ECONOMIC IMPACT OF FRONT LINE DEMONSTRATIONS ON CEREAL & PULSE CROPS IN GODDA DISTRICT OF JHARKHAND

A.P Thakur* and Shurya Bhushan**

Godda is one of the most backward districts of Jharkhand (India) having 88.5% of area as rainfed. Maize (Zea mays), Paddy (Oryzae sativa) and Pigeon pea (Cajanus Cajan) are the two major cereal crops and one pulse crop grown in the district during the kharif seasom 2015-16. Farm Science Centre known as Krishi Vigyan Kendra laid down Front Line Demonstrations on these both cereal crops and pulse by introducing some new varieties and applying scientific practices in their cultivation. The productivity and economic returns of maize, paddy and pigeon pea in improved technologies were calculated and compared with the corresponding farmer's practices (local checks). All the three cereal crops recorded higher gross returns, net return and benefit cost ratio in improved technologies as compared to the plots where farmers were using traditional practices in their cultivation. It is suggested that location-specific integrated approaches would be needed to bridge the productivity gap of the cereal & pulses crops grown in the district.

Keywords: *Cereal crop, Front Line Demonstrations, Technology and Extension gaps, Technology index, Improved Technologies, Rainfed.*

INTRODUCTION

Technology transfer refers to the spread of new ideas from originating sources to ultimate users (Prasad et al. 1987).

The main aim of Krishi Vigyan Kendra is to reduce the time lag between generation of technology at the research institution and its transfer to the farmers for increasing productivity and income from the agriculture and allied sectors on sustained basis. KVKs are grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different 'micro farming' situations in a district. Front line demonstration (FLD) is a long term educational activity conducted in a systematic manner in farmers' fields to worth of a new practice/technology. Farmers in the district are still producing crops based on the knowledge transmitted to them by their forefathers leading to a grossly unscientific agronomic, nutrient management and pest management practices.

As a result of these they often fail to achieve the desired potential yield of various crops and new varieties. Potential yield is determined by solar radiation, temperature, photoperiod, atmospheric concentration of carbon dioxide and genotype characteristics assuming water, nutrients, pests, and diseases are not limiting the crop growth. Under rainfed situation like Godda district of Jharkhand state, where the water supply for crop production is not fully under the control of the grower, water-limiting yield may be considered as the maximum attainable yield for yield gap analysis assuming other factors are not limiting crop production. However, there may be season-to-season variability in potential yield caused by weather variability, particularly rainfall. The baseline survey was conducted by Krishi Vigyan Kendra, Godda during 2007-08 through PRA method for preparation of village profile. The Front Line demonstrations (FLD)

** Technical Programme Assistant, ** & ** Subject Matter Specialists Plant Protection , GVT-Krishi Vigyan Kendra, Godda, Jharkhand, respectively*

were conducted in three clusters (table-1) consisting of 14 villages and involving 120 households of the total area of 30 ha of the lands. It was found that farmers were using old varieties of cereal and pulses crops without proper use of chemical fertilizers, herbicides and pesticides, resulting low production and productivity as compare to average national productivity. Keeping in view the constraints, GVT-Krishi Vigyan Kendra Godda conducted front line demonstrations on major cereal crops and pulse crop to determine the yield potential of the three crops which grown under scientific maner under FLD programme, which would also ensure livelihood, nutritional security and economic empowerment of poor households at faster pace.

Table 1: Details of Crops, Variety, Nos. of Villages & Farmers and Area of the Front Line Demonstrations.

Sl. Nos.	Crop	Variety	Nos. Village	Nos. of Farmers	Area (ha)
1.	Paddy	MTU-7029	3	25	05.00
2.	Maize	DHM-117	5	50	20.00
3.	Pigeon Pea	NDA-1	6	45	05.00
Total			14	120	30

MATERIALS AND METHODS

Profile of the Study Area:

The GVT-Krishi Vigyan Kendra, Godda is situated in the Central-North Eastern Plateau Zone (Zone -II) & north east of Jharkhand state. The zone is characterized by heavy humid and sub humid tropical monsoon type of climate with average temperature of the district varies from 20.8- 450C in summer and 20-240C in winter, the average rainfall of the zone is 1320 mm. Monsoon breaks in the second week of June in normal years, pre-monsoon rains are received in the month of May which account for 40-60 mm and help farmers to start land preparation. South west monsoon accounts for major portion of rainfall during monsoon months and nearly 80 per cent of precipitation is received during mid June to first week of October. Winter rain during December to February is very helpful for Rabi crops. It is situated between 24°50’ to 57° 9’ northern latitude and between 87°12’ to 24°7’ eastern longitude. The total geographical area of the district is 2,110.40 Sq Km, of which cultivated area is 1, 31,140 hectare. There are nine blocks, 172 panchayats and 2,310 villages in Godda district. The total population of the district is 13.13 lakh (male 6.77 lakh and female 6.35 lakh) according to 2011 census. The total number of farmers in the district is 1, 62,551. There are two major cereal crops being cultivated in Godda which include maize and paddy and one pulse crop includes pigeon pea during Kharif season Table-2 shows the area, total production and productivity of major crops cultivated in the district during 2015-16 (Govt. of Jharkhand, 2015-16).

TABLE 2: Area, Production and Productivity of Major Crops Cultivated in the District (2015-16).

Sl. Nos.	Crop	Area (ha)	Production (mt)	Productivity (kg/ha)
1.	Paddy	35695	32457	909
2.	Maize	11301	19776	1950
3.	Pigeon Pea	1069	739	691
4.	Cropping Intensity	108%		

The cropping intensity of the district is about 108 %. The present investigation was carried out in the adopted villages located in the operational area of Krishi Vigyan Kendra Godda with the objective to identify the yield gaps as well as to work out the difference in input cost and monetary returns under front line demonstrations and farmers' practices (local checks). Soil of the study area is sandy loam in texture with acidic in reaction (pH 6.5), low organic carbon (0.32 g kg-1 soil), low nitrogen (225 kg ha-1), medium phosphorus (15.7 kg ha-1) and high in available potassium (221 kg ha-1). The critical inputs were applied as per the scientific package of practices recommended by the research wing of Birsa Agricultural University, Ranchi. The data on production cost and monetary returns were collected during the years (2015-16) from Front Line Demonstration plots to work out the economic feasibility of improved and scientific cultivation of cereals. Besides, the data from local checks, data was also collected where farmers were using their own practices for cultivation of cereal crops). The technology & extension gaps and technology index were calculated as given by Samui et al. (2000) as:

- Technology Gap = Potential yield – Demonstration yield
- Extension Gap = Demonstration yield – Yield from farmers practice
- Technology Index = Potential yield – Demonstration yield × 100/Potential yield

OBJECTIVES

The specific objectives of the study are: (1) To determine the economics of crops and (2) To determine the impact of technological gap, extension gap and technology index yields of the crops in the demonstration areas.

RESULTS AND DISCUSSIONS

Description of Front Line Demonstrations:

The details of demonstrations conducted by Krishi Vigyan Kendra, Godda are presented in Table 3. In each front line demonstration, the improved variety suitable to local condition was selected and the recommended package of practices was adopted. Some of the major differences between the improved technologies adopted in front line demonstrations and farmers practices (local checks) adopted by farmers in different crops are summarized as below.

Maize: The improved technologies included improved varieties (cv. DHM-117), integrated nutrient management (120:60:40 NPK kg ha-1) and integrated pest management (deep ploughing+ seed treatment with carbendazim @ 2 g kg-1 seed) were tested under demonstrations. Deep ploughing was done during the month of May-june. Crop was sown by using seed @ 20 kg ha-1 with crop geometry 75X25 cm after receiving sufficient rainfall. The full dose of Phosphorus and Potash in the form of Diammonium Phosphate (DAP) and Muriate of Potash (MOP) were applied as basal dose and Nitrogen in the form of Urea was top dressed in two equal splits at 25 and 45 days after sowing. Herbicide Atrazin a. i. @ 0.5 kg ha-1was applied pre emergence of maize. The Methyl Parathion 2% dust @ 25 kg ha-1 was top dressed at the time of incidence of grasshopper (Hieroglyphus nigroripletus) and Carbofuran 3% G @ 7.5 kg ha-1was applied in the shoots for the control of maize stem borer (Chilo artillus).

Paddy: Farmers were using local course variety of paddy. The seed rate used by the farmers was very high and during transplanting 3-4 seedlings per hill were used by the farmers. Chemical fertilizers i.e. Urea and DAP were used by the farmers. In improved technologies includes improved varieties (cv. MTU-7029), Nutrient Management (120:60:30:40 N P K kg ha-1) and

Weed Management (Banthiocarb @1.5 Lit. ha-1 after 3-5 days of transplanting) were tested. Crop was sown between 2nd week of July to last week of July. The 2-3 seedlings per hill were transplanted with crop geometry of 25×20 cm. The full dose of the Phosphorus, and Potash were applied in the form of Diammonium Phosphorus, and Muriate of Potash as basal dose and Nitrogen in the form of Urea was top dressed in two equal splits at 25 and 60 days after sowing.

Pigeon pea: The improved technologies included improved varieties (cv. NDA-1), integrated nutrient management (25:50:25 NPK kg ha-1 + Rhizobium) @ 10 g kg-1 seed) and integrated pest management (deep ploughing+ seed treatment with carbendazim @ 2 g kg-1 seed were tested under demonstrations. Deep ploughing was done during the month of May-June. Crop was sown by using seed @ 20 kg ha-1 with crop geometry 60X25 cm after receiving sufficient rainfall. The full dose of Phosphorus and Potash in the form of Diammonium Phosphorus (DAP) and Muriate of Potash (MOP) were applied as basal dose and Nitrogen in the form of Urea was top dressed in two equal splits at 25 and 45 days after sowing. The seed was treated with carbendazim @ 2 g kg-1 seed and then seed was inoculated with bacteria as bio fertilizers each @ 20 g kg-1 seeds. Herbicide pendimethiline a. i. @ 1.5 kg ha-1was applied pre emergence of Pigeon pea. The monocrotophos @ 0.750 liter ha-1 was spayed at the time of incidence of Pod borer.

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Table 3: Productivity of Cereal & Pulses Crops, Yield Gaps and Technology Index (Average Over Years).

Crop	Productivity (qha^{-1})			Per cent increase over local	Technology gap (qha-1)	Extension gap (q/ha-1)	Technology index (%)
	Potential	Improved Technology	Local check				
Paddy	55	45.62	30.54	49.38	9.38	15.08	17.05
Maize	60	35.49	24.27	46.23	24.51	11.22	40.85
Pigeon Pea	25	18.79	14.16	32.70	6.21	4.63	24.84

During the period of study, it was observed that front line demonstrations of improved technologies increased productivity over respective farmers practices (local checks) (Table-3). The improved technologies recorded higher productivity of maize, paddy and pigeon pea i.e. 45.62 q ha-1, 35.49 q ha-1 and 18.79 q ha-1as compared to farmers practices. 30.24 q ha-1, 24.27 q ha-1 and 14.16 q ha-1 respectively. The increase in productivity of maize, paddy and pigeon pea over respective local checks were 49.38 %, 46.23 % and 32.70%. The higher productivity of maize, paddy and pigeon pea under improved technologies were due to the sowing of latest high yielding crop varieties and adoption of improved Nutrient and Pest Management techniques. The fluctuations in yields were observed mainly on the account of variations in soil fertility status and moisture availability due to untimely rainfall of the region. The yield improvement in all kharif crops might be due to the combined effect of high yielding, moderate disease resistant varieties & adoption of improved Weed and Nutritional Management. The technology gap shows the gap in the demonstration yield over potential yield and it was highest in paddy (24.51 q ha-1) in comparison to Pigeon pea (6.21 q ha-1) and Maize (9.38 q ha-1). The observed technology gap was mainly attributed to rainfed conditions prevailing in the district. The other reasons include dissimilarity in soil fertility status, marginal land holdings and hilly terrain in the plateau region of Santhal Pragana. Further the higher extension gap of 15.08 q ha-1was recorded in Maize after Paddy (11.22 q ha-1) and Pigeon Pea (4.63 q ha-1). This emphasized the need to educate the farmers through various extension means for the adoption of scientific practices in cultivation of all the cereal crops and pulses crops. Mukharjee (2003) has also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing system productivity. The data presented in Table-3 revealed that, the technology index was minimum for maize (17.05 %) compared to Pigeon pea (24.84 %) and paddy (40.85%). Technology index shows the feasibility of evolved technology at the farmer's field and lower the value of technology index more is the feasibility of the technology. Similar yield enhancement in different crops in front line demonstration has amply been documented by Haque (2000), Tiwari et al. (2003), Mishra et al. (2009) and Kumar et al. (2010).Yield of the front line demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gaps (Hiremath and Nagaraju, 2009).

Table 4: Economics of Cereal & Pulses Crops Production under Front Line Demonstrations and Farmers Practices.

Particulars	Practice	Maize	Paddy	Pigeon Pea
Yield (qha-1)	Improved Technology	40.50	45.20	12.30
	Farmers Practices	30.54	32.50	8.50
Cost of Cultivation (Rs.ha-1)	Improved Technology	28746	36500	**26200**
	Farmers Practices	22500	28100	**18400**
Additional cost of cultivation over local (Rs.ha-1)		7966	8400	5800
Gross returns (Rs.ha-1)	Improved Technology	48600	54240	49200
	Farmers Practices	**36648**	**39000**	34000
Net Returns	Improved Technology	19854	17740	25000
	Farmers Practices	14148	10900	15600
Additional Net Returns over local (Rs.ha-1)		5706	6840	9000
B:C Ratio	Improved Technology	1.69	1.49	1.87
	Farmers Practices	1.62	1.38	1.84

The inputs and outputs prices of commodities prevailed during the year 2015-16 of demonstrations were taken for calculating cost of cultivation, net return and benefit cost ratio (Table 4). The economic analysis of the data were revealed that Pigeon Pea under front line demonstrations recorded higher gross returns (Rs49200 ha-1.), net return (Rs. 25000 ha-1) and B:C. ratio (1.87) as compared to the local check where farmers got gross returns, net returns and B:C ratio of Rs. 34000 ha-1, Rs. 15600 ha-1 and 1.84 respectively. Maize recorded gross returns of Rs. 48600 ha-1, net return Rs. 19854 ha-1and B:C ratio of 1.69 as compared to the local check where farmers got gross returns, net returns and B:C ratio of Rs. 36648 ha-1, Rs. 14148 ha-1 & 1.62, respectively. Similarly, Paddy recorded gross returns of Rs. 54240 ha-1, net return Rs. 17740 ha-1and B:C ratio of 1.49 as compared to the local check where farmers got gross returns, net returns and B:C ratio of Rs39000 ha-1, Rs. 10900 ha-1 & 1.38 respectively.

CONCLUSION

Thus, the cultivation of cereal and pulse crops with improved technologies including suitable improved varieties, Weed Management, Nutrients and Pest Management has been found more productive and grain yield in Maize, Paddy and Pigeon Pea was increased up to 49.38, 46.23, and 32.70 per cent, respectively. Technological and extension gaps existed which can be bridged by popularizing package of practices with emphasis on the seed of improved crop varieties, use of proper seed rate, balanced nutrient application and proper use of plant protection measures. Replacement of local varieties with the released varieties of maize, paddy and Pigeon Pea would increase the production and net income of these crops.

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