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Impact of Education on Agricultural Operations: A Case study

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Abstract

Agricultural activities as well as the system of agriculture anywhere in the world depend on a set of physical, socio-economic, and techno-institutional determinants. Among these, a farmer's education is very crucial in the process of production. Education plays a decisive role in adopting modern implements and technology in agriculture and, therefore, in the productivity of crops. The main objective of the paper is to analyze the relationship between the farmer's level of education and agricultural operations, including the productivity of crops in the interfluves of the Mayurakshi and Bansloi rivers in Birbhum district, West Bengal, India. Data for the study have been collected from door-to-door surveys by making a suitable questionnaire. Pearson's correlation has been used to show the relationship between the variables. The study shows that almost in all cases, there is a direct and positive relationship between the level of farmers' education and agricultural activities, especially in the application of farm inputs and the productivity of different crops.

Keywords: Correlation, Farmer's education, Agricultural inputs, Net value of crops. Farm implements

Abstrak

Kegiatan pertanian serta sistem pertanian di mana pun di dunia bergantung pada serangkaian faktor penentu fisik, sosio-ekonomi, dan tekno-kelembagaan. Diantaranya, pendidikan seorang petani sangat menentukan dalam proses produksi. Pendidikan memainkan peranan penting dalam mengadopsi peralatan dan teknologi modern di bidang pertanian dan, oleh karena itu, dalam produktivitas tanaman. Tujuan utama dari makalah ini adalah untuk menganalisis hubungan antara tingkat pendidikan petani dan operasi pertanian, termasuk produktivitas tanaman di daerah aliran sungai Mayurakshi dan Bansloi di distrik Birbhum, Benggala Barat, India. Data untuk penelitian ini dikumpulkan melalui survei dari pintu ke pintu dengan membuat kuesioner yang sesuai. Korelasi Pearson telah digunakan untuk menunjukkan hubungan antar variabel. Studi ini menunjukkan bahwa hampir di semua kasus, terdapat hubungan langsung dan positif antara tingkat pendidikan petani dan aktivitas pertanian, terutama dalam penerapan input pertanian dan produktivitas berbagai jenis tanaman.

Kata Kunci: Korelasi, Pendidikan Petani, Input Pertanian, Nilai Bersih Hasil Tanaman. Peralatan pertanian

BACKGROUND

The cultivation of crops as well as their productivity is a complex function of a set of physical, socio-economic, and techno-institutional factors. Farmers all over the world produce crops considering such factors and their own experience. It has been found that, within the same set-up of parameters, there is a variation in the productivity of crops and, therefore, the net value or profit from this sector. It is due to the differences in the level of intelligence, experience, management capacity, and education of the farmers. Although farmers usually have rich knowledge about local conditions and valuable practical knowledge or experience of how best to successfully exploit their environment, they require innovation information generated from research and development to boost productivity in the modern farming system, for which education is obligatory (Apata, 2010). In an era of rapid technical advancement,

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education helps to achieve higher output by using the best technological inputs (Schultz, 1975; Foster and Rosenzweig, 1996). Educated farmers are more likely to explore and adopt new technologies or products early since they have better access to related information and are able to easily distinguish between promising and doubtful innovations (Nelson and Phelps, 1966). They can by far access and adopt more recent advancements in the agricultural sector, such as GPS technology (used for precision farming, which can reduce the amount of agro-chemicals applied in crop production), satellite-based technology like SMOS (which predicts the exact crop production parameters like soil moisture, climate parameters, floods, and droughts), and so on. Education makes it possible for them to adhere to certain specified guidelines for the use of appropriate and suggested chemical and other input dosages (Appleton and Balihuta, 1996; Huang and Luh, 2009). It gives farmers the power to analyse the level of application of inputs and outputs and, obviously, their relationship. Educated farmers can supervise all the farming activities better than an illiterate farmer. Literacy makes it possible for farmers to read and comprehend the instructions on agricultural inputs like chemical fertilizers, pesticides, weedicides, etc., whereas numeracy allows for the computation of the right quantity of inputs to be shared to get the desired output. They help equip the uneducated farmers with new farming knowledge and create a sort of scientific temper in our rural farming communities. Education lets farmers become better managers by enhancing their decision-making skills (Asadullah and Rahman 2009). Education is expected to accelerate agricultural productivity by enhancing the productive capabilities of producers by exposing them to a more systematic and dynamic production system and by enhancing their ability to choose the optimal levels of inputs and outputs (Welch 1970). Generally, educated farmers potentially pay and receive better prices for their inputs and outputs (Jamison and Lau 1982). So, there is a significant and direct relationship between the education of the farmers and the management of agricultural activities and thus their productivity (Young and Deng, 1999; Phillips, 1994, p. 149), although some mixed results have been noticed in some cases.

Literature Review

Many researchershave reported a noteworthy contribution of education to the increase in agricultural output(Abdulai and Huffman, 2014; Asadullah and Rahman, 2009; Azhar, 1991; Chaudhri, 1979; Duraisamy, 1992; Mellor, 1976; Pudasaini, 1983; Ram, 1980; Singh, 1974; Lockheed et al., 1980; Young and Deng, 1999). Lockheed, Jamison, and Lau (1980) observe a strong correlation between elementary school education and farm efficiency. They argue that profits or agricultural productivity vary with the level of education, whether primary, secondary, or higher, with the returns on primary education being the highest. A survey conducted by the World Bank to measure the relationship between farmers' education and their agricultural efficiency in low-income countries in 1992 clearly shows that farmers with basic education were 8.7% more productive than farmers with no education (Gasperini, L., 2000). In Nepal, the completion of at least seven years of schooling increased productivity in wheat by over 25% and in rice by 13% (Jamison and Moock, 1994). Ilevbaoje (2004) observed that agricultural messages could enhance the productivity of farmers when they could access them. In a study in Bangladesh, Asadullah and Rahman (2009) surprisingly show that basic education, especially primary and secondary schooling, is relatively more important for agricultural productivity than higher education. However, research by Wadud and White (2000), Llewellyn and Williams (1996), Kalirajan and Shand (1985), Deb (1995), Coelli et al. (2002), and Battese and Coelli (1995) found no evidence of a substantial relationship between education and farm productivity and efficiency. A notable detrimental effect of education on farm efficiency was discovered by certain researchers (Hasnah and Coelli, 2004).

Studies such as Phillips (1994), Tilak (1993), and Lockheed et al. (1980) also revealed mixed results. In this context, the main objective of the paper is to analyse the relationship between the education of the farmers and the level of application of different inputs as well as crop productivity in the Mayurakshi-Bansloi interfluve of Birbhum District, West Bengal.

Data base and methodology

The study is based on primary data, which is collected by making a suitable questionnaire. The *independent variables* like rate of application of organic manure, chemical fertilizers, farm implements, high-yielding variety (HYV) seeds, irrigation, and labour have been considered here to establish the relationship between the *education* of the farmers and application of *inputs of production* and *output.* For the purpose of collecting relevant information, 250 farm heads have been *interviewed* in five different villages across the entire study area during 2021-22. Relevant data regarding the productivity and total production of five principal crops of this area - aman pady, boro pady, wheat, mustard seed, and potato - has been collected *and* calculated to find out the gross and *net production value* and *gross expenditure value* of the same. Here, crop productivity has been considered as the *net value of crops* or the *net return of* the farms, which has been calculated by subtracting the *gross expenditure value* of each crop from the *gross production value* of the same. The gross production value of all crops has been obtained by averaging the market price (rate) of that crop during *harvesting time (least* price) and in the *event of the least supply* (highest price) of the crops and multiplying it with the total production of that crop. In the same way, the gross expenditure value has been calculated by adding all the input costs.

To find out the *relationship* between the education of the farm heads and the application of different inputs (x), as well as the gross and net production value and gross expenditure value of crops (y), *Pearson's correlation* and for determining the magnitude of relationship *correlation coefficients* (r) have been used.

The study area

The interfluve of the Mayurakshi and Bansloi Rivers in Birbhum district has been selected for the present study. The area is delimited by the Bansloi River in the north, the river Mayurakshi in the south, Murshidabad districts in the east, and Jharkhand state in the west. The area covers Murarai-I&II, Nalhati-I&II, Rampurhat-I&II, Mayureswar-I&II, and Md. Bazar blocks of the district. For data collection five villages namely *Angargoria, Dakshingram, Kamakha, Paikar* and *Tail para* have been selected purposively form different corners of the entire study area. (Figure 1)

The interfluve is one of the agriculturally advanced tracts of the district. The agro-climatic environment of the area is suitable for the cultivation of multiple crops, which are grown throughout the year. More than 80% of the *people* in the study area are engaged in this sector and depend solely on it for their livelihood. They produce a variety of crops like *aman* and *boro pady, wheat, potato, mustard seed,* and a number of other crops and *vegetables* all through the year, depending on the agro-climatic situation and their socio-economic condition. In *KHARIF* season, more than 94% of the plots in this area come under plowing. Different types of modern inputs, like chemical fertilizers, pesticides, HYV seeds, farm implements, labor, irrigation, etc., are used in crop production. *Organic manures* are used selectively, to some extent, to produce some preferred crops. All these increase productivity and, therefore, the *net value of crops* significantly.

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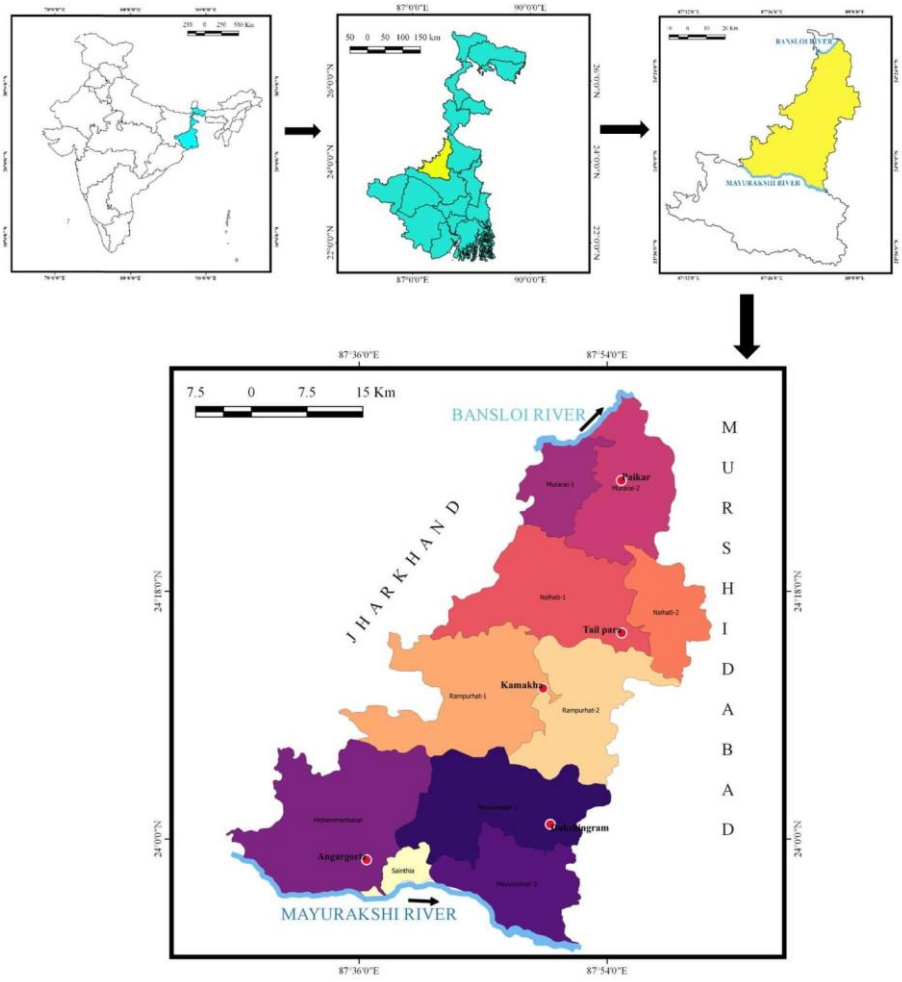

Figure 1. Location of the study area

Educational profile of the farmers

In the study area, more than 74.6% of the farm heads are *literate,* with varying levels of education from primary to postgraduate, although their number varies from village to village. The majority of the literate farmers have either passed out of primary or middle school. There are a large number of farmers in different villages who are engaged in agriculture, some with a *graduate degree* or *postgraduate degree*. At Kamakha village, about 78% of farm heads are literate, whereas the same is true at Angargoria village. The farm heads of Dakshingram, Kamakha, and Tail Para villages are mostly passed out in either the *middle or secondary* sections of schools. (Figure 2)

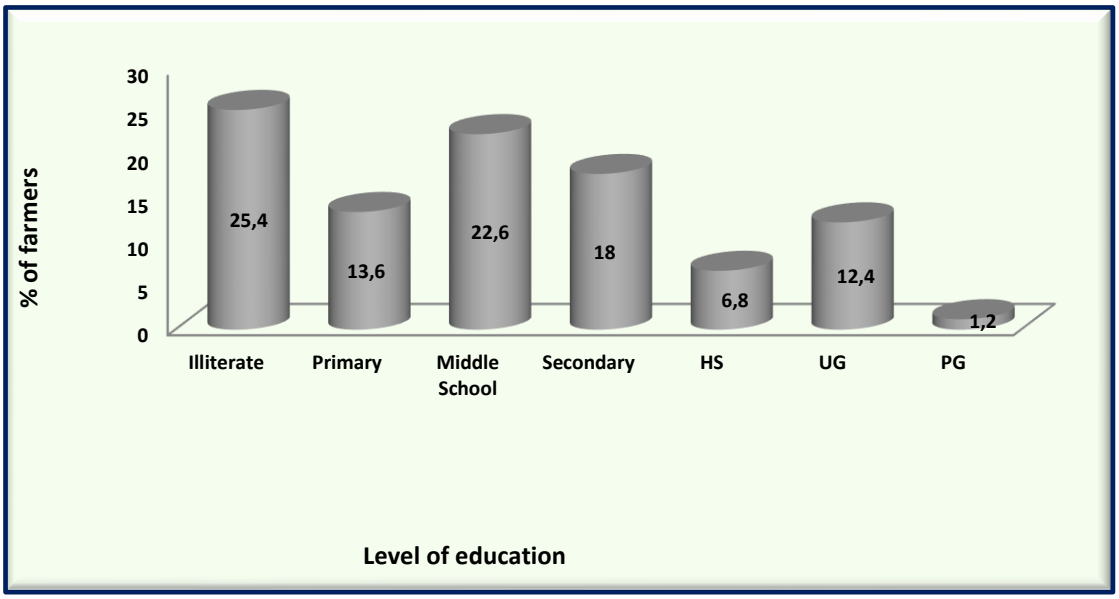

Figure 2. Level of education of farm heads at different study villages (from Field survey data)

Discussion

The study shows that there is a *direct* and *positive relationship* between the education of the farmers and the application of different inputs to production as well as the productivity of crops, although the magnitude of the relationship is *moderate*. In some cases, the correlation becomes *negative,* indicating *rejection of the relationship* between the variables. No *correlation has* also been noticed in some cases.

Educational status of the farmers and application of different inputs

The study made on the basis of correlation coefficients clearly shows that there is a *positive relationship* between the education of the farm heads and the application of different inputs. At Angargoria village, the educated farmers apply a significant amount of organic manure, farm implements, HYV seeds, and irrigation for the production of different crops. They also largely apply chemical fertilizers. In the case of Dakshingram, the same result was noticed. This relationship also holds good for applying irrigation, HYV seeds, and organic manure, although it is not significant. But here, the opposite picture is observed in case of the application of chemical fertilizers. A large number of educated farmers in Kamakha village apply all the inputs, largely except organic manure, which shows an *inverse correlation*. In all the villages, the educated farmers completed their farm work with the help of hired labor, except in Paikar, where there is no correlation between these variables. (table 1)

Table1. Magnitude of correlations between educational status of the farmers and application of different inputs.

Villages	Application of different inputs (Rs)					
	Organic manure	Fertilizers	Irrigation	Farm implements	HYV seeds	Labour
Angargoria	.35*	.11	.32*	.27*	.42**	.22
Dakshingram	.05	-.12	.17	.37**	.07	.15

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Kamakha	-.04	.21	.36*	.24	.33*	.27*
Paikar	.15	.28*	-.07	-.12	.29*	.00
Tail para	-.20	.31*	-.02	.09	.22	.12

Computed from field data ** = Significant at 1% level and * = significant at 5% level of significance

Educational status of the farmers and gross production value of crops

The cash value of the total production of a particular crop or the *gross production value* of crops depends largely on factors like quality of products, market price, demand, and obviously, the productivity of crops. The study shows that education of the farmers has a *direct and significant* correlation with the gross value of aman pady in almost every village, except Paikar. In the case of boro pady, only a *slight positive correlation* is noticed with the education of the farm heads in the farms of Dakshingram, Kamakha, and Tail Para villages. The opposite picture is found at Angargoria and Paikar. It has been noticed that the gross value of the production of wheat crops in this area is also directly correlated with the education of the farmers. It is significant in Angargoria, Kamakha, and Paikar villages. But in case of the productivity of mustard seed, there is *no relationship* with the education of the farmers at Dakshingram. At all other villages, these two variables are *directly correlated, but the* relation is significant at Angargoria and Paikar. The same trend holds good for the potato crop at Angargoria and Dakshingram. But at all other villages, a negative correlation is observed between these two variables. So a mixed relationship is noticed between these variables in this area. (table 2)

Table2. Magnitude of correlations between educational status of the farmers and gross value of production of crops

Villages	Gross value (Rs) of productivity of				
	Aman pady	Boro pady	wheat	Mustard seed	Potato
Angargoria	.33*	-.16	.34*	.51**	.39**
Dakshingram	.49*	.09	.17	.00	.31*
Kamakha	33*	.10	.38**	.09	-.13
Paikar	.17	-.01	.33*	.32*	-.16
Tail para	.42*	.13	.10	.05	-.19

Computed from field data ** = Significant at 1% level and * = significant at 5% level of significance

Educational status of the farmers and gross expenditure value of production

Gross expenditure value, or the total cost to be paid by a farmer for cultivating a specific crop, includes *all the input costs* like seed, fertilizers, pesticides, irrigation, farm implements, labor, transport, and so on. Adding all of these, the total cost of production or gross expenditure value of a crop has been obtained. It is common that educated farmers prefer to adopt the latest techniques in the production process, so they use a variety of modern inputs for the same. This ultimately increases the production cost, although there is an increment in production, and so the net profit for using such keys.

The synthesized observation clearly indicates that the gross expenditure value of all crops is higher on the farms of all educated farmers, almost in all the villages. The education of the farmers here is directly related to the cost of production of boro pady and wheat, although it is significant only in the case of the wheat farms at Angargoria, Kamakha, and Paikar. A positive relationship is also noticed between these two variables for the cultivation of aman pady in all the villages except Dakshingram. But the

relationship is significant only at Tail Para. The same result is noticed for the cultivation of mustard seed in Angargoria, Dakshingram, and Paikar villages. The variables show no correlation at Kamakha, and the same is negatively correlated at Tailpara. The educated farmers at Angargoria and Dakshingram have a large amount of gross expenditure value for the cultivation of potatoes. But a *negative result* is observed between these variables in the potato farms in the rest of the villages. In all cases, the correlation between these two variables is feeble in nature. (Table 3)

Table 3. Magnitude of correlations between educational status of the farmers and gross expenditure value of production

Villages	Gross expenditure value (Rs) of productivity of				
	Aman pady	Boro pady	Wheat	Mustard seed	Potato
Angargoria	.17	.11	.30*	.33*	.36*
Dakshingram	-01	.07	.23	.11	.06
Kamakha	.19	.07	.33*	.00	-.21
Paikar	.17	.07	.32*	.22	-.15
Tail para	.37*	.06	.05	-.03	-.01

Computed from field data ** = Significant at 1% level and * = Significant at 5% level of significance

Educational status of the farmers and net value of crops

The net value of crops indicates the net profit of the farmers. It depends largely on two economic components: the total revenue earned from the production and the cost structure of the production. The study depicts the fact that there is a positive correlation between the education of the farmers and the profit generated from the farms, although the magnitude of the relationship is low to moderate. The educated and skilled farmers generate a significant amount of net value by cultivating aman pady, wheat, and mustard seed crops. The profit is significant in the case of aman pady in all the villages, for wheat in Kamakha and Paikar, and for mustard seed in Angargoria, Kamakha, and Paikar villages. The variables are *negatively correlated* in the case of the cultivation of boro pady at Angargoria, Dakshingram, and Paikar. This indicates that the illiterate farmers have also generated a large amount of net value from crops after cultivating boro pady. The educated potato cultivators in Angargoria, Dakshingram, and Kamakha villages produce a larger amount of net profit, although it is significant only in Angargoria and Dakshingram. But an inverse relationship is noticed between these variables at Paikar and Tailpara villages. Here, the illiterate farmers also produce a large amount of profit by cultivating this crop. (table 4)

Table4. Magnitude of relationship between educational status of the farmers and net value of crops

Villages	Net value (Rs) of productivity of				
	Aman pady	Boro pady	wheat	Mustard seed	potato
Angargoria	.32*	-.22	.22	.39**	.33*
Dakshingram	.31*	-.11	.07	.06	.27*
Kamakha	.35*	.14	.33*	.36*	.03
Paikar	.37*	-.09	.31*	.27*	-.14
Tail para	.28*	.10	.07	.11	-.22

Computed from field data ** = Significant at 1% level and * = significant at 5% level of significance

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CONCLUSION

The findings clearly indicate that there is a mixed relationship between the education of the farmers and the application of agricultural inputs, as well as the productivity of crops. The relationship is positive and more or less continuous in almost all the study villages. In the majority of cases, the relationship between these variables is significant. This indicates that educated farmers apply a large amount of different inputs for the production of different crops. This increases the cost of production, or the gross expenditure value, of all crops. Somewhere, the increase is large and significant for some crops. But at the same time, it increases the gross production value of all the crops. All these boost the net value of all crops, or the net profit of the farms, proportionately, although the opposite picture is also noticed in some cases. Somewhere, the variables are not at all related to each other. So, education has an important role in enhancing crop productivity.

In the present era, where there is a fast-moving change in the field of agriculture around the globe, farmers are in need of continuous education to make them aware of the changes and to adopt the innovations added to this field. Thus, farmers must be educated to generate their highest level of productivity by cultivating crops. Then, they will get their best return from this sector. Their thoughtful application of different agricultural inputs, especially agrochemicals, in crop production will also make agriculture sustainable and pollution-free.

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