P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-4* ISSUE-2* (Part-1) May- 2019
E: ISSN NO.: 2455-0817 Remarking An Analisation

Technology Advancement in Agriculture (A Special Reference to Selected District of Bihar)

Abstract

This paper looks at potential technologies for marginal districts of the most backward states in India - Bihar. Based on technological performance, we identified the marginal districts for principal crops, i.e. rice, wheat, and maize and assessed the potential of the technologies in terms of their agro-ecological suitability, as well as the complementary inputs required for success. Using secondary data, wegaugethereal opportunities and constraints for technology adoption directly from the farmers, including their aspirations about crop choices and the technologies that exist to grow them. Maizeturnout to be crops that farmers currently aspire to get into. Also, data distinctly reveals, in some cases, the disconnect between perceived potential of the technology among experts and the valuation of the same by likely adopters.

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Keywords: Agriculture Technology, Agriculture Economics, Transfer of Technology.

Introduction

Agricultural technology means technology used for the production of machines used on a farm to help with farming. Tractor is the most common and well known example. Different agricultural machines are used at different stage of agricultural process i.e. from filling the soil to the cultivation of crops.

Technological integration in agriculture, it can be further divided in two parts: (a) Land augmenting technological change. (b) Labour intensifying technological change.

Land Augmenting Technological Change

When advanced biological technique is used for high yielding of crops. It includes the use of fertilizer, high yielding seeds, and advanced irrigation technology and plant protection measures.

Labour Augmenting Technological Change

In this technological change, the labour has been intensified with agricultural machinery. Like tractors, harvesters, threshing machines etc.

So, fewer employees are needed for the same output or we get more output for the same input. Hence a labour cost has been decreased.

Review of literature (Table Summary)

Review of literature shows, past research work, idea generation and provides valuable information related to the research works:

S. No.	Author	Year	Title	Findings
1.	Santosh K. Sahu and Sukanya Das	2015	Impact of Agricultural related Technology adoption on poverty	This paper applies a program evaluation technique to assess the causal effect of adoption of agricultural related technologies on consumption by different indices.
2.	ArundhatiSuvaraj, G	2015	Impact of new Agricultural Technology on income and employment	It is concluded from the analysis that The adoption of new agriculture technology has led to higher rates of growth in Production.
3.	Nooruzzaman	2015	Impact of Technological change on Agricultural development	It has been found that all together use of various inputs like, irrigation, fertilizers, pesticides, HYV seeds, machineries and tools and literacy are responsible to increasing the crop production.
4.	Surendra, P.	2015	Impact of technological intervention on agricultural scenario	It has been found that the farmers who have adopted low cultivation technology, has reduced yield of paddy and sugarcane in Mandya district because seed set treatment, lack of application ofbio-fertilizer And imbalanced use offertilizers, use of oldseedlings.
5.	Singh Nalin	2014	Pattern of labour use in Bihar Agriculture in the context of changing Technology	In this study to examine the pattern of labour use horizontally in different regions of Bihar and vertically across various farm sizes. The study also attempt to analyses labour use by different irrigationstatus of the households and also in various crops.
6.	Sharivastava, Narayani	2014	Technological changes an agricultural development	This study was an attempt to quantify the new import of new paddy technology on paddy production and Agriculture development.

Need of the Study

Agriculture sector plays a very important role in providing employment and food production. In Bihar, a large proportion of population depends on agriculture and agriculture related activities. Economic growth of Bihar largely depends on development of agriculture. Over a period of time extensive use of technology has led to growth in agriculture production all over the world. Bihar is also benefited from technological infusion in agriculture.

Objective of the Study:

The present study is undertaken with the following specific objectives:

1. To identify various technological aspects of selected marginal District of Bihar agriculture.

Research Methodology

In order to achieving the above objectives the following research methodology will be adopted:

Sample Size

For attaining different objectives, the following Agro-climatic zones and represented marginal Districts will be taken for the study purpose:

S. No.	Bihar Agro-climate zones	District (Marginal)	Total cropped area in Hectare
1.	Agro-climate zone (I)	West Champaran	399802
2.	Agro-climate zone (II)	Araria	268913
3.	Agro-climate zone (III) (A)	Banka	165784
4.	Agro-climate zone (III) (B)	Rohtas	320244

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

Justification of Sample Selection:

1. On the basis of Agro climate zones of Bihar.
2. On the basis of use of Techno-Agriculture inBihar.
3. On the basis of highest cropped area in selected Districts of Agro-climate zones of Bihar.
4. On the Basis of Marginal Districts of Bihar.

Data Collection

The relevant data will be collected from secondary sources.

Secondary Data will be collected mainly from Department of Bihar Agriculture controlled by Ministry of Bihar agriculture. In addition data and information will be also collected from, Agriculture Economics Journals and Government Publications of Bihar etc.

Technologies Represented In Marginal Districts of Bihar (Table Summary)

Name of the technology	Definition	Suitable for crop	Suitable area	Special features
1.Water conservation interventions	Interventions which reduce water requirement to produce same or higher level of yield	Crops which are highly water intensive	Mostly in irrigated areas but some interventions can be applied under rain-fed situations	Reduce irrigation water requirement, Maintain water balance of the environment, Reduce GHG emissions due, Yield advantages are also observed in some cases
1.1. Water conservation	Field water conservation through preparation of 20–25 cm dike around the field	Rice, wheat	Irrigated and rain- fed	Reduce run-off to increase effective use of water; Reduce irrigation water by 15–20 % without damaging yield
1.2. Precision water application	In this practice, farmers should determine when and how much to irrigate for optimal crop production, which can be done by irrigation scheduling	Rice, wheat, maize	Irrigated areas	Reduce excess use of water; Reduce methane emission from rice field; Around 20–52 % of water can be saved; In the case of wheat, yield can be increased up to 40 %
1.3. Mid-season drainage through AWD (alternate wet-ting and drying of field)	Drain out excess water to protect plants from soil and salinity effects; Effluent can be used for alternative purpose like ground water recharge	Rice, maize	Low land surface irrigated areas and rain-fed areas which are affected due to salinization or water logging	Increase crop yield; reduce salinization; Up to 42–45%yieldloss due to water logging or salinization can be protected
1.4. Laser Land-Leveling farming (LLL)	Leveling of land with laser leveler	Rice, wheat, maize	Upland areas both irrigated and rain- fed	Reduce water requirement by 20–25 % and reduce fuel use by 20 % without affecting crop yield
1.5. Systems of Rice Intensification (SRI)	7–10-day-old seedlings are transplanted at spacing of 20 cm, with 1–2 seedlings per hill	Rice	Irrigated areas with excess labor availability for agriculture	Reduce water by 30 %; 25–30 % yield can be achieved; Poor management can reduce yield 10– 20 %; Highly labor intensive
1.6. Furrow irrigated bed planting	Growing crops on ridges or beds, Depending on each crop, height and width of the bed aremaintained	Wheat, maize	Irrigated areas for wheat; Irrigated and rain-fed areas for maize	Wheat yield may increase up to 4 % and 30 % less water is required for wheat; 20 % less water is required for maize and better grain yield
2. Energy conservation	Technologies which help to reduce energy consumption during land preparation without affecting yield level; These also help to reduce water requirements for crops	Rice, wheat, maize	Irrigated and rain- fed areas	Reduce fuel and water consumption; Increase yield, Reduce GHG emission.

2.1.Direct seeded rice	Dry seed are sown either by broadcast or drilling in line	Rice	Rain-fed areas with no supple- mentary, irrigation facility	Weeding is a critical problem which causes yield loss; Proper weeding can prevent yield loss.
2.2. Zero-tillage	Crops grown in the zero till field; Happy seeder is also used for planting wheat seed; This practicealso involves incorporating residue of rice crops into rice wheat system.	Wheat, maize	Irrigated area	15–20%watercan be saved without affecting yield; Yield of wheat ranging from 7 to 12tons/ha (or 5–7 % increase in yield as com- pared to conventional tillage); Diesel saving by 8 %; In case of Khariff, maize, 11 % yield canbe Increased.
3. Nitrogen conservation	Technologies which supplement chemical fertilizer use for crops; Long-term benefits are greater than short-term benefits; Integrated nutrient management is key to achieving nitrogen-smart agriculture	Rice, wheat, maize	All types of area	Reduce chemical fertilizer use; Reduce on-farm and off-farm GHG emissions; Improve organic components in soil in the long run to prevent land degradation and yield loss.
3.1. Green maturing	Cultivation of legumes in a cropping system; This practice not only improves N economy but also has many other beneficial effects on soil health/ quality	Rice	All types of area	Reduce fertilizer Nuseby50–75%; Integrated use of green manure increases yield 20 % in upper IGP and 8 % in lower IGP.
3.2. Partial organic farming	Integrated use of FYM with chemical fertilizer to partially (25–50 %)compensate NPK requirements without affecting productivity	Rice, wheat, maize	All types of area	Improve soil health/quality; Reduce 25–50 % fertilizer requirement for rice and maize, 25 % for wheat.
3.3. Complete organic farming	This technology involves use of nutrients from organic sources to 100 % compensate for chemical fertilizer use	Rice, wheat, maize	All types of area	No significant impact on yield; Improve soil health/quality.
3.4. Leaf Col-our Chart (LCC)	Techniques to estimate fertilizer requirement for crop	Rice, wheat, maize	All types of area	Reduce chemical fertilizer use by 30 %; Change in yield depends on farmers, cropcultivation practices
4. Weather	This intervention provides services related to financial security and weather advisory for farmers.	Rice, wheat, maize	All types of area	Compensate financial loss of farmers, Help make decision about seed sowing, which has directimpact on yield.
4.1. Crop insurance	Crop specific insurance to pre- vent income loss of farmers	Rice, wheat, maize	All types of area	Cost of cultivation can be compensated from the losses due to climate change effects.

4.2. Weather forecasting	Information and communication technology-based forecasting about the weather	Rice, wheat, maize	All types of area	Help farmers to make balance between rainfall and irrigation, which reduces irrigation water use; Proper time management gives yield advantage.
5. Knowledge	This involves knowledge about intensive input use for achieving higher levels of yield and to choose seed variety to protect yield loss under difficult conditions	Rice	All types of area	Give higher level of yield, Increase input consumption, mainly fertilizer and water, Protect crop yield under sub mergence and dry situations.
5.1. Fully intensive agriculture	Increase chemical fertilizer use by 100 %	Rice, wheat	Irrigated areas	Up to 20 % yield can be increased, Cost of fertilizer Will increase.
5.2. Partial intensive agriculture	Increase chemical fertilizer use by 50 %	Rice, wheat	Irrigated areas	Up to 10 % yield can be increased, Cost of fertilizer will increase.
5.3. Flood-tolerant variety	Seed variety which is tolerant to flood or heavy rainfall situation	Rice	Rain-fed areas or irrigated areas when flood situation is severe	Yield loss can be prevented in a flood year.
5.4. Drought-tolerant variety	Seed variety which is tolerant to drought or relatively dry weather situations	Rice	Drought prone areas	Yield loss can be prevented in a drought year or under dry situations.

Conclusions

In this paper, we conduct an extant assessment of technologies for crop-specific districts in Bihar.

The technologies in rice with under exploited potential in the marginal districts are as follows:

1. *Varietal substitution towards (climatic) stress-tolerant, high-yielding varieties* developed and tested for specific agro-climatic ecosystems. Some marginal districts lie in these ecosystems and adequate varieties need to be promoted for these areas. The rice cultivars that are high yielding and tolerant to climatic stress (including drought and flood) are available to try in the marginal districts of the states. For example, the Swarna Sub 1 and Varshadhan rice varieties give high yields under flood conditions, while Sahbhagidhancultivar (IR74371- 70-1-1) is drought-tolerant (see Yamano et al. 2013; Reddy et al. 2009). How- ever, ready availability of the right seed cultivars is anissue?
2. *Mechanized Direct Seeded Rice (DSR) technology* for rice-cultivation among small and marginal farmers. This technology saves on cultivation costs by conserving labor and water for irrigation; it also enables timely sowing that helps achieve higher yields for rice, as well as for the succeeding winter crop (wheat) (see Pathak et al. 2011). The crop matures earlier than the traditional practiceby7–10 days. Rohtas is the most marginal rice district in Bihar (with the lowest yields currently across districts). It has started to see some success with DSR. The adoption and spread of this technology needs to be initiated and scaled up in other marginal areas as well. In Bihar, the mechanized DSR is a new phenomenon; its introduction into the state dates to2009–2010. It has so far not been widespread. Bihar is predominantly engaged in manual DSR – 80 % of the rice cultivation area was under manual DSR in1990. Timely transplanting of rice is facilitated through the use of the self-propelled paddy trans planter, while also reducing costs of labor, fertilizer, seed and irrigation, as well as ensuring uniform spacing and optimum plant density. Post-2004, the mechanization efforts in Bihar have met with some success; Bihar has to cover more ground in promoting mechanization. Mainstreaming custom hiring centers would be an important contributor to improving the out- comes in the marginalized districts. There are possible synergies with other forms of mechanization as well, such as the *power-tiller, the pedal thresher and the paddy reaper.* The economies of scope should be exploited among the different forms of mechanization.
3. *Use of integrated nutrient management, involving use of both organic and inorganic fertilizers* can result in superior yields and the achievement of better ‘nutrient-use-efficiency’, but requires many complementary inputs. The System of Rice Intensification (SRI), for example, in conjunction with organic treatment can, in principle, give significantly higher yield and superior nutrient-

use efficiency to rice (see Prasad2006).

4. In maize, the salient technology is the adoption of hybrid varieties, most importantly the single cross hybrids (SCH) that have become widespread in Bihar. Within Bihar as well, hybrid varieties of maize have largely bypassed the marginal districts. Also, there has been much lower adoption of hybrid maize in the rainy season because of flooding issues. Bihar experienced severe floods in 2004–2005, 2007–2008 and 2008–2009 that were most intense in the northern and eastern districts. Water logging affects crop yields in an area of about 0.63 million ha (6.7 % of the total) (Chowdhary.2008).
5. In general, there is a lack of timely availability of hybrid seeds and other agricultural inputs for farmers, along with the usual demand supply gap and lack of timely availability in the rainy season. This can be addressed through an increase in seed production and by strengthening the seed supply chains. Adequate attention is warranted from the private sector during the rainy season, similar to its role in the winter/spring seasons in heralding the hybrid maize revolution in the rainy season. Marginal districts have the potential to become the maize seed hubs of east-India owing to the favorable agro-climatic conditions prevailing mainly in the winter season, along with their fertile and plain land. Marginal districts can enjoy great commercial benefit from sales/export of seed, grain and technology for maize.

The wheat technologies (broadly defined) identified for the marginal districts are:

Surface Seeding Technique for Rice-Wheat Systems

This involves the broadcast of wheat-seeds in standing rice crops, under a condition of excess moisture (low land moist field) 15–25 days before the paddy-harvest. It helps avoid delay in wheat sowing, while also saving on tillage cost. Due to timely planting, higher yields are achieved. Further, it saves water in amounts from 35 % to 40 %.

Zero Tillage Wheat with Resource Conserving Technologies (Rcts)

This involves different sowing practices (like equal row, paired row and control traffic). It can be done through suitable zero till (ZT) drills, double discplanters, multi-crop planters and rotary disc drills in rice residue. Immediately after the rice harvest, zero till wheat is sown through use of a ZT drill, which advances the sowing by15–20days, thereby helping escape the terminal heat stress prevalent in many marginal districts in Bihar. It is estimated to save as much as Rs. 2500/ha in tillage, 20 % in seed, and 20 % in first irrigation, besides an additional yield gain of about 1.0 tons/ha (based on focus group discussions and expert elicitation).

Laser Land Leveling(LLL)

This saves irrigation water, increases cultivable area by 3–5 %, improves crop establishment, improves uniformity of crop maturity, increases water application efficiency up to 50 %, increases crop yield by 15 %, and improves weed control efficiency. The cost of LLL on average is Rs. 400/h and the average cost of leveling is found to be in the range of Rs.5000–9500/ha.

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