

THE IMPACT OF NEW AGRICULTURAL TECHNOLOGY ON TRIBAL FARMING: A STUDY OF RANCHI DISTRICT OF JHARKHAND STATE

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The major tribal groups in Jharkhand are dependent on agriculture for their livelihood. Low agricultural productivity and production have resulted into their economic deprivation. New agricultural technology can improve the production and productivity of agricultural sector in tribal region and can cause the improvement in economic condition of the people. NAT has been introduced in this area but it is concentrated in those areas, which have irrigation and other supporting facilities, and among those farmers who have relatively better resource base than the rest of the villagers. Spread of information regarding NAT, improvement in irrigation facility, support from block, bank or NGO, easy availability of HYV seeds and fertilizers are some of the factors, which have helped in adoption, and spread of NAT in this region. Ignorance of the farmers, lack of irrigation facility, poor credit supports etc. are some of the factors restricted its spread. The NAT is characterized both labour and land augmenting one. HYV seed is quick maturing variety therefore, increases cropping intensity. It affects the cropping pattern as well. The nature and magnitude of impact, varies from region to region and therefore, needs to be explored. All these aspects were thoroughly studied in this research work.

Keywords: Agriculture, Tribals, Livelihood, Deprivation, Productivity, Technology.

INTRODUCTION

Jharkhand is a state of India carved out from Bihar state on November 15, 2000. 'Jharkhand', meaning 'the forest area', forms the north-eastern portion of peninsular plateau of India. Out of the total area of Jharkhand (79714 sq.Km) only 23 per cent of the land area (30 lakh hectares) is cultivable. The total population is 21.84 million according to the 2001 census and about 26 percent represents the tribal (indigenous people) population. There are 30 tribal groups in Jharkhand, which include eight minor tribes, known as Primitive Tribal Groups (PTGs). This area was the home land of aboriginal races such as the Santhals, Mundas, Oraons, Hos, Kharia, Bhumij, Birhors, etc. These indigenous people of the area are known as *adivasis* literally meaning 'original settlers' or the earliest settlers¹.

Agriculture, which forms the livelihood of 80 per cent of the people, is still predominantly dependent on rainfall. Net irrigated area forms just 9.3 per cent of net sown area and the vagaries of monsoon hit the economy hard. The productivity of the soil found in the whole Jharkhand is determined by the relief, which divides the land into two categories, viz., upland (*tanr*) and the low land (*don*). The upland produces coarse rice and various such crops. The don land is terraced low and rice is grown. There are three main crop seasons namely, *kharif*, *rabi*, and *garma* (summer) crops. Major kharif crops are rice, *bazra* and maize etc. Rabi crops are wheat, pulses, gram, and mustard etc. *Garma* crops are rice, maize, groundnuts and vegetables etc. The land is irrigated by surface water, reservoirs, wells and natural streams, etc.

The application of new knowledge in the method of cultivation and other agricultural activities by the farmers to increase production, productivity and quality is called the adoption of new agricultural technology (NAT). The NAT aims at increasing agricultural productivity in

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the country by replacing the old method of farming by a modern and more efficient technique of cultivation. The sixties and seventies witnessed the development and widespread adoption of the seed-irrigation fertilizer-plant protection technology ushering in the green revolution. Acceptability[¶] and implementation of NAT usually depend upon the following factors:

- 1) Response of the farmers' community to Innovative ideas.
- 2) Extent and level of Education of the farming community.
- 3) Financial situation of the innovative farmers, credit availability and accessibility to the Adopters.
- 4) Existing position of Technology, and
- 5) The present position of available Agrarian Infrastructures.

OBJECTIVES OF THE STUDY

The study was designed to fulfil the following objectives:-

- 6) To find out the spatial, economic and social class wise and crop wise spread of the new agricultural technology in Ranchi district.
- 7) To explore the extent of spread of the new agricultural technology in Ranchi district.
- 8) To identify the factors affecting adoption of new agricultural technology in Ranchi district.
- 9) To compare productivity between the traditional and new agricultural technology using farmers of the sample villages of Ranchi district.
- 10) To examine the impact of new agricultural technology on production, productivity and income of the people from the sample villages of Ranchi district.

SIGNIFICANCE OF THE STUDY

One of the major problems of tribal regions in general and this area in particular is low level of agricultural production and productivity. Most of the tribes are dependent on agriculture for their livelihood. Low agricultural productivity and production has resulted into their economic deprivation. New agricultural technology can improve the production and productivity of agricultural sector of this tribal region and can thus cause the improvement in economic condition of the people living in this region.

METHOD AND STUDY AREA

This study has been conducted in Ranchi district of Jharkhand state. This district houses Birsa Agricultural University (BAU) and its agricultural extension centres which conduct different agricultural experiments among the farmers in the rural areas of this district. For this Research Study, eight villages from four blocks (viz., two villages from each block) were selected on the basis of three-stage multi-level sampling from Ranchi district of Jharkhand State. First of all four blocks viz., Bero, Bundu, Karra and Murhu were selected on the basis of random sampling.

Macro level data were obtained from the published material and micro level data through village and household surveys and case studies undertaken in eight villages, Jamtoli and Purio from Bero Block, Pancha and Tunju from Bundu Block, Birda and Madugama from Karra Block, Burma and Gutigada from Murhu Block. Data were collected for agriculture year 2011-2012,

pertaining to the three main agricultural seasons, e.g. *Kharif, Rabi and Garma* (summer crops).

Land Utilisation

In general, a higher proportion of cultivable land to total area in the state shows a higher potential of agricultural output.

Table 1
Land Utilization (2002-03)

Country/State	Cultivable Area as % of Total Area	Net Irrigated Area as % of Net Area Sown
Jharkhand	52.48	9.27
India	46.90	35.41

Source: Ministry of Agriculture

Less than 10 per cent of the total sown area of Jharkhand is under irrigation. Economically better performing states like Punjab has as high as 94 per cent of its sown area under irrigation.

Food Grain Yield

An important indicator of measuring agriculture productivity is food grain yield. The basic food grains include cereals and pulses².

Table 2
Yearwise Food Grain Yield in the Jharkhand Compared to India

(in kg/ha)

States	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Jharkhand	1199	1053	1490	1479	1077	1550	1588	1678
India	1734	1535	1731	1744	1716	1756	1854	1898

Source : Ministry of Agriculture, GOI, Various Years.

Fertilizer Consumption

As part of modern technology, the use of fertilizers has been encouraged as it increases the yield from the soil. Thus, higher per hectare consumption of fertilizers is an indicator of improved productivity from agriculture.

Table 3
Yearwise Fertilizer Consumption in the State of Jharkhand

(kg/ha)

Country/State	2001-02	2002-03	2003-04	2004-05	2005-06
Jharkhand	88	87	81	62	68
All India	82	82	85	95	107

Ministry of Agriculture, 2004.

Bank Credit to Agriculture

The lower amount of agricultural loan extended per household may affect the agricultural productivity further as there might be a consistent financial constraint in investing in agriculture³.

Loan extended to agriculture per household is considerably lower in Jharkhand as compared to economically developed states like Punjab, Maharashtra and Tamil Nadu.

Area under Crops in Ranchi District and Sample Blocks

The main crops of Ranchi district are paddy, wheat, maize, pulses, oilseeds, vegetables and millets etc. Paddy is cultivated on around 80 percent of the gross cropped area. The other crops occupy a very insignificant portion of the total geographical area.

Table 4
Area under Crops in Ranchi District and Sample Blocks
(as a percentage of Gross Cropped area)

District/Blocks	Paddy	Wheat	Maize	Pulses	Oilseeds	Vegetables	Millets
Ranchi	86.60	1.70	2.12	15.33	3.07	9.52	15.19
Bero	68.50	3.94	0.02	6.69	2.02	10.36	1.84
Bundu	82.25	1.89	0.05	3.97	4.23	2.20	0.67
Karra	78.87	0.92	0.08	4.27	6.15	2.64	1.87
Murhu	79.71	0.38	0.46	2.27	5.10	1.61	2.55

Source: Compiled from District Credit Plan 2001-2002, Ranchi, Published by Bank of India.

The Operational Land Holding

Most of the farmers have very small size of holdings⁴. More than 70 percent of the farmers have less than one acre of land. In Murhu block around 40 percent own less than one acre of land. On the other hand less than 2 percent of the farmers of Bero Block. (Appendix-2).

Irrigation

Around 6 percent of the gross cropped area of Ranchi district is irrigated. Well is the most important source of irrigation in most of the sample blocks. As much as 88 percent of the irrigated area of Karra and more than 60 percent of those of Bero and Murhu were irrigated by this source.

Banking Services

According to the District Credit⁵ Plan 2001-2002, Ranchi, published by Bank of India (Lead Bank Scheme), in sample blocks of Ranchi district there were 11 commercial banks (CBs), 10 Regional Rural banks (RRBs), 4 District Cooperative Banks (DCBs), 2 Land Development Banks (LDBs) and 17 LAMPS. Thus, 44 various credit institutions were functioning in sample blocks (viz., Bero, Bundu, Karra and Murhu) .

Marketing Facilities

There were 42 weekly village hats⁶ and 4 regular markets in the Sample Blocks (viz., Bero, Bundu, Karra and Murhu) according to the survey 1991. In these markets the farmers sell their

products and also buy some necessary household items.

ANALYSIS

Profile of the Sample Blocks and Villages

196 respondents were contacted from these 8 sample villages for the analysis of the impacts of the adoption of new agricultural technology (NAT) in Jharkhand State. The total population of the sample villages was 1314, 52.74 percent were male and 47.26 percent female. The table -5 below shows the percentage of respondents selected from each village.

Table 5
Village-wise Distribution of the Respondents

Villages	Blocks	Respondents (in Percentage)
Purio	Bero	13.27
Jamtoli	Bero	13.78
Tunju	Bundu	12.76
Pancha	Bundu	11.22
Birda	Karra	11.73
Madugama	Karra	11.73
Burma	Murhu	13.27
Gutigada	Murhu	12.24
Grand Total		100.00

Source : Primary

Caste Group

The respondents belonged to three caste groups OBC, SC and ST. They represented 10.05 percent, 12.56 percent and 77.40 percent respectively of the sample households. More than half of the respondents are the followers of *Sarna* religion about one third are Hindus and other are Christians.

The Main Crops in the Sample Villages

The main crops produced in the sample villages are paddy, *marua*, sweet potato, pulses, vegetables, wheat, tomato and oilseeds. Rice being the staple food of the villages, paddy is the main crop. The study reveals that the highest proportion of net sown area (72.16 %) was used for the production of paddy and it represents 83.12 percent of the gross yield. *Marua* was another important crop of the sample villages. 7.33 percent of net sown area was brought under the *marua* crop and it represented 5.91 percent of the gross yield.

The Cropping Pattern

On an average paddy crop occupied more than 76 percent of the gross cropped area in the district and only 24 percent of the gross cropped area under wheat (2.26 %), maize (2.05 %), millets (2.62 %), pulses (2.74 %), potato (1.11 %), oilseeds (4.07 %) etc. Wheat is a relatively new crop for this area. Cropping pattern of various sample blocks are presented in the table below.

Table 6
Area Under Different Crops
(As percentage of Gross Cropped Area)

Blocks	Paddy	Wheat	Maize	Millets	Pulses	Potato	Tomato	Oilseeds
Bero	68.50	3.94	0.02	1.84	5.29	8.56	0.27	2.02
Bundu	82.25	1.89	0.05	0.67	2.29	0.99	0.82	4.23
Karra	78.87	0.92	0.08	1.87	3.10	1.51	1.06	6.15
Murhu	79.71	0.00	0.46	2.55	0.00	0.73	0.79	5.10

Sources: Compiled from District Credit Plan 2001-2002, Ranchi Published by Bank of India.

Area under HYV Seeds

The average area under HYV paddy crop was recorded 77.33 percent of the total paddy cropped area in 20 blocks of Ranchi district.

Use of Chemical Fertilizers

The chemical fertilizers used in Ranchi district were Nitrogen (N), Phosphorous (P) and Potassium (K). The per hectare average consumption of NPK combination was estimated to be 46.35 kg in Ranchi district. The per hectare average consumption of the NPK combination of the sample blocks viz.; Bero, Bundu, Karra and Murhu is 63 kg, 70 kg, 17 kg, 42 kg respectively.

Table 7
Use of Fertilizers per ha. (in Kg.)

Use of Fertilizers per ha. (in Kg.)				
Blocks	N	P	K	Total
Bero	40	16	7	63
Bundu	43	21	6	70
Karra	10	5	2	17
Murhu	21	16	5	42

Sources: Compiled from District Credit Plan 2001-2002,
Ranchi Published by Bank of India.

The Ratio of Fertilizers Used

The ratio in which the three constituents had been used in the blocks of Ranchi district is given in the table below.

Table 8
The Ratio of Fertilizers used

Blocks	N	P	K (Potash)
Bero	63.49	25.40	11.11
Bundu	61.43	30.00	8.57
Karra	58.82	29.41	11.76
Murhu	50.00	38.10	11.90

Sources: Compiled from District Credit Plan 2001-2002 Ranchi Published by Bank of India.

IMPACT OF NEW AGRICULTURAL TECHNOLOGY

Donal and Donald (1995)⁷ have suggested that sustainable agriculture must meet four important criteria: (i) it must produce adequate food of high quality, (ii) be environmentally safe, (iii) protect the resource base, and (iv) be profitable. This section tries to evaluate the impact of new agricultural technology on production and productivity, marketable surplus and income of the cultivators and its effect on environment of the sample area.

The use of HYV seeds along with other complementary inputs has increased the production and productivity of the crops for which they have been used. The use of fertilizer helps in regaining the soil nutrients but the chemical fertilizer and pesticides have affected the environment adversely. Excessive use of water for irrigating HYV crops in some areas has affected the ground water level as well.

Impact on Cropping Pattern

The cropping pattern⁸ refers to the yearly sequence and spatial arrangement of crops and fallow, in a given area. The study revealed that before the adoption of NAT the net sown area under *kharif* crop was estimated 75.70 percent whereas, after the adoption of NAT the area decreased to 68.02 percent of Gross cropped area in the sample villages. The area under Rabi crop was estimated at 14.36 percent before the NAT whereas, after the adoption of NAT the area increased to 18.73 percent.

Block-wise Impact on Cropping Pattern

The area under *Rabi* and *Garma* increased after the adoption of NAT while that of *Kharif* declined in all the blocks where the study was made. The areas under both these crops increased by around 4 percent each in all the blocks.

Cropping Intensity

Cropping intensity refers to the ratio between total cropped area and actual net cultivated area expressed in percentage. Cropping intensity = Total cropped area in a year/Net cultivated

area X 100. The average cropping intensity of the 20 blocks of Ranchi district is estimated 118.44 percent. The average cropping intensity of the sample blocks viz.; Bero, Bundu, Karra and Murhu are estimated 119.70 percent.

Table 9
Impact on Cropping Pattern (acre in percent)

Blocks	Area Under Rabi		Area Under Kharif		Area under Garma	
	Before NAT	After NAT	Before NAT	After NAT	Before NAT	After NAT
Bero	19.11	24.34	67.86	58.53	13.03	17.12
Karra	8.29	13.19	86.77	79.00	4.94	7.81
Bundu	8.53	12.28	83.12	76.83	8.35	10.90
Murhu	17.13	19.76	71.20	66.03	11.67	14.21
Total	14.37	18.73	75.69	68.05	9.94	13.22

Source : Primary

Average Yield of the Main Crops

Per acre average yield of paddy was recorded 844 Kg represented the highest yield among all the crops grown in the sample villages. The per acre average yields of main crops of the sample villages are presented in the Table given below.

Table 10
Per Acre Average Yield of the Main Crops of the Sample Villages

(in Kg/ acres)

Main Crops of Sample Villages	Average Yields After NAT	Average Yields Before NAT	Difference in production
Paddy	844	677	167
Marua	591	306	285
Sweet potato	552	340	212
Pulses	283	146	137
Vegetables	464	167	297
Wheat	425	127	298
Tomato	272	139	133
Oilseeds	242	135	107
All Crops	3673	2037	1636

Source : Primary

IMPACT OF NAT ON TOTAL OUTPUT

Output refers to the total yield of the crop during a specific crop season from the total crop

area. Per acre higher yield implies the higher production and higher production implies the higher output.

Table 11
Impact of NAT on Total Production (In Kg)

Crops	Before NAT Gross Production	After NAT Gross Production	After NAT Change
Kharif Paddy	242250	512860	270610
Garma Paddy	9311	15662	6351
Wheat	6413	12617	6204
Marua	16215	30060	13845
Vegetables	22930	41385	18455
Tomato	9348	16699	7351
Potato	9868	18101	8233
Sweet potato	13210	23434	10224
Pulses	5228	9153	3925
Gross Production	334773	679971	345198

Primary Source

Hence, the gross output obtained on account of the adoption of NAT was estimated higher than the gross produce obtained without adoption of NAT. The increase in the gross output was estimated to 49.23 percent on account of the adoption of NAT.

SUMMARY AND CONCLUSION

The main finding of the study are classified into positive impacts and obstacles. They are as follows:-

Positive Impacts

Some specific findings of the impact of new agricultural technology and transformation among the farmers' community of the regions under study are noteworthy: -

- 1) Many small and marginal farmers including the tribal farmers have started using high yielding variety seeds, chemical fertilizers, insecticides, pesticides and sprayers.
- 2) The growth in the level of overall awareness among the beneficiaries was observed.
- 3) The tribal farmers and other marginal farmers of the regions have more food to eat and have lessened the period of food scarcity.
- 4) Improvement in food habits reduced the problems of malnutrition, under nutrition and starvation.
- 5) In the sample villages vegetable consumptions have improved the overall health and hygiene of the farming community of the region. The vegetable sales enabled the farmers to educate

their children, better clothing and other such benefits

Burning Obstacles

Some of the burning obstacles in the path of adopting new agricultural technology among the tribal farmers of the region under study were as follows:

- 1) Due to lack of adequate and timely assured irrigation facility the agricultural activities are often delayed..
- 2) In order to increase productivity the technical input has got to be reoriented and reinforced.
- 3) Lack of manpower in the household due to increasing preference for nuclear family pattern and migration of youth to urban centers for glamorous city life.
- 4) There were inadequate marketing facilities for good price.
- 5) There was Loss of interest in agriculture especially among the educated youth of the villages.

Policy Implications

The following policy implications are recommended:-

1. The basic needs of the village can be and should be met locally if sustainable development has to have any meaning.
2. Soil fertility in dry lands can be sustained only through maintenance of organic matter and achieving better fertilizer use efficiency through integration of
3. moisture-conservation practices along with soil-fertility management. Strategies for on farm generation of organic matter need to be evolved.
4. Agricultural universities and research organizations have to lay more emphasis on developing seeds, which require less water, so that farmers are able to increase productivity even in critical environment conditions.
5. Agriculture is still dependent on timely arrival and intensity of the monsoon. It is high time that an overall water management plan for conservation of water, preparation of watershed schemes, rainwater harvesting and recharging of ground water.
6. Information technology should be used for maintaining an update and enriched database of region specific agricultural information and timely dissemination to farmers of information.
7. Thus it could be concluded that the tribal farmers of Jharkhand are capable of turning the soil of the plateau into fertile land if perennial water flow is assured into their fields. The tribal farmers of Chotanagpur (the greater Jharkhand) are well known for honesty and hard labour. If the basic infrastructures along with the assured irrigation facilities were set up in the region they could turn the plateau in to grain bowl. Therefore, it is a challenge for the policy makers, academicians and the planners to invest on these basic infrastructures in the region on a priority basis.

References

- A. Van Exem, (1992): Basic Socio-Economic Attitudes of Chotanagpur Tribals:, Catholic Press Ranchi.
Annual Report (1999-2000): Karra Society for Rural Action.

- Banerjee, K.G., Jharkhand an Outline:, Kailash Paper Conversion (P) Ltd., Ranchi, 2009, p.5.
- Bhandari, L. & Kale, S., Indian States at a Glance 2008-09, Jharkhand, Dorling Kindersley, Pvt. Ltd., New Delhi, 2009.
- Deogharia PC (2011) 'Employment of Agriculture Labour in Mechanised and Non Mechanised Farms of Jharkhand' Southern Economist, Vol.-50, No.-15.
- G Toppo, (1996): Agricultural Innovation and Problems of Diffusion, Catholic Press Ranchi, p. 65.
- Bharti and J P et al., Economic Structure of Tribal Agriculture in Nainital, Tarai, Indian Agricultural Situation, 28 (2), pp. 821-825.
- LP Donald, and L W Donald, (1995): Technology for Sustainable agriculture, Sci. Am. 273 (3): pp.182-186.
- Bhilegoankar M G, (1976): A Study of Fertilizer Utilization Behaviour of Farmers and Communication Pattern under Constraints, IARI, New Delhi, p.87.
- Praveer, P. (2001): Jharkhand Profile.
- VNP Sinha and LKP Singh, (2003): Jharkhand Land and People, Rajesh Publications, New Delhi, p.385.