

Enhancing Productivity and Profitability of Tribal Farmers of Jharkhand through Institutional Linkages

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ABSTRACT

Public sector extension continues to be the most important source of information for majority of farmers but its performance is under scrutiny for quite some time and questions are being raised on its capability to deliver goods and services in the rapidly changing environment. The shifting emphasis of Indian agriculture towards diversification, commercialization, sustainability and efficiency has made it necessary to look for new approaches and models for extension. The Indian Agricultural Research Institute (IARI) over the period has experimented with different extension approaches and models which have immensely contributed to the development of roadmaps for national extension systems. One such model of Institutional partnership based extension to diffuse IARI technologies all over India, a partnership led extension was initiated under National Extension Programme. Under this programme the IARI varieties and production technologies were diffused in collaboration with 15 ICAR Institutes and SAUs for quick and wider spread to a large number of farmers in different parts of the country. One such collaboration with Birsa Agricultural University (BAU), Ranchi was initiated to address the production problem of tribal farmers of Jharkhand during year 2007-08 (Rabi Season). The specific objectives of the project are to demonstrate improved seeds of major crops and to produce quality seed by the farmers themselves. Although, agriculture is main source of livelihood for 80 per cent of the population in Jharkhand, it is characterized by reliance on low investment, low productivity and mono cropping with paddy as the overriding crop. Under this collaboration suitable crop varieties of paddy, wheat, mustard, lentil and vegetables were demonstrated on farmers' fields. Farmers were continuously giving their opinion towards selected traits of the demonstrated improved varieties of rice. Paddy variety Pusa 2511 was preferred by the farmers due to its high yield, aroma and long grain quality. It has been accepted and adopted by the farmers in the demonstration villages as well as nearby villages. Rice variety Jaldi Dhan-13 was demonstrated during kharif 2012 and 2013 was liked owing to its coarse grains for their own consumption as they perform hard physical activities and found this variety suitable for their upland areas. Among rabi crops, wheat variety HD-2733 was liked by farmers due to its high yield, varieties HD-2985 and HD-2932 due to their relatively early maturing trait. Pusa Jaikisan variety of mustard was preferred by the farmers due to its high yield and relatively more oil content. Majority of the farmers preferred to grow mustard with wheat, due to the fact that area under irrigation was relatively less. The farmers also revealed that varieties provided by IARI were insect-pest and disease resistant. The paper describes the process and outcome of the IARI interventions for having its implications among extension professionals and practitioners in India.

Keywords : Productivity, profitability, tribal farmers

INTRODUCTION

Agricultural sector in the developing world is changing rapidly and is driven by a number of external and global factors. Therefore, extension services which have a crucial role to play in promoting agricultural innovations have to keep pace with the changing context for improving livelihoods of the farming community. A number of innovative approaches and methods have been evolved to transform the extension system and to respond

to changing demands and challenges. In this context partnerships and linkages for pluralistic systems offer a tremendous opportunity in today's context, the concept of linkage implies the communication and working relationship established between two or more organisations pursuing commonly shared objectives in order to have regular contact and improved productivity. Havelock (1986) contends that linkage is a term used to indicate that two systems are connected by messages so as to form a greater system. The linkages are important for

improving the effectiveness of extension systems to resolve the problem of coverage, ability to relate cause and effect, accountability, fiscal sustainability, and interaction with knowledge generation.

Public sector extension continues to be the most important source of information for the majority of farmers but its performance is under scrutiny for quite some time and questions are being raised on its capability to deliver goods in the rapidly changing environment. The shifting emphasis of Indian agriculture towards diversification, commercialization, sustainability and efficiency has made it necessary to look for new approaches and models for extension. India has made significant achievements in agriculture by increasing food grain production by about five folds during last six decades. Among many drivers to accomplish this task, the policy, research and extension support have played crucial role.

Public extension played a major role in ushering green revolution in Indian agriculture. However, considering the varied agro-ecological situations under which farmers operate besides variations in the resource base of farmers, the extension system envisaged to achieve desired growth in agricultural sector has to be pluralistic in nature and hence multiplicity of extension systems are operating in India.

Indian Agricultural Research Institute (IARI) over the period has experimented with different extension approaches and models, which have immensely contributed to the development of roadmaps for national extension systems. One such model of Institutional partnership based extension to diffuse IARI technologies all over India, a partnership led extension was initiated under National Extension Programme.

Under this programme, the IARI varieties and production technologies were diffused in collaboration with 15 ICAR Institutes and SAUs for quick and wider spread to a large number of farmers in different parts of the country. One such collaboration with Birsa Agricultural University (BAU), Ranchi was initiated to address the production problems of tribal farmers of Jharkhand during year 2007-08 (Rabi Season). Ranchi has a hilly topography and is surrounded by dense tropical forests. The district is spread over 18.73 lakh acres. Total rainfall of the state is more than sufficient to raise 2-3 crops satisfactorily, but its distribution is highly skewed, with more than 80 per cent of the rain occurring during four monsoon months (June-Sept.) restricting the farmers with no other choice except to grow only one rainy season

crop and during the rest of the year the land remains fallow due to lack of irrigation. The specific objectives of the project are to demonstrate improved seeds of major crops, to produce quality seed by the tribal farmers and thereby enhancing their productivity and profitability.

METHODOLOGY

The project was initiated from rabi 2007-08 in Silli block of Ranchi district covering eight villages. Since inception, the programme was implemented in 26 villages of five blocks in Ranchi district namely, Silli, Nagri, Itki, Mandar and Kanke. To have maximum spread, each year new block and villages were selected for project implementation.

Prior to interventions, survey through PRA tools and techniques were conducted in adopted villages. After assessment of technological gaps, the technology and training interventions were done. The assessment of technologies was done on the basis of yield results, economic benefit, feedback and spread of the technologies. The details of year-wise and block-wise adopted villages in Ranchi district are given in Table 1.

Table 1: Year-wise and block-wise adopted villages in Ranchi district

Year	Block	Villages
2007-08	Silli	Lota, Aamtikra, Nagedih, Nayatoli, Kita, Bandhdih, Palsdih and Khalari
2008-09	Nagri	Kulgu, Kalende and Piska
2009-10	Itki	Kundi, Patratoli, Rani Khatanga, Naya Tanr and Bandhya
2010-11	Mandar	Karge, Hatma and Nawatoli
2011-12	Kanke	Boreya, Kumharia, Nagri and Chauri
2012-13	Kanke and Nagri	Saheer, Hotwar and Konki
2013-14	Kanke and Nagri	Gari Hotwar, Boreya and Saheer

RESULTS AND DISCUSSION

Rabi season

Demonstrations on suitable varieties of wheat, mustard, lentil and gram were conducted. In all, 13 varieties of wheat (HI 1539, HI 1500, HI 1531, HI 1454, HI 1418, HD 2733, HD 2985, HD 2824, HD 2894, HD 2967, HD 2851, HD 2733 and WR 544), mustard (Pusa Tarak, Pusa Bold, Pusa Jaikisan, Pusa Vijay and Pusa Jagannath), lentil (L 4076 and K 75) and gram (BGD 72 and BG 1088) were assessed during 2007-2014 on the fields of 213 farmers covering an area of 58.9 ha.

Table 2: Yield performance of different rabi crops demonstrations

Crop/Variety	No of Dem	Area (ha)	Yield (q/ha)		Gross Return (₹/ha)	Total Cost (₹/ha)	Net Income (₹/ha)	% increase in Yield	B C Ratio
			Max	Ave					
Rabi 2010 11									
Wheat control (DL 788)				38.00	44460	18090	26370		2.45
HD 2733	3	2.0	46.50	45.50	53235	18630	34650	19.73	2.85
HD 2985	3	2.0	44.00	40.00	46800	18500	28300	10.52	2.52
HD2894	3	1.50	44.50	42.50	49725	18610	31115	11.84	2.67
Mustard control (Krantii)				8.00	20000	12000	8000		1.66
P Vijay	5	0.50	13.50	12.50	31250	12210	19040	56.25	2.55
P Jagamath	5	0.50	12.50	10.50	26250	12300	13950	43.75	2.13
Lintil control (PL406)				10.00	28000	12000	16000		2.33
K 75	2	0.40	15.00	14.00	39200	12150	27050	50.00	3.22
Gram control (P114)				11.00	27250	12200	15050		2.25
BGD 72	1	0.25	14.00	14.00	35000	12500	22500	27.27	2.80
Rabi 2011 12									
Wheat control (DL 788)				37.75	50962	25050	25912		2.03
HD2733	15	5.00	45.50	43.80	59130	25208	33922	16.02	2.34
HD2985	13	3.60	42.00	41.80	56430	25208	31222	10.72	2.23
HD2894	14	4.50	44.00	42.75	57712	25208	32504	13.24	2.28
HD2932	03	2.00	42.00	41.40	55890	25208	30682	9.66	2.21
Rabi 2012 13									
Wheat control (DL 788)				36.70	55050	26250	28800		2.09
HD2932	4	1.00	40.00	38.50	57750	26310	31440	4.90	2.19
HD2985	4	1.00	42.05	40.02	60030	26250	33780	9.04	2.28
HD2733	8	2.50	41.20	40.10	60150	26305	33845	9.26	2.28
Mustard control (Local)				6.75					1.69
P Vijay	8	3.00	11.00	10.25	33825	13105	20720	51.85	2.58
P Jagamath	9	3.00	13.00	11.75	38775	13150	25625	74.00	2.94
P Bold	15	12.50	9.50	8.75	28875	13145	15730	29.62	2.19
Lintil control (Local seed)				3.20	17600	12810	4790		1.37
L 4076	8	3.00	5.00	4.25	23375	12850	10525	32.81	1.81
Rabi 2013 14									
Wheat control (Sonalika)				28.5	54245	25855	28390		2.09
HD2967	6	2.24	46.0	38.50	80085	26350	53735	47.63	3.03
HD2851	6	2.56	37.5	35.02	64125	26350	37775	18.21	2.43
HD2733	4	1.60	40.0	40.10	73625	26500	47125	35.72	2.77
WR 544	3	1.33	25.0	31.00	48600	25215	23385	14.88	1.92
Mustard control (Shivani)				7.50	28050	13145	14905		2.13
P Bold	5	2.00	20.10	19.30	63690	13252	50540	127.05	4.80
P. Vijay	5	2.00	16.00	14.38	47454	13252	34202	69.18	3.58
Lintil control (non descript)				9.90	54450	12215	42235		2.13
L 4076	7	2.20	12.0	10.80	59400	12345	47055	9.09	4.81

Table 2 discusses the yield performance of rabi crop demonstrations in comparison of local varieties grown over there. It could be observed from the data that wheat variety HD 2733 consistently provided higher yield since rabi 2010-11, ranged from 9.26 per cent to 19.73 per cent in four years. This variety was highly accepted by the farmers due to its high yield, dwarf height, medium early maturity (130-135 days) and resistance to leaf rust and leaf blight. Variety HD 2985 also gave an higher yield and higher B:C ratio than the local check. Tribal farmers liked wheat varieties HD 2985 and HD 2932 due to their relatively early maturing trait. Wheat variety HD 2967 was highly accepted by the farmers due to its high yield and resistance against leaf rust diseases and leaf blight.

Although, all mustard varieties demonstrated on farmers' field performed well in terms of yield and economic benefit, Pusa Jaikisan variety was most

preferred by the farmers due to its high yield and relatively more oil content. Majority of the farmers preferred to grow mustard with wheat, due to the fact that area under irrigation was relatively less. The farmers also revealed that varieties provided by IARI were insect pest and disease resistant.

Varieties transferred during kharif season (2007-14)

Kharif season :

Total, seven varieties of rice and three varieties of pigeon pea were introduced and assessed on tribal farmers' fields. Of which, 85 demonstrations of improved varieties of rice (PRH 10, Pusa 1401, Pusa 1460, Pusa Basmati 1121 and PB 1) and 35 demonstrations of pigeon pea (Pusa 2001, 2011 and P991) were conducted on fields of tribal farmers. These improved varieties were diffused to a total of thirty villages on 115 farmers' field covering an area of almost 36 hectares.

Yield performance of kharif crops demonstrations

The details of year wise performance of kharif crops for their yield and economic return in comparison to local check is presented in Table 3. All demonstrated varieties of IARI showed significantly higher yield in comparison to local varieties except at one or two instances. Since the area is rainfed and crop is affected by rainfall, Paddy variety P 2511 was demonstrated during kharif 2011 to 2013. During kharif 2011, due to drought in the area, the yield potential of improved varieties could not be realized, all varieties of crops demonstrated performed better than local ones. There was 25 per cent increase in yield in case of variety Pusa 2511 and its B:C ratio was 1.56. During kharif 2012-13, the average yield recorded for P 2511 was 58.75 q/ha and 51 q/ha having 6.8 per cent and 6.25 per cent increase over the local checks. This variety was preferred by the farmers due to its high yield, aroma and long grain quality. It has been accepted and adopted by the farmers in the demonstration villages as well as nearby villages. PRH 10 was demonstrated continuously for four years from kharif 2009 to 2014 except 2012. Farmers were very much impressed with this hybrid but due to inadequate availability of its seed, it had less spread effect. It was also reported that in medium land situation P 2511 and PRH 10 performed better than the local checks *i.e.* Lalat and P 6444 respectively.

Paddy variety JD 6 and JD 13 were demonstrated during kharif 2012 and 2013. The average yield of JD 68 & JD 13 was 28.50 q/ha and 25.25 q/ha respectively. Though the average yield of JD 68 & JD 13 was substantially higher than the local check (26.25%), the potential yield could not be realized due to the fact that the farmers in uplands generally do not adopt the

recommended package of practices. The tribal farmers liked JD 13 for their upland areas. The tribal farmers also liked JD 13 due to its coarse grains as they perform hard physical activities.

Table 3 : Yield performance of kharif crops demonstrations

Crop/Variety	No of Dem	Area (ha)	Yield (q/ha)		Gross Return (₹/ha)	Total Cost (₹/ha)	Net Income (₹/ha)	% increased in Yield	B C Ratio
			Max	Ave					
Kharif 2011									
Paddy Control (Lalat)				20.00	19000	14850	4150		1.27
P 2511	13	3.20	28.00	25.00	23750	15150	8600	25.00	1.56
PRH 10	5	2.00	25.00	22.50	25650	15050	10600	12.50	1.70
Pigeon pea Control (Local)				5.50	18700	12000	6700		1.55
P 2001	5	2.00	8.00	7.00	23800	12500	11300	27.27	1.90
Bottle Guard (P. Naveen)	15	1.60			New introduction				
Kharif 2012									
Paddy Control Lalat				55.00	71500	19800	51600		3.61
IR 36				54.00	70400	19800	50600		3.55
BVD 109				30.00	39000	19800	19200		1.96
BVD 108				25.00	32500	19800	12700		1.64
P 2511	8	3.00	60.00	58.75	76375	19900	56475	6.80	3.83
P 44	2	0.75	58.50	56.00	72800	19850	52950	3.70	3.66
JD 6	3	1.00	35.50	33.75	43875	19000	24825	12.5	2.30
JD 13	1	0.25	28.50	28.50	37050	19000	18050	14.0	1.95
Pigeon pea Control (Birsar Arhar)					51000	13500	37500		3.77
P 2001	2	1.00	17.50	16.50	56100	13500	42600	10.0	4.15
Kharif 2013									
Paddy Control -Lalat, BVD 108				48.00/25.00	69600	22250	47350		3.12
Pusa 2511	08	3.00	52.00	51.00	73950	22250	51700	6.25	3.32
PRH 10	15	3.33	56.00	54.00	78300	22250	56050	12.50	3.48
JD 13	07	1.00	26.00	25.25	36613	21250	15363	1.00	1.72

Opinion of the farmers towards traits of selected improved varieties

Opinion of the farmers were sought to identify the traits which they preferred in different crops introduced on their fields. Kirsten vom Brocke *et al* (2010) also concluded that farmers' assessment of traits is often more multivariate than the breeder's approach to assessing these same traits. This was especially so for the criteria of grain quality, earliness and productivity for which the farmers' definition encompasses factors such as flour yield and stability across environments. However, rating results between farmer groups were variable.

As revealed in Table 4 farmers rated all IARI crop varieties as higher yielding. Rice varieties were rated high in terms of early maturity, grain & eating quality, insect pest & disease resistant. Besides, high yielding wheat varieties were perceived to have resistance against insect pest and diseases. Mustard varieties were also rated good in terms of yield, early maturity, good grain quality and resistant to insect pest and diseases.

Table 4: Opinion of the farmers towards traits of selected improved varieties

Crop	High yield	Early maturity	Good eating quality	Insect pest resistance	Disease resistance	Good grain quality
Rice	✓	✓	✓	✓	✓	✓
Wheat	✓			✓	✓	
Pigeon pea	✓	✓		✓		✓
Mustard	✓	✓		✓	✓	✓
Chickpea	✓					✓
Lady's finger	✓		✓			
Bottle gourd	✓					

On further probing about traits of different varieties farmers rated wheat varieties HD 2932, HD 2985 and HD 2733 high in terms of yield, insect-pest and disease resistant. However, they did not rate HD 2733 high on account of its early maturing trait. Mustard varieties, Pusa Jaikisan and Pusa Vijay were rated high yielding and disease resistant.

Table 5: Opinion of farmers towards traits of selected improved wheat and mustard varieties

Crop	Variety	High yield	Early maturity	Insect pest resistance	Disease resistance
Wheat	HD 2932	✓	✓	✓	✓
	HD 2985	✓	✓	✓	✓
	HD 2733	✓		✓	✓
Mustard	Pusa Jaikisan	✓			✓
	Pusa Vijay	✓			✓

The participating farmers gave their opinion towards selected traits of the demonstrated improved varieties of rice also. Varieties namely Pusa 2511 and PRH 10 were rated as high yielding, having good grain and eating quality while JD 13 was high on early maturing and its resistance to insect pests and diseases.

Table 6 : Opinion of farmers towards traits of selected improved rice varieties

Crop	Variety	High yield	Early maturity	Good eating quality	Insect pest resistance	Disease resistance	Good grain quality
Paddy	P 2511	✓		✓			✓
	PRH 10	✓		✓			✓
	JD 13		✓		✓	✓	

Spread of selected technologies demonstrated under collaborative programme with IARI from the start of the partnership programme

Since the collaborative programme is under operation from 2007-08, the spread and share of different crop varieties were estimated. The seed of the varieties liked by the farmers were exchanged with other fellow farmers and also popularized through training programmes and field days. These varieties had their share from 15 per cent to 45 per cent in total area of the crop grown over there. The highest spread was estimated in paddy variety P 2511 (45%) followed by varieties of wheat, HI 1539 (40%), Pigeon pea P 2001 (30%) and 20 per cent each of wheat HD2985, mustard Pusa Jaikisan and Pusa Vijay.

Table7: Spread of selected technologies demonstrated

Year	Crop	Total area (ha)	Name of IARI variety demonstrated	Share of IARI varieties (%)
2008- 2013	Rice	450.0	P 1121	25.0
2011- 2013	Rice	450.0	P 2511	45.0
2007- 2012	Wheat	200.0	HI 1539	40.0
2010- 2012	Wheat	200.0	HD 2985	20.0
2010- 2013	Wheat	200.0	HD 2733	15.0
2012 -2013	Wheat	40.0	HD 2932	15.0
2010 -2013	Pigeon pea	60.0	P 2001	30.0
2009 -2012	Mustard	48.0	Pusa Jaikisan	20.0
2009 -2012	Mustard	48.0	Pusa Vijay	20.0

Success stories

Prosperity through Paddy Variety Pusa Sugandha 5 (P 2511)

- Paddy variety P 2511 was demonstrated in Karge village of Mandar block.
- The demonstration was conducted in 6.0 ha of area in which 12 farmers participated.
- The average yield of the demonstration was 52.9 q/ha.
- The highest yield obtained by a farmer Sri Juwel Tigga of the village was 55.8 q/ha.
- About 32.8 per cent increase in yield was observed over local check (Lalat).
- The average gross return in demonstration plot was ₹ 63,2100.00 per ha.
- The net return was ₹ 44,710.00 per ha with B:C ratio of 2.42.
- Due to extra long grain with aroma it fetches higher price in the market.
- The variety is accepted by farmers and area under this variety has increased to around 80.0 ha in Mandar block through farmer to farmer extension.

Wheat Var. HD 2733 – Proved to be A Boon for Food Security

- Wheat variety HD 2733 was demonstrated in the village Gari Hotwar of Ranchi district.
- The demonstration covered 5.0 ha of area.
- The highest yield of 46.5 q/ha was obtained by a farmer, namely Sri Rajesh Kujur of the village.
- The average yield of the demonstration plot was 45.5 q/ha.
- The area under this variety has increased to around 40.0 ha in adopted and around the adopted village near check dam, rivers and dug well.
- The cropping intensity in this area has been doubled.

CONCLUSION

The collaborative project has been proved useful on many accounts. While assessing the improved technologies, yield and income from agriculture of tribal framers have also improved. The inbuilt activities like capacity

building programmes and field days helped in spreading the improved technology. Earlier, rice-fallow was the dominant cropping system in the adopted villages where traditional varieties were dominating but due to intervention under this project about 25% increase in cropping intensity was recorded in the adopted village. It was observed that majority of the farmers adopted line sowing in rice as well as wheat. The farmers exchanged/purchased seed of improved varieties of rice, wheat, pigeon pea and mustard from the participating farmers and area under these varieties increased to an extent of 50 per cent. Through this collaborative programme, the technology interventions have been proved to be instrumental in increasing productivity of selected crops with the concerns of profitability and stability. This programme also improved the farmers' participation that helped in spreading of IARI technologies is gaining momentum.

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