by trained personnel in their fields. Demonstration of various technologies and exposure visits of farmers to other states would also be important components of transfer of technology. The flagship scheme of agricultural extension of the state, the Kisan Samman Yojana, would be further strengthened with experiences gained in the past. At block level, use of information technology in agriculture is proposed to be enhanced through the establishment of e-kisan bhavans, which will offer many services such as soil-testing laboratories, farmer information centers, etc.

Income Generation Schemes

The Roadmap primarily aims to increase the income of farmers. With this in view, integrated farming models prepared by the Indian Council of Agricultural Research (ICAR) and the Rajendra Agriculture University are proposed to be implemented. The scheme is to maximize farm-income through convergence of schemes like dairy, fisheries, horticulture, poultry and duck rearing and crop husbandry ideally on a one-acre land. The Roadmap also visualizes reclamation of degraded land through watershed development in districts of south Bihar.

Marketing

A major program included in the Roadmap is integrated market development with a view that farmers get a higher share of the consumer price. The market development programs include Modern Terminal Markets at the top, agribusiness centers in the middle tier and rural markets or *haats* at the bottom rung. As a part of the market development program about 10,000 on farm primary processing centers are proposed to be built on farmer's fields for value addition and increased income.

Capacity Building and Institutional Development

The Road map has placed a strong emphasis on rejuvenation of extension services, training of staff and farmers and enhancing institutional capacity of the State Agriculture Department. Similarly, the market infrastructure program also calls for an institutional mechanism to oversee developmental activities and for asset management.

The Way Forward

Addressing food insecurity and alleviating hunger and poverty remain a high priority for the state governments of Bihar. Moreover, the Central Government of India has also recognized building food security as a national priority. Both state and central governments have acknowledged the challenges of the post-green revolution in terms of stagnation in the production of staple and basic food grains. India was also affected by the global food crisis of 2007-2008 and this crisis has led to policy reforms and new interventions to address the food security in a sustainable manner. At the national level, the Central Government of India has drafted a new Food Security Bill which is pending approval of the parliament.

This information collected reveals that food security in Bihar is a complex problem encompassing issues related to availability, access and utilization of food. The findings of this study indicate that the population of Bihar is increasing at a steady pace each year and the pace of food production is not keeping up with the pace of population growth. Also, food prices are increasing at a higher rate than the real income of the people. Addressing these issues will require an integrated approach to create an enabling environment at local, state and national levels.

The new Roadmap is devised to improve the agricultural sector by identifying weak parameters and addressing them gradually through various statewide interventions. Although all targets set by the Roadmap may be hard to achieve in the set time frame of four years, progress is already underway in terms of input supplies and marketing. If the current interventions and support for food production and food security programs are sustained, Bihar's food security situation is expected to improve and millions of rural and urban poor can be lifted out of poverty and hunger. The implementation of this new roadmap is still in the early stages. For this roadmap to achieve its goals, it needs to be implemented effectively and monitored closely. It will take several years to see the real impacts of this roadmap and new interventions, and require research to measure them.

The review and analysis of the 2009 Roadmap indicates that the programs and schemes that are proposed and have been implemented focus heavily on enhancing and ensuring food production and availability and to some extent food accessibility. However, in order to build a comprehensive food security program, the strategy must include and consider mechanisms to improve access as well as utilization or adequacy of food, especially in terms of food intake, food safety and quality, and nutritional aspects.

Sites and Institutions Visited in Bihar and New Delhi, India – March 2010

- Meetings and interviews with researchers, government officials and farmers:
  - Indian Council for Agricultural Research (ICAR) – Patna, Bihar, India
  - Bihar District Directors
  - National Centre for Agricultural Economics and Policy Research (NCAP), Dr. Anjani Kumar and Dr. Ramesh Chand – New Delhi, India
  - The Energy and Resources Institute (TERI), Dr. Vibha Dhawan – New Delhi, India
  - International Food Policy Research Institute (IFPRI), New Delhi office, Dr. Ashok Gulati – New Delhi, India
  - Farmers Commission of Bihar - Dr. R. K. P. Singh, Rajendra Agricultural University – Pusa, Bihar, India
  - Farmers organization in the village of Bilap, near Patna – Bihar India
- Other visits:
  - Indian Agricultural Research Institute (IARI) – New Delhi, India
  - Meeting with urban communities in Adam area, in Patna – Bihar India
  - Visit to the neighborhood market near Patna – Bihar India

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