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Yield from Pulse Cultivation in Purulia, West Bengal: The Socio-Ecological and Techno-Managerial Interpretation

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Authors' contributions

This work was carried out in collaboration among all authors. Author SM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SKA and AB managed the analyses of the study. Author RC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

In India, pulses are mainly cultivated on marginal lands under rain fed conditions. Only 15% of the area under pulses has assured irrigation. High level of fluctuations in production of pulse crops because of various biotic and abiotic stresses and erratic prices, farmers are not very willing to take up pulse cultivation inspite of high wholesale pulse prices in the recent years. In rice-fallow agriculture in Purulia, pulse is the main source of protein to millions and a dependable mentor of soil health. The present study has been conducted in Manbazar-1 and Purulia-1 blocks of Purulia district and data were collected from 75 respondents who are mainly small and marginal farmers. The selection of the respondents has followed the random sampling method by using an exhaustive list of pulse growers from selected locale. Size of land holding and cost of fuel have got the most importance. The study has offered a unique micro level policy implication at a time when the entire nation is trying to boost up pulse productivity and cultivation throughout the length and breadth of geography of India.

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1. INTRODUCTION

Pulses are one of the important crops which provide high quality protein. Although being the largest pulse producing country in the world, India's pulse production is relatively mere in comparison to country's total cereal production [1].

In India, pulses are mainly cultivated on marginal lands under rain fed conditions. Only 15% of the area under pulses has assured irrigation. High level of fluctuations in production of pulse crops because of various biotic and abiotic stresses and erratic prices, farmers are not very willing to take up pulse cultivation inspite of high wholesale pulse prices in the recent years [2].

Nevertheless, improvement in yields, albeit modest, has contributed to higher pulse production in recent years. Most of the increase in pulse production in recent years has been in gram low pulse yield in India compared to other counties is attributed to the poor spread of improved varieties and technologies, abrupt climatic changes, vulnerability to pests and diseases, and generally declining growth rate of total factor productivity.

In order to give the much-needed fillip to pulse production, the government has included pulses in the NFSM (along with wheat and rice) since the launch of NFSM in October 2007 and has been significantly increasing the MSP for most pulses. In 2012-13 the MSP of Gram and Musur was Rs, 3000 and 2900 respectively which was increased in 2016-17 Rs, 4000 and 3950 respectively.

An important goal in the sustainable use of land worldwide is to increase productivity on available croplands while restricting agricultural expansion, which often occurs at the expense of forests and wetlands. Nine billion people will inhabit the planet by 2050. To avoid crop expansion and just meet projected 2050 crop needs by increasing production, it is predicted that crop yields would need to increase by an estimated 32% more from 2006 to 2050 than they did from 1962 to 2006 during the height of the 'green revolution [3]. However, reaching such increases in yields is highly unlikely. Pulses have a significant role to play in 'sustainable intensification,' yet, in developing countries, production increases have come primarily from the expansion of cropping areas. The yield growth of pulses between 1980 and 2004 in developed countries was 2% per annum, while in developing countries, it languished at about 0.4% per annum [4]. This large yield gap between developing countries and developed countries is of concern and cannot be addressed by improved pulse crop genetics alone, but rather requires a range of interventions, some of which are further explored in the Africa case.

The present study of pulse enterprise, in terms of its selected and predicted character, thus invites a perception of experience on pulse cultivation with the following objectives:

1. To organize a study on socio economic and ecological variables in order to estimate income, livelihood and productivity of pulse enterprises.
2. To estimate the nature, level and direction of interactive relationships among and between yield of the pulse crop and the set of economic and ecological variables as selected for the study.
3. To generate a micro level policy for the improvement in the aspect like income, livelihood and productivity for equitable and sustainable development.

2. METHODOLOGY OF RESEARCH

2.1 Participants

Participants in the survey were 75 farmers of the villages Dhanara & Sidpur. Some of them work on the family farm and some as hired agricultural labours.

2.2 The Locale of Research

Dhanara & Manara GP of the Manbazar-1 & Purulia-1 block of Purulia district in West Bengal were purposively selected for the study. The villages namely were Dhanara & Sidpur selected by random sampling. The area has been selected for the study because of – a) there is sample scope for collecting relevant data for the present study, b) acquaintance with the local people as well as local language, c) the concerned area was very easily accessible to the researcher in terms of place of residence, d) the area was very easily accessible to the researcher in terms of transportation and e) the closer familiarities of the student researchers with the area, people, officials and local dialects.

Chart 1. Sampling techniques and sampling design

Step	Items	Level	Approach
1	State	West Bengal	Purposive
2	District	Purulia	Purposive
3	Subdivision	Purulia Sadar	Purposive
4	Block	Manbazar-1 & Purulia-1	Purposive
5	Gram Panchayat	Dhanara & Manara	Purposive
6	Village	Dhanara & Sidpur	Random
7	Respondents	75	Random

2.3 Pilot Study

Before taking up actual field work a pilot study was conducted to understand the area, its people, institution, communication and extension system and the knowledge, perception, and attitude of the people towards climate change concept.

2.4 Sampling Design

Purposive as well as simple random sampling techniques were adopted for the study.

2.5 Techniques of Field Data Collection

The respondents were personally interviewed from September 2017 to November 2018. The items were asked in Bengali in simple and understandable terms. The entries were done in the interview schedule by student investigator himself at the time of interview.

2.6 Empirical Measurement of the Variables

After reviewing various literatures related to the field of study and consultation with respected chairman Advisory Committee and other experts, a list of variables was prepared.

Variables in the present study have been categorized into two main categories.

1) Independent variables. 2) Dependent variable.

The selected variables for the present study had been operationalised and measured in the following manner.

2.6.1 Independent variables

- Age(x_1): In all societies, age is one of the most important determinants of social status and social role of the individual. In the present study, the age of the respondents was measured on the basis of their chronological age at the time of the investigation.
- Education(x_2): Education is instrumental in building personality structure and helps in changing one's behaviour in social life. Education may be conceptualized as the amount of formal schooling literacy acquired by the respondents.
- Exposure Unit(x_3): Participation in meeting
- Family Size(x_4): Number of family members of individual farmers.
- Family Labour (x_5): Family farming is a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, including both women's and men's. Here the number of family members who attach with the farming was taken as family labour.
- Size of Holding(x_6): The amount of land owned by a person is an important parameter to access the economic status of the person in society.
- No of fragments(x_7): It is the number of fragmented lands of an individual farmer.
- Cropping Intensity(x_8): It has been conceptualized as the proportion of total annual cropped area to the size of holding expressed in percentage. It's calculated as-

$$= \frac{Gross\ Cropped\ area}{Net\ Sown\ Area} \times 100$$

- Home Stead Land(x_9): The amount of land owned by a person is an important parameter to assess the economic status of the person in society.
- Marketable Surplus(x_{10}): The marketable surplus is a term that agriculturalists use to refer to a specific type of surplus that farmers and ranchers deal with. It was taken on the per bigha basis of the individual farmer.

- Marketed Surplus(x_{11}): Marketed Surplus as compared to Marketable Surplus is a practical ex-post concept and refers to that part of the marketable surplus which is marketed by the producer i.e., not only the part which is available for disposal but that part which is made available to the market or to the disposal of the non-farm rural and urban population. It was taken on the per bigha basis of the individual farmer.
- Distance from Market(x_{12}): It's the distance between the market and the field of a farmer.
- Cost of Fuel(x_{13}) $= \frac{consumption\ of diesel.Petrol.Electricity\ in\ a\ year}{Size\ of family}$
- Family Expenditure(x_{14}) = $\frac{\text{Family income in a year}}{\text{Family size}}$
- Total Cost(x_{15}) = $\frac{Total\ cost\ of fuel+Family\ expenditure+Expanse\ in\ pulse\ cultivation}{Size\ of family}$
- Crop Biodiversity(x_{16}) = $\frac{Total\ no\ of crops}{Size\ of holding}$
- Animal Resource(x_{17}) = $\frac{Total\ no\ of\ animal}{Family\ size}$

2.6.2 Dependent variable

Yield from pulse crop (Y): It is measured in term of Kg/Bigha.

3. RESULTS AND DISCUSSION

3.1 Correlation Analysis

The co-efficient of correlations were computed to primarily asses the linear relationship between Yield from pulse crop (Y) and 17 exogenous variables.

3.1.1 Results

Table 1 presents the Coefficient of correlation between yield of pulse crop (Y) and 17 independent variables.

The following variables have been found to register a significant co-relation with yield of pulse crop (Y) viz, family members (x_4), size of holding (x_5), number of fragments and average size (x_7), home-stead Land (x_9), marketable surplus (x_{10}), marketed surplus (x_{11}), cost of fuel (x_{13}), crop biodiversity (x_{16}).

3.1.2 Revelation

Yield of pulse crop has gone better for the families having more family members and those having a higher size of holding land. The more number of fragments distributed over various topography for the same holding land has offered better yield opportunity for pulse crop.

Table 1. Coefficient of correlation between yield from pulse crop (Y) and 17 independent variables (x1-x17)

Independent variable	r Value	Remarks
Age(x1)	-.0.061	
Education(x2)	-0.148	
Exposure Unit(x3)	-0.153	
Family Members(x4)	0.297	**
Family Labour(x5)	0.219	
Size of holding(x6)	0.620	**
Number of Fragments and average size(x7)	0.570	**
Cropping Intensity(x8)	-0.181	
Home-stead Land(x9)	0.374	**
Marketable Surplus(x10)	0.973	**
Marketed Surplus(x11)	0.963	**
Distance From Market(x12)	-0.168	
Cost of fuel(x13)	-0.299	**
Family Expenditure(x14)	0.027	
Total cost(x15)	-0.046	
Crop Biodiversity(x16)	-0.403	**
Animal Resources(x17)	-0.188	

(Source of data: Collected by the authors themselves using personal interview schedule)

However, some studies stated that the large farmers due to adoption of new and improved agricultural technologies have reversed the yield advantage of the small farmers [5].

Sizes of the farms are sometimes attributed for the difference in yields. It is argued that small farmers either increase cropping intensity or raise numbers of crops and their family labour works intensively on and finally increase output per unit of land [6].

The respondents having a bigger size of home-stead land, more marketable and marketed surplus pulse production have contributed to a higher yield of pulse crop.

If the cost of fuel gets increased, farmers will cultivate less number of crops in a lesser area. Ultimately yield will be reduced. Besides, uses of fossil fuel energies create threat to soil fertility and break the economic independence of farmers [7].

Since the pulse is followed in a rice-fallow cropping sequence, it has been nature's choice for farmers with a low value of crop biodiversity.

3.2 Regression Analysis

Table 2 presents the multiple regression analysis wherein 17 causal variables have been regressed against the consequent variable yield from Pulse crop (Y).

3.3 Stepwise Regression Analysis

Table 3 presents stepwise regression analysis wherein 3 causal variables have been retained at the last step to imply their critical contribution to the resultant behaviour of the variable Y (yield from Pulse crop). So, these 3 variables can be as important as in optimum resource allocation or strategic importance in determination of pulse yield.

3.3.1 Result

Tables 2 and 3 present the full model of multiple regression analysis followed by stepwise regression analysis.

Table 2 presents that 17 causal variables together have explained 96.6 per-cent of the variance of the dependent variable yield from pulse crop (Y). That indicates that the selected variables for this study have been fairly relevant.

Table 2. Multiple regression analysis: Yield from pulse crop (Y) with 17 causal variables

Model	B	Std. error	Beta	t	sig.
x_1	-.099	.214	-.012	-.463	.645
x_2	.241	.620	.012	.389	.699
x_3	1.363	1.013	.038	1.345	.184
x_4	2.962	2.526	.072	1.173	.246
x_5	-4.239	2.472	-.074	-1.714	.092
x_6	1.791	1.468	.089	1.220	.227
x_7	.278	1.055	.018	.263	.793
x_8	.066	.100	.019	.662	.511
x_9	.911	1.415	.026	.644	.522
x_{10}	.984	.183	.889	5.389	.000
x_{11}	.043	.197	.037	.217	.829
x_{12}	.414	.721	.022	.574	.569
x_{13}	-.063	.030	-.121	-2.108	.039
x_{14}	-.021	.010	-.267	-2.185	.033
x_{15}	.021	.010	.316	2.202	.032
x_{16}	5.413	6.001	.032	.902	.371
x_{17}	1.467	3.159	.012	.465	.644

a. Dependent Variable: Y

(Source of data: Collected by the authors themselves using personal interview schedule)

R square: 96.6%, The standard error of the estimate: 9.732

Table 3. Stepwise regression analysis: Yield from pulse crop (Y) with 17 causal variables

Model		B	Std. error	Beta	t	sig.
1.	x10	1.015	.033	.917	30.719	.000
	x13	-.041	.013	-.078	-3.033	.003
	x6	1.381	.616	.069	2.240	.028

a. Dependent Variable: Y
(Source of data: Collected by the authors themselves using personal interview schedule)
R square 95.8 %, The standard error of the estimate: 9.768

The stepwise regression analysis elicits that three variables; marketable surplus (x10), cost of fuel (x13) and size of holding (x6) have come out with stronger determining character on yield from pulse crop(Y).

3.3.2 Revelation

The causal effect of higher marketable surplus on yield from pulse crop(Y) is well discernible, higher size of land holding and higher cost of fuel here also offers a better indicator for assessing yield from pulse crop. These three variables have together interpreted 95.8 per-cent of variance embedded with yield from pulse crop(Y).

Some of the literatures also found that marketable surplus depends on the farm size as small farms are not as efficient as large farms in developed areas, however, they could be more efficient in backward regions [8].

Reid [9] also stated that the age and educational status of the household head, household size and farm land size also determine the yields of crops.

4. CONCLUSION

Although, pulse is more important from the nutritional point of view, there is not any significant improvement in India in both area and production since last 50 years [1]. Thus, productivity of small holders can be increased through improving access to institutional financing functionary, spread of agricultural extension network and farm technology centre creation. From the present study, it has evinced that, size of land holding of the farmers of India is one of the greatest factor governing pulse production in India. Besides, they are not only small but fragmented too. So no scientific cultivation with improved implement is possible, which hampers the yield of pulse in Indian context [10]. So, this is only through an integrated effort of policy or programme can help to meet the challenges faced by the pulse production enterprises in India.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Pulses in India: Retrospect and Prospects. GOI, Ministry of Agriculture, DAC, Directorate of Pulses Development, Bhopal, M.P.; 2016.
2. Maurya O, Kumar H. Journal of Pharmacognosy and Phytochemistry. 2018;7(5):1175-1177.
3. Searchinger TD. The food, forest and carbon challenge. National Wildlife Federation; 2011.
4. Nedumaran S, Abhinaya P, Jyothsnaa P, Rao P, Bantilan C. Grain legumesm production, consumption and trade trends in developing countries. ICRISAT; 2015.
5. Fan S, Chang-Kang C. Is small beautiful? Farm size, productivity and poverty in Asian agriculture. Agricultural Economics. 2005;32(Supplement 1):135-146.
6. Singh RKP, Kumar A, Singh KM, Chandra N, Bharati RC, Kumar U, Kumar P. Journal of Community Mobilization and Sustainable Development. 2018;13(1):61-67.
7. Zahid H, Azam KM, Irfan M. Water energy and economic analysis of wheat production under raised bed and conventional irrigation systems: A case study from a semi-arid area of Pakistan. Soil and Tillage Research. 2010;109:61-67.
8. Toufique KA. Farm size and productivity in Bangladesh agriculture: Role of transaction

costs in rural labour markets. Economic and Political Weekly. 2005;40(10):988-992.
9. Reid I. Alberta. Agriculture and rural development and Alberta pulse growers commission and pulse Canada. Factors Influencing Pulse Consumption in Canada. Final Report; 2010.
10. Pal D. 8 main causes of low productivity in Indian agriculture. Economic Discussion; 2007.

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