

## Trends in Adoption of Farm Technology: An Overview of Survey in Bhagalpur District of Bihar

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### Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Study

### ABSTRACT

Agriculture is the primary source of livelihood for rural areas in Bihar. Agriculture being mostly dependent on monsoon is highly affected by scanty rainfall, weather variations, flood, etc. The study was conducted in Bhagalpur district of Bihar to assess role of different technologies in enhancing income and mitigate challenges faced by farmers. Three villages of Sabour block in Bhagalpur district namely Farka, Ghospur and English were selected for study. A total of 150 farmers (50 from each village) were selected randomly and data was collected using semi-structured interview schedule. Production innovations like high yielding varieties, new techniques, and home-made remedies of costly designs were identified, along with a marketing channel to sell vegetables from diara region. Some new crops like strawberry and fruits plantation in large area seemed to have good scope; poultry business also appeared to be promising. Some constraints were also identified which when rectified can give new potentials to agricultural production in this area.

Keywords: Innovation; adoption of technology.

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## 1. INTRODUCTION

Indian agriculture is diverse in nature. According to 10<sup>th</sup> agricultural census (2015-16) 86.21 per cent of the farmers own less than two hectares of land with average size being only 1.08 hectares. They sustain livelihood by agriculture in resource scarcity and stressed conditions. According to NABARD (2015-16) farm households had an average monthly income of Rs. 8,931 as against Rs. 7,269 earned by non-agricultural households with cultivation being main source of monthly income (35%) of agricultural households, followed by wage labour (34%). The incidence of indebtedness was 52.5 per cent among agricultural households. Weaker economic condition of farmers stops them to try new innovations hence condition of farmers has to increase for all round development and prosperity of rural household.

Indian farmers practice agriculture in diverse habitat coping up with the climatic stress and natural disturbances. Current trends suggest that the environmental conditions are changing at an alarming rate and occurrence of flood, heat waves, and thunderstorm is very common. The country is experiencing declining trend of agricultural productivity due to fluctuating temperatures, frequently occurring droughts and floods [1,2]. These factors are creating problems for the farming community. But capability of farmers for utilising knowledge of local climate and adjustment made using existing technology makes them cope up with stress [3]. Techniques utilised in first green revolution has already yielded its maximum. So, there is a need that farming community takes ideas and innovations from other fellow farmers, agricultural scientists and other sources and may be they adopt some innovations that make agriculture more sustainable and profit generating in their area. Government is also emphasizing today on documenting and promoting useful adoptions by the individual farmers which can be easily diffused among other farmers in the society for income generation and reducing drudgery and improving the living standard of the farming community [4].

The locale under study is Sabour block of Bhagalpur district in state of Bihar. This block has wide variability in land patterns with *diara* and *tal* region dominating the land face. The region witnesses flood almost every year and also face water scarcity during some months of year as farmers are mostly dependent on

monsoon. Though not much study has been done in this area, few studies have suggested the proper agri-preneur behaviour of farmers. Growing of mushroom, papaya, goater, poultry, etc are some ventures that have helped farmers in gaining income and confidence [5]. So, with a view to document the practises that yielded better profit and helped farmers to improve their living standards this case study was conducted.

## 2. RESEARCH METHODOLOGY

The present study was conducted in Sabour block of Bhagalpur district. Being on a proximal distance with a state university, it is consistently used for dissemination and testing of new innovations. Three villages namely Farka, Ghoshpur and English were selected from the block. 50 respondents from each village were selected with a total of 150 respondents. Descriptive research design was used in the study. The interview was conducted with the help of semi-structured questionnaires about the variables and certain case study of innovations was documented by audio recordings and narrations. The perception of farmers about their innovations and adoptions were recorded and was analysed further.

## 3. RESULTS AND DISCUSSION

The study conducted in three villages yielded identification of 34 productions and one marketing adoption. Some adoptions were carried out by more than one farmer like mushroom cultivation was done by four to five farmers, poultry by two farmers and most of the farmers had varietal change of major crops like maize and wheat. Some innovations were introduced by the agricultural university and they were widely adopted as training and extension services were also provided to the farmers. Few other adoptions like growing mung in *Tal* region was traditional practise but was discontinued in course of time. Some innovations have been discussed further in details in this section.

### 3.1 Adoption of Mung in Cropping System

The village under study Farka, Ghospur and English faces problem of yearly flood. Due to recurring flood every year during August-September, only two crops could be taken in a year. Kharif crop was mostly lost due to flood in chaur region. Growing only two crops in a season resulted in low income of farmers and

affected their livelihood. Moong was cultivated in the village since a long time but it was discontinued earlier due to shift to rabi and summer maize cultivation. Some farmers initially tried growing moong in the chaur region as a remedy to utilise chaur land before flood. Moong takes less time and one or two flush can be harvested before flood in Chaur region. Not much input is required but labour requirement during harvesting is high. Productivity rises even up to 4 quintals per acre. Most of the farmers grow it on 0.5 to 2 acres of land. Price widely varies throughout the year from Rs.45 per kg to Rs. 75 per kg. Due to this high price of pulses, farmers started obtaining profit and land is not left fallow anymore. It fulfils the pulse requirement for the household throughout the year and is a good source of protein. This event paved the way for other farmers to utilise their land in similar fashion and moong is widely grown in the chaur region and even in adjoining areas.

As farmers witnessed considerable profit in growing mung beans, major crops like maize was also replaced by mung in some areas but the productivity of traditional varieties being low, mung could not fully replace maize. Only one or two flush of mung is harvested, production would be higher if the third flush could be harvested. Farmers grow it as an extra source of income from waste land.

### 3.2 Adoption of Mushroom

Mushrooms are the edible fruiting bodies of certain fungi grown under climate controlled rooms or sometimes collected wild. Some large and ambitious farmers belonging to high income category were interested in mushroom cultivation. They already had big farms, wheat straw from those farms were utilised in mushroom production. They after being trained in Bihar Agricultural University, Sabour for mushroom cultivation tried cultivating it on small scale in their homes. Large drums and heating stoves were used for sterilization of straw and raw materials. Only few materials like lime and urea were purchased from the market. By their hard work they were able to grow large-sized button mushrooms. But they didn't get market to sell their produce. They even had to distribute it between their relatives for free which incurred heavy economic losses. Rest farmers had to search for new markets. Some sold it in local market and others to the vendors for Rs. 160 per kg generating good income but the demand was

quite low. Still some farmers found it quite profitable venture. There are major marketing constraints like low prices, lack of good market, etc which must be overcome for flourishing this business.

Cost of growing mushroom: Rs. 25,000

Yield: 700 kg

Income by selling mushroom @ Rs.150 per kg: Rs 1,05,000 expected

Profit generated: Rs. 80000 expected

But the foresaid profit was not achieved by the farmer as he couldn't get market for the mushroom produce. Hence this adoption was discontinued.

### 3.3 Changing Varieties of Maize

There are many varieties of maize being planted in Sabour block. Some major varieties used are 3522 & 3533 of Pioneer, 7720 & 6607 of Syngenta, Ganga safedi, 9192, etc. Farmers tend to experiment with new varieties for increasing yield. Pioneer and Syngenta varieties are very much popular as their companies provide good extension service, easy procurement of inputs and also model & progressive farmers to assist farmers during crop production. Input dealers are the major source of information in those villages. Pioneer and Syngenta varieties provide good yield as the yield of maize has increased up to 4-5 quintals per bigha generating higher income. It has been tried with keeping spacing as learnt from the company representatives. These varieties cover around 80% of the total cropped maize area. Some still stick to traditional varieties for the sweet taste. Maize is the source for balanced income in this area. Due to low income some farmers have changed from maize to wheat.

### 3.4 Incorporating Wheat and Raincha in the Cropping System

Owing to the spread of input responsive wheat varieties, some farmers have incorporated wheat and raincha in the cropping system. Wheat varieties like PBW 343 being highly input responsive and having good customer support have gained huge popularity among the wheat-growers. Yield has significantly increased as the farmers have started irrigating the crops, using recommended fertilizer doses, etc. They get

added insurance facilities by the company thus increasing their trust in the variety. Some farmers also performed line sowing of crops requiring less seed rate thus reducing cost of cultivation, but the variety had constraint of late harvesting. Varieties like PBW 343 gives 5-6 quintals more yield than normal traditional varieties.

### **3.5 Incorporation of Vegetables in Cropping System**

Sabour faces constant problem of flooding by River Ganges. Almost every year some part of cultivable land is lost in the river but when it emerges on other side, land is highly fertile and rich in alluvial soil. It is called Diara land and very good for vegetable cultivation. Diara land is a very good vegetable growing region and acts as a good source of income. Mostly contract farming is done in this area, landless labours or other small farmers take land on lease from owners and use it to grow vegetables. Every kind of seasonal vegetables can be grown on these land like pointed gourds, sponge gourd, ridge gourd, brinjal, etc. Farmers earn nearly Rs.50000 per bigha or Rs. 1 lakh per acre from diara land. The profit is equally distributed between land owners and vegetable farmers. The vegetable is mostly grown in the diara region.

### **3.6 High-value Cash Crops Like Onion and Garlic**

Major crops grown in this area are maize and wheat. Prices of these commodities are fixed and farmers have to sell the produce at these prices to PACS or in market by themselves. Income or profit generated from these produce are more or less same every year [6]. On the other hand high value cash crops like onion and garlic have very volatile prices. Prices for these commodities fluctuate from one season to other. Some farmers took the chance to grow these high-value crops like onions and garlic. Onion is an important crop and a major constituent of every day meal. It faces a very high price fluctuation in recent times, sometimes even reaching up to Rs. 140 per kilogram thus, being luxury for farmers. Some farmers used this opportunity to generate higher profits and good return. They planted garlic and onion to get remunerative returns. No storage facility being available in the vicinity forced farmers to sell their produce at low prices. Price fluctuation affected them and proper prices were not obtained due to glut production of onions that year.

### **3.7 Planting Papaya and Other Fruits for Added Income**

Continued problem of low income produced by major crops in Sabour block has led to diversification of cropping pattern by some farmers. A clear example of such diversification is the plantation of papaya as the main crop. They obtained advisory and necessary inputs like seed from agricultural college sabour. Some farmers reported to also grow lemon, pomegranate and other fruits. 30 tonnes per acre harvest can be achieved when proper practice is followed. Selling this at Rs 4500 per tonne generates higher income and the business seems to be fairly sustainable. Papaya plantation proved to be profitable. It is sold for Rs. 50 per fruit in local market.

Farmer is satisfied with the production efficiency and agreed that it has increased; farmer also agreed that higher income can be obtained by this venture which increases economic viability. However, sustainability and labour saving remains undecided, as there is high labour requirement at some point of time in the business.

### **3.8 Poultry Cultivation on Their Own**

Some farmers irrespective of high risk and losses in poultry business rear broiler on their own. They buy chicks, feed and bedding materials from the company and sell the harvest to local dealers. They have to keep the chicks for 1 to 1.5 months. Chicks attain a weight of 1.2 kg to 1.5 kg over a month. Price fluctuates and they attain amount of profit after the harvest. They get a price of Rs. 60 to Rs. 65 per kg of bird. In nearly a farm for 1500 birds, 1100 survives generating an income of Rs 78000. But the profit margin is very low as cost of rearing goes upto Rs 55000 to Rs 60000 for 1500 birds.

### **3.9 Poultry Cultivation as a Change through Company**

Poultry cultivation is widely spread in other blocks of Bhagalpur district. Mostly poultry is reared on contractual basis with the company where company provides chicks, feed, medicine, etc and farmers have to rear it for one month to one and half month, after which it is taken by the company. It generates a very high amount of profit for the farmers and minimises the risk from the farmers. Farmers just have to lower the

mortality rate of the birds. Nearly Rs.35000 to Rs 40000 income is transferred to the bank accounts of the farmer's every time.

### **3.10 Trial of Strawberry Plantation**

A farmer tried strawberry cultivation by growing only 3 to 4 seedlings in his pot. He obtained very good results by producing large sized fruits. The seedling was obtained from agricultural university, but he failed to obtain the seedling next season. So he had to discontinue the innovation. Strawberry cultivation has produced very good results in some districts like Aurangabad and it has a huge scope in this area for willing farmers.

### **3.11 Marketing of Vegetables through River Channels**

Diara region and other regions of sabour block have good production of vegetables but proper marketing is not available. Prices for vegetables is low in Sabour market and continued jam on National Highway limits the reach of farmers to Bhagalpur market. The time wasted in transportation causes heavy loss to farmer as vegetables are demanded fresh to obtain good prices. Some farmers employed an alternative technique for this situation. The vegetables grown in diara region are directly transported to Bhagalpur market by boat in river Ganges [7]. The cost of transportation is reduced and fresh vegetables reach market timely. Vegetables being fresh gets good price in the market. Farmers earn Rs.200 to Rs.300 extra on daily basis.

### **3.12 Low Cost Drip Irrigation System in Vegetables**

Some farmers used low cost drip irrigation system by making all the equipments at their home. They used plastic bottles as a water emitter by boring a hole in its base. Cost of drip system was much reduced as only PVC pipes had to be purchased from the market. This low cost system of drip irrigation had been planned for strawberry cropping but due to unavailability of planting material farmer grew vegetables in the area. Water was saved at a great extent but labour requirement was high as water in bottles was filled manually.

Waghmare and Sangle (2012) stated that though there are many problems in present farming scenario, some marginal and small farmers have

evolved ideas to cope up with this situation [8,9]. It involves adopting new cropping pattern, farming techniques, proper water management approach and understanding the economics of farming. This new approach has made them economically successful and regained their confidence in the agriculture.

### **3.13 Perception of Farmers about Adoption of Technology**

Table 1 shows perception of respondents towards the innovation adopted by them. As many as 15 innovators were totally satisfied with their production efficiency of the innovation and 11 innovators could not decide whether their production efficiency has increased or decreased over previous venture. 5 farmers were not satisfied with production efficiency of their technology adoption.

Sustainability of the venture decides whether the venture will go on for a long time or discontinued. It is important for an innovation to be sustainable for being easily adopted by other members of the social system [4]. As many as 13 farmers were undecided about their venture's sustainability. 9 innovators including some mushroom growers and poultry by their own called their venture unsustainable whereas 13 farmers called their venture sustainable. Sustainable venture included marketing through river channels, poultry by the company, change of varieties of maize and using pioneer and Syngenta varieties, etc.

Labour saving is complex situation, as some crops require labour only at a particular time of the year [10,11]. There was no major labour saving adoptions, only two strongly agreed on labours saving as they used plastic bottle for drip irrigation and vegetables marketing by river channels. Most adoptors using high-yield wheat and maize varieties disagreed on labour saving as more labour is required in these crops. 17 among 35 farmers disagreed to labour saving.

Economic viability is the character of a farm technology to be viable for a long time in monetary terms. Farmers must generate proper profit for his venture. 20 respondents responded to their innovations being viable economically. Only 7 respondents didn't think that their technology was economically viable and can be transferred among a social system. Rest 8 respondents were undecided. Higher income is always necessary for an innovation to be

**Table 1. Distribution of respondents according to their perception about the farm technology**

Sl. no.	Statements	(n=35)				
		SA	A	UD	DA	SDA
1	Production efficiency	15	4	11	2	3
2	Sustainability	6	7	13	5	4
3	Labour saving	2	8	8	10	7
4	Economic viability	4	16	8	3	4
5	Higher income	10	16	2	4	3
6	Input use efficiency	11	7	9	6	2
Total		48	58	51	30	23

successful. 26 out of 35 adoptor farmers generated higher income than other ventures, thus we can say adoptors generated higher profit and their venture was successful. As many as 18 farmers were satisfied with response of input to their adoption, 9 adoptorss being undecided in the matter and only 8 respondents were unsatisfied with their input use efficiency. Devarakonda [12] found that Majority of the farmer innovations/re-inventions 155 (94.51%) has shown high perceived effectiveness followed by medium 7(4.27%) and low 2 (1.22%) perceived with regard to the different attributes i.e., inexpensiveness, availability of inputs, high relative advantage, compatibility, low complexity, trialability, observability, predictability and profitability [12,13].

#### 4. CONCLUSION

Farming in Sabour block is a stressful business as farmers have to face draught and flood in adjacent regions. Climate change has further worsened the situation due to scanty rains and untimely floods. However, by compiling creativity and traditional knowledge base they have coped up with stress and have come up with solutions to their problem. Growing vegetable crop in diara region and planting papaya as the sole crop has added to the income of some farmers. Taking mung and other pulse crops has proved to add income and also helped in utilising fallow land. Some adoptions were also modified in the process like in the case of poultry, others like mushroom failed to give promising return due to lack of available market. Strawberry plantation and poultry rearing has very high potential in the area. Developing a proper marketing infrastructure can help in developing strawberry cultivation and mushroom.

#### CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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