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Role of scientific production technology and farm inputs on varietal popularisation of rapeseed Mustard in Assam

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Abstract

In order to increase the production, popularization of improved technology as well as for uplifting the socio economic conditions of the small and marginal farmers of Sonitpur district which typically lies in North Bank Plain Agro-climatic Zone of Assam, a Crop demonstrations was conducted among 20 numbers of agricultural beneficiaries in Bihaguri block in the year 2020-2021 for popularization of technology as well as cultivars. Selection of the beneficiaries and Villages were done based on their cropping pattern under Directorate of Rapeseed Mustard Research Research, Sewar Bharatpur, Rajasthan (DRMR) of the project entitled "Augmenting Rapeseed-Mustard Production of Assam farmers for Sustainable Livelihood Security" linked with Assam Agribusiness and Rural Transformation Project (APART) scheme. During the period of cropping season, the selected farmers for adoption had showed keen interest in attending farmer's technical training programme conducted at the block level for adopting scientific production techniques and methods gradually, which was considered as a very important technique to be followed by the farmers of Assam to obtain good crop population and ultimately higher yield. Adopting scientific agricultural techniques had helped farmers to reduce the labour cost during intercultural operation and also reduced the application of pesticides and fertilizers thus benefitted the farmers by reducing the cost of cultivation. Due to its suitable soil and climatic conditions as well as through their dedication and continuous efforts towards farming, they could be able to achieve higher yield and income within a

short period of time as well as could motivate the other small and marginal farmers of nearby villages for further uplifting their economic status thereby preserving their ancestral occupation for future generations.

Keywords: Rapeseed Mustard, Crop demonstrations, Scientific Production Technology, Farmers Practices, Benefit Cost Ratio

Introduction

Oilseeds such as rapeseed and mustard as well as local Toria also plays an important role in the agrarian economy of Sonitpur district of Assam. This district is endowed with a wide variety of agro-climatic conditions and soil types that enable the cultivation of various oilseed crops. All these oilseed crops are major oilseeds of the district. Low productivity of oilseeds is mainly due to their cultivation under rainfed conditions and in marginal lands. Besides this, the use of sub-optimal doses of chemical fertilizers and non adoption of plant protection measures further aggravate the problem of poor productivity in oilseeds. Keeping in view the importance of oilseeds in food security and being vital component of sustainable farming systems, the present investigation was undertaken to analyze the impact of oilseed technology transfer through Field Demonstrations for sustainable productivity of oilseeds in Sonitpur district of Assam. In order to have a clear and concise understanding regarding field demonstrations among the small and marginal farmers of Assam, it has been described as a long term extension educational activities conducted in a precise manner in the farmers fields of the crop demonstrations allotted villages of the particular block of the district in order to showcase the new and improved technologies and farmers practise. Hence it is rightly said that "Seeing is believing" is the basic propaganda of field demonstrations. Field demonstrations are likely to be an outcome for providing knowledge and educating farmers through its results derived in terms of acquiring higher yield, good quality seeds with higher oil content, varieties resistant to diseases and pests as well as identification of the superior varieties resistant in terms of disease and pest as well as popularisation of the varieties among the farmers of the nearby villages of the district. Apart from that, it also educates the farmers in order to understand the economics of input-output ratio and net returns. It also builds confidence amongst them for further adoption of improved technologies and practises which they had adopted in the previous years. In field demonstrations, the farmers get an opportunity to observe the crops themselves, interact with the resource persons or extension workers on the field itself, get help in identification of occurance of various pests and diseases of the particular crops from the resource persons as well as clarify doubts on the spot itself. Hence the present investigation was mainly emphasised based on the data obtained through field demonstrations conducted in the year 2020-2021 under ICAR Directorate of Rapeseed Mustard Research (DRMR) by adoption of improved technologies and practises among the farmers of Sonitpur district of Assam for further aiming in doubling farmer's income.

Methodology

A field demonstration on rapeseed mustard was conducted in the year 2020-2021 in Bihaguri block under adopted villages in Sonitpur district of Assam. The district is located in the North Bank Plain Agro-climatic Zone of Assam. Sonitpur district is surrounded by Kameng district of Arunachal Pradesh in the north, mighty river Brahmaputra in the south, Lakhimpur district in the East as well as Darrang district in the West. The district lies in between 26.28-27.08 degree north latitude and 91.19 to 93.47 degree east longitude. Cropping systems prevailing in the demonstration area were Rice followed by Mustard and Maize. Truthfully leveled Seeds (TFL) of rapeseed mustard of three cultivars such as DRMR 150-35, PM-28, and NRCHB 101 were provided by ICAR, Directorate of Rapeseed Mustard Research (DRMR) Sewar Bharatpur. Inputs such as Urea, Single super phosphate (SSP), Murate of Potash (MOP) and Borax were also provided by the Department of Agriculture, Sonitpur Assam.The experiment involving the Rapeseed mustard cultivars such as DRMR 150-35, PM-28, NRCHB 101 with recommended doses of fertilizers ie: Urea @32 kg, SSP@ 62 kg, MOP @ 17 kg and Borax @ 2.5 kg was applied in split doses in the crop demonstrated adopted plots of the farmers field. Basal doses of fertilizers specifically Urea @16 kg at the time of sowing and another dose as top dressing at pre-flowering stage was applied after 45 days of sowing. Size of improved plot was 0.25 ha and farmers plot was 0.05 ha. Type of soil in crop demonstrated area was sandy loam with a pH of around 7-7.5. Seeds were sown in a field plot of size 0.25 ha with row to row spacing of 30 cm and a plant to plant spacing of 10 cm which was maintained through thinning manual weeding and other intercultural operations after 25 days of sowing. Apart from it, FYM @ 2t ha^{-1} was also applied to the crop demonstrated area. Line sowing method at a spacing of 30x10 cm was followed in order to maintain uniform plant population as well as to increase production. Indigenous technological method such as rope and (desi) mould board plough was used for preparing lines and furrows at a depth of 2 cm in order to sow seeds. Sowing was done in the first fortnight of November 2020. Farmers used indigenous technology knowhow (ITK) for uniform sowing of seeds such as piercing of disposable plastic bottles at the bottom thereby shaking it for free flowing of the seeds at a smaller quantity. After sowing, first irrigation was practiced after 25 days of sowing during vegetative stage. Source of irrigation was artificial irrigation in the form of sprinkler irrigation to avoid water logging in demonstrated plots. In case of pest and disease infestation, occurance of mustard sawfly (*Athalia proxima*), mustard aphid (*Lipaphis erysimi*) bihar hairy caterpillar (*Spilosoma obliqua*) at vegetative stage of crop growth thereby making irregular holes in tender leaves during the month of December at a temperature ranging from 10-18 degree Celsius. The rainfall and daily weather data was collected from Department of Agrometeorology, Biswanath Chariali College of Agriculture, (BNCA) of Sonitpur district of Assam.

Data Collection

The data on Crop Demonstrations of parameters such as YIOFP: Yield increase over farmer's practice; GMR: Gross monetary return; ANMR: Additional Net Monetary

Return; B:C: Benefit: Cost were recorded using appropriate formulae conducted under the field conditions during the year 2020-2021 and was used to study the economic benefits arising from technology inputs developed by the field demonstrations.

Yield increase over farmer's practice (%YIOFP): The yield increase in demonstrations over farmers' practice was calculated by using the following formula:

$$\frac{\text{Avg. improved plot yield - farmer's avg. plot yield}}{\text{Farmer's avg. plot yield}} \times 100$$

Gross Monetary Return (GMR): The GMR represents the net monetary returns received by the farmer who adopts the scientific production technology considered as improved plot (IP) as compared to the farmer's traditional practice of cultivation indicated as farmers plot (FP). It is calculated by the following formula

(GMR) = Yield of main product x Price of main product

Additional Net Monetary Return (ANMR): The Additional Net Monetary Returns (ANMR) for each of the crop demonstrated area is calculated based on the data on gross monetary return of improved plot and farmers plot. The ANMR represents the net additional monetary returns received by the farmer who adopts the scientific production technology as compared to the farmer's traditional practice of cultivation. It is calculated based on the following formula:

(ANMR) = GMR of IP- GMR of FP

Where **GMR** - Gross Monetary Return

IP - Improved Plot

FP- Farmers Plot

Benefit: Cost (B: C): To determine benefit cost ratio of crop demonstrations, it is calculated based on the following formula

$$\textbf{B: C} = \frac{\text{Additional Net Monetary Return}}{\text{Cost of Cultivation}}$$

Results

Seed Yield (Kg/ha) and Yield increase over farmers plot (YIOFP %):

Data on seed yield among the three cultivars revealed that the highest yield in improved plot was recorded in the cultivar NRCHB 101 (1880 kg/ha) followed by DRMR 150-35 (1832 kg/ha) and PM-28 with a seed yield of 1792 kg/ha under rainfed situation, whereas on the other hand cultivar NRCHB 101 had also shown lowest yield (1224 kg/ha) in improved plot of demonstrated area. In case of farmers plot, maximum seed yield was recorded in the cultivar NRCHB 101 (1100kg/ha) followed by 1080 kg/ha and PM-28 (1040 kg/ha). Introduction of high yielding varieties and demonstration of improved technology through Field Demonstrations on oilseeds would eventually lead to higher adoption among farmers in the region.The same cultivar PM-28 in some farmers plot had recorded with the lowest yield of 880 kg/ha which was due to lack of

irrigation facilities as well as negligence of farmer's adoption of improved technology. Negligence of the farmers practice in adopting new and improved technological intervention had led to the decrease in seed yield of the same variety NRCHB-101 in improved plot. Similarly in case of yield increase percentage over farmers practise, in Table 1, it varied between 19.23% to 103.63%.Highest and the lowest percent was recorded to be 19.23% and 103.63% in cultivar PM-28. Hence the data clearly indicates that increase in yield over farmers practice would benefit the farmers by increase in income thereby leading to an economic growth for their better livelihood in the region of the district.

Cost of Cultivation (Rs/ha)

The expenditure on cost of cultivation of an individual farmer was recorded and comparison was done based on improved and farmers plot among three mustard cultivars viz.PM-28, NRCHB-101 and DRMR 150-35. It was calculated based on the expenditure in cost of labour charges during land preparation either with tractor or bullock cart drawn plough, sowing operations, irrigation, intercultural operations, plant protection measures, harvesting, threshing, cleaning and transportation. Family labour charges were included in the demonstration plot. Seeds and inputs like fertilizers were supplied directly by Directorate of Rapeseed Mustard Research Sewar Bharatpur. Data on cost of cultivation (Table 1) ranged from Rs. 19400 to Rs. 25200 and the highest was recorded to be in cultivar PM-28 (Rs. 25200) in improved plot. In farmers plot, it varied between Rs.18000 to Rs.20000 which was comparatively lesser than the improved plot due to non adoption of improved technology and farmers own traditional practice of cultivation. Gross Monetary Return (GMR) and Additional Net Monetary Return (ANMR): Regarding economic analysis in terms of GMR, the highest and the lowest values was recorded in the cultivar NRCHB 101 which ranged from Rs. 62700 to Rs. 88000 in improved plot whereas in farmers plot, maximum GMR was recorded to be Rs.53900 in NRCHB 101 and the lowest value was recorded in the cultivar PM-28 with a gross return of Rs. 38500. Regarding additional net monetary return, highest and the lowest values varied between Rs. 19800 to Rs.49500 in cultivar PM-28 which was mainly due to lack of technology in terms of plant protection measures and weed control in the form of intercultural operations. Hence economic analysis in terms of GMR and ANMR indicates that due to the complete adoption of improved technology as well as recommended use of package of practice by the farmers, it has become possible to get a satisfactory yield along with gradual increase in economic status of the allotted adoption villages in Sonitpur district of Assam.

B: C Ratio: Data on Benefit cost ratio was recorded and comparison was done among the improved and farmers plot. In improved plot, B: C ratio varied between 0.58 to 2.14 and the highest value was recorded in cultivar DRMR 150-35 and the lowest was observed in PM- 28.On the other hand in farmers plot, B: C ratio ranged from 0.59 to 2.31 in which the highest value was recorded in the cultivar DRMR 150-35. Technologies like application of recommended doses of sulphur and weed control along with plant protection measures have been found to have higher potential in terms of

increase in B:C ratio and seed yield.From this result, it can be easily understood that despite of facing some major constraints such as lack of irrigation facilities and cultivating under rainfed situations, the farmers have managed to earn quite a profitable income by solely depending on the trainings and improved technologies provided by the resource persons as well as the extension workers. The farmers growing rapeseed mustard under rainfed condition are more reluctant for technology adoption and therefore the role of technology demonstration suited for rainfed regions is much more than their role in irrigated conditions where income risk from crop failure arising from adverse climatic conditions is limited.

Conclusion:

The individual parameters does not fully capture the yield advantage due to the adoption of technology, hence an integrative method using a combination of parameters should be used in prioritization of technology for the farmers. Adoption of improved technology and authentic farming methods brings a significant impact on increase in production, productivity as well as popularisation of the high yielding rapeseed mustard cultivars.Based on the present investigations carried out in the year 2020-2021, it can be concluded that comparison among improved and farmers plot in terms of seed yield, cost of cultivation, yield increase over farmers practice as well as economic analysis specifically Gross Monetary Return, Additional Net Monetary Return and Benefit Cost Ratio, were done through which awareness could be created amongst the small and marginal farmers of Sonitpur district of Assam for distinguishing and understanding the advantages of adoption of new and improved technological intervention and also to educate them for further popularization of these authentic farming techniques in order to diversify and preserve and strengthen their ancestral and upcoming generations.

Table 1 Comparative effect on Yield and Economics of Improved and Farmers plot in Mustard Cultivars under DRMR Crop Demonstrations in North Bank Plain Agro-climatic Zone of Assam

Varieties used in IP	Situation Irrigated/ Rainfed	Varieties used	Yield (kg/ha)		YIOFP (%)	COC (Rs/ha)		GMR (Rs/ha)		ANMR (Rs/ha)	B: C Ratio	
			IP	FP		IP	FP	IP	FP		IP	FP
PM-28	Rainfed	PM-28	1320	980	34.69	23400	24000	63800	44000	19800	0.84	0.82
NRCHB 101	Rainfed	NRCHB 101	1224	1000	22.4	24600	24000	63800	44000	19800	0.80	0.82
NRCHB 101	Rainfed	NRCHB 101	1880	1080	74.07	24800	24000	88000	49500	38500	1.55	1.60
DRMR 150-35	Rainfed	DRMR 150-35	1232	940	31.06	24400	24000	63800	44000	19800	0.81	0.82

Varieties	**Situation**	**Varieties**	**Yield (kg/ha)**		**YIOFP**	**COC (Rs/ha)**		**GMR (Rs/ha)**		**ANMR**	**B: C Ratio**	
NRCHB 101	Rainfed	NRCHB 101	1680	1100	52.72	24800	24000	85800	53900	31900	1.28	1.32
NRCHB 101	Rainfed	NRCHB 101	1304	800	63.00	20400	20000	74800	33000	41800	2.04	2.09
PM-28	Rainfed	PM-28	1576	980	60.81	20600	20000	82500	44000	38500	1.86	1.92
PM-28	Rainfed	PM-28	1328	1000	32.8	23400	20000	63800	44000	19800	0.84	0.99
PM-28	Rainfed	PM-28	1792	880	103.63	24200	22000	88000	38500	49500	2.04	2.25
PM-28	Rainfed	PM-28	1264	1000	26.4	24200	24000	63800	44000	19800	0.81	0.82
DRMR 150-35	Rainfed	DRMR 150-35	1832	920	99.13	25200	24000	88000	42900	45100	1.78	1.87
DRMR 150-35	Rainfed	DRMR 150-35	1368	1000	36.8	25000	24000	66000	44000	22000	0.88	0.91
DRMR 150-35	Rainfed	DRMR 150-35	1536	980	56.73	22200	22000	66000	44000	22000	0.99	1.00
PM-28	Rainfed	PM-28	1240	1040	19.23	24600	24000	63800	49500	14300	0.58	0.59
PM-28	Rainfed	PM-28	1432	960	49.16	22800	20000	66000	44000	22000	0.96	1.1
NRCHB 101	Rainfed	NRCHB 101	1256	800	57.00	24400	24000	62700	33000	29700	1.21	1.23
DRMR 150-35	Rainfed	DRMR 150-35	1704	1000	70.4	19400	18000	85580	44000	41580	2.14	2.31
PM-28	Rainfed	PM-28	1584	880	80.00	24400	24000	66000	41800	24200	0.99	1.00
DRMR 150-35	Rainfed	DRMR 150-35	1760	1080	62.96	24400	24000	88000	49500	38500	1.57	1.60
NRCHB 101	Rainfed	NRCHB 101	1496	920	62.60	22200	22000	66000	44000	22000	0.99	1.00

Abbreviations used: ***YIOFP:*** *Yield increase over farmer's practice;* ***GMR:*** *Gross monetary return;* **ANMR:** Additional Net Monetary Return; **IP:** Improved practices; **FP:** Farmers' Practices; **B:C:** Benefit : Cost

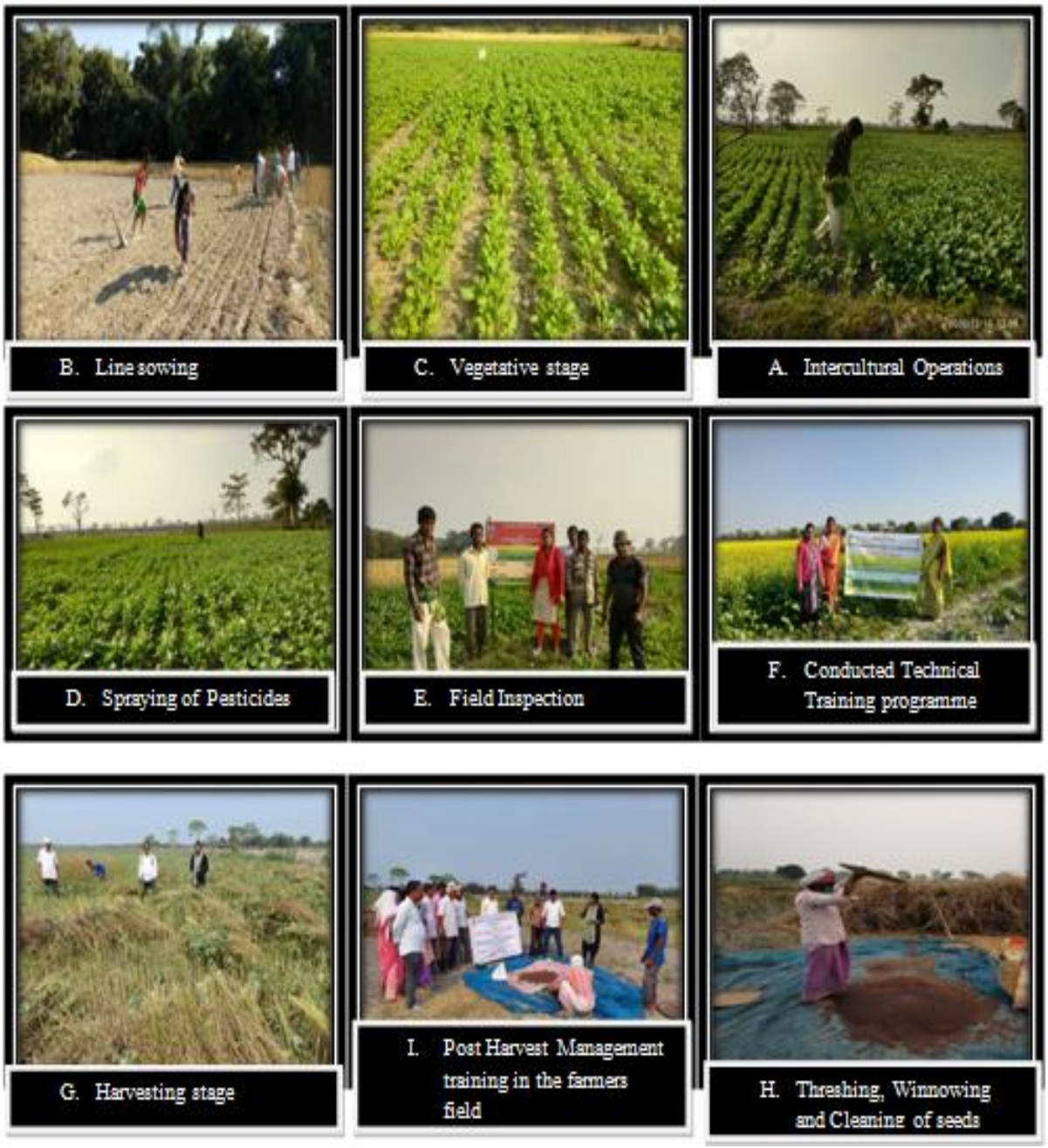

Figure 1 Impact of adoption of improved technological intervention by the selected agri beneficiaries of Bihaguri block of Sonitpur district provided by the resource person and extension worker under ICAR Directorate of Rapeseed Mustard Research (DRMR) linked to Assam Agribusiness and Rural Transformation Project

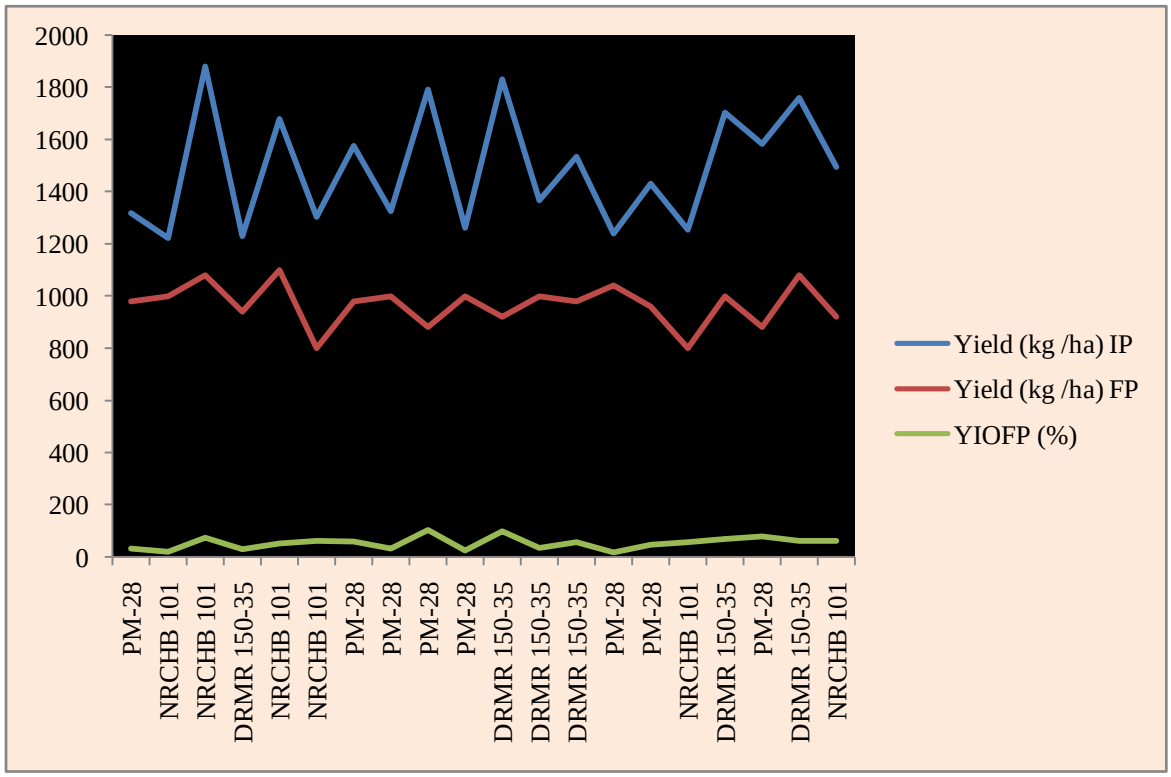

Figure 2 Comparative effect of yield in IP and FP with yield increase over farmers practice (YIOFP %) in cultivars PM-28, NRCHB 101 and DRMR 150-35