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Impact of Training and Demonstrations on Adoption of Narendra Lalmati in Eastern Plain Zone of Uttar Pradesh

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ABSTRACT
The study was carried out in Sohawal, Masodha and Harington blocks of Faizabad district of Uttar Pradesh. These three blocks were purposely selected because, traditionally, these blocks have maximum area under rice. Apart from training programmes and demonstrations, other extension methodologies viz., farmers-scientists interactions, field days and media coverage were also employed to get the maximum impact. Total ten practices were selected as a criterion to evaluate the farmers for the extent of knowledge gained and adoption of short duration scented rice production technologies as a result of the training programmes conducted by Krishi Vigyan Kendra and Crop Research Station, Masodha, Faizabad. The results of the study revealed that the farmers had gained knowledge about the production technologies for scented variety ranging between 13.33% in case of plant protection to 100.00% in case of high yielding Narendra Lalmati variety, after attending the training programmes. It was noticed that none of the farmers were following the improved practices before acquiring training whereas, after attending training programmes 95.00% trainees adopted HYV Narendra Lalmati, 70.00% establishment method, 65.60% time of sowing and nutrient management, 57.50% seed rate and 45.0% weed management. The demonstration results showed that the yield of newly introduced rice variety Narendra Lalmati increased successively over the years in demonstration plots and with little increase in cost of cultivation a higher return was achieved. Improved technology increased yield (35.08 q/ha) over farmers practices by the margins of 49.02% in rice crop under rainfed conditions. Net profit of Rs. 17,905/ha and B:C ratio of 1.95 was found with demonstrations and was much higher when compared with farmers' practices (Rs. 8,900/ha and 1.56, respectively) in the crop under studied. These results indicate that there are great possibilities of increasing productivity and profitability of above crop with adoption of improved techniques in eastern plain zone of Uttar Pradesh.
Keywords: *Knowledge, Adoption, Impact, Production technology, Technology gap, Extension gap, Technology index*

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INTRODUCTION

Training programmes and front line demonstrations are very effective tools in any extension methodology being used for dissemination of latest agricultural technologies to the farmers. Besides this, the course content of the training was formulated in such ways that address the location specific production constraints and other socio-economic problems being faced by farmers. Demand to organize specialized training is increasing now-a-days among the farming community as farmers requires recent and improved production technologies. Front line demonstration is a long term educational activity conducted in a systematic manner in farmer's field to worth of new practices/ technology. Demonstration provide an effective learning situation as farmers see the crops themselves, interact with the scientists and extension workers on the fields, and get doubts clarified then and there itself. Farmers in India 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. The main aim of these extension methodologies is to reduce the time lag between generation of technology at the research institution and transfer technology to the farmers for increasing productivity and income from the agriculture and allied sectors on sustained basis.

Rice is the major crop in Uttar Pradesh and is grown in about 5.90 million hectare which comprises of 13.5% of total rice in India. The state ranks 3rd in the country in production of rice. Annual rice production is around 12 million metric ton in the state. The average productivity of the state is 2.0 t/ha. However, natural hazards including submergence or drought or both adversely affect the productivity. The average productivity of favourable irrigated areas is more than 3.0 t/ha while rainfed lowland and upland area's average productivity are 1.50 t/ha and 1.00 t/ha, respectively. Rainfed areas are vulnerable to the vagaries of rain and therefore, the fluctuations in their output. The average rice productivity from rainfed ecology is low and fluctuates between 0.5 to 1.6 tonnes/ha. The irregularities in south-west monsoons do result in moderate to severe droughts in rainfed rice growing areas especially in eastern Uttar Pradesh. Such moisture stress with varying duration may occur during any stage (vegetative, flowering and terminal) of the crop growth in uplands, whereas, seedling stage drought generally occurs in lowlands. An effect at initial and terminal stage depends on sowing time and growth duration of the varieties. Unlike many other places of the state rainfed region is also extensively occupied by rice crop during monsoon months. The cropping systems followed here are rice-based, the crops grown during *rabi* season after rice face the problem of late sowing; due to which the productivity of *rabi* field crops remain low. There is hardly any scope to replace the rice crop in the rainfed low lands considering the high moisture contents remain throughout the growing periods during the monsoon season. However, pulses and oilseeds could be introduced under rainfed upland conditions. Rainfed lowlands which contribute more than 50% area under rice in eastern Uttar Pradesh, multiple cropping system using short duration rice varieties and intensive input management may enhance the land use efficiency and increase the production level if sowing of *rabi* crops was done in time (Khanda *et al.*, 2005). Hence, there remains a scope to introduce a short duration high yielding scented rice variety Narendra Lalmati in the existing rice-based cropping system in rainfed areas of eastern Uttar Pradesh.

Mostly the farmers of this region cultivated medium duration (120-140 days) rice varieties as rainfed crop. Sarjoo 52, NDR 359, BPT-5204, Mehsuri, Arize 6444, PHB 71 etc are the popular rice varieties mostly grown in this region; but among these Sarjoo 52 is the predominant variety which covers more than 50% of the rice growing area. However, cultivation of scented rice was very limited and was confined only to the large and medium farmers and the varieties like Mehsuri long, Type 3 and Pusa Sugandha was solely under cultivation in the name of fine and scented rice. The low yields coupled with less returns from scented rice discouraged the farmers not to grow and adopt it on a larger scale. Therefore, earlier whatever fine and scented rice was being produced by the farmers, a significant proportion of that was retained in order to meet out their domestic requirement and, as such, there was no surplus available for marketing. Due to the liberalized trade related policies of the Govt. of India and at State level, fine and scented rice has got recognition as a trade commodity not only at national but at international level. The congenial change in trade related policies along with the increasing interest of the farmers and the release of high yielding short duration varieties of scented rice like Narendra Lalmati provided the impetus to formulate and design specialized farmers training and FLD programmes to impart knowledge as well as skills involved in the production of fine and scented rice. Besides this, other extension efforts were also planned and executed to narrow down the time lag and ensured speedy adoption of technologies.

MATERIALS AND METHODS

Skill oriented trainings and front line demonstrations (FLDs) on paddy variety Narendra Lalmati (IET 21051) was conducted by Krishi Vigyan Kendra Faizabad, Uttar Pradesh (India) with the technical support of Crop Research Station, Masodha during the period from *kharif*, 2009 to *kharif*, 2013 in five villages *viz.* Madhupur, Gopalpur, Magalsi, Katrauli and Malethu Bujurg. Front line demonstrations were conducted to demonstrate the production potential of newly released variety or proven technologies in farmers' field under real farming situation. These types of on farm demonstration are so far the most effective extension tools. The available technology should reach the farmers, the ultimate users through KVK activities and adoption of the technology by the farmers will reflect the feasibility of the technology (Mazumder *et al.*, 2012).

The study was conducted during *kharif* season in five adopted villages across the three different blocks (Masodha, Sohawal, Haringtonganj) of Faizabad district for wider dissemination and popularization. Before demonstration, group meetings were conducted in each and every village where the problems associated with medium duration rice varieties and scented varieties were discussed and the advantages of growing short duration variety scented varieties were addressed. A probable list of interested farmers has been prepared from the meeting. Further, KVK scientists visited the land of the selected farmer in presence of the villagers. Before implementing the programme, the skill training programmes were organized involving the selected farmers. Field days and other extension programmes were also organized inviting the farmers of the said and nearby villages. The fertilizer dose was fixed on the soil test values. The fertility status of the demonstration plots was medium in N, low in P and medium in K.

The component demonstration of front line technology in paddy was comprised of improved short duration scented variety Narendra Lalmati, proper tillage, proper seed rate and direct seeding through drum seeder, lower dose of fertilizer (100 kg Nitrogen + 40 kg P_2O_5 and 40 kg K_2O/ha), seed treatment with streptocycline and carbendazim, weed management and protection measure. An area of 50.0 ha was covered in five consecutive years. In the demonstration, one control plot was also kept where farmers practices was carried out. The demonstrations were conducted on block concept with an area varying from 0.2-0.4 ha involving 5-10 farmers per block.

The trainings and FLDs was conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and the technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The technology gap, extension gap and technological index (Samui *et al*., 2000) were calculated by using following equations as given below:

Technology gap (q/ha) = Potential yield (q/ha) - Demonstration yield (q/ha)

Extension gap (q/ha) = Demonstration yield (q/ha) – Farmer's yield (q/ha)

Technology Index (%) = (Potential yield - Demonstration yield) /Potential yield × 100

RESULTS AND DISCUSSION

Impact of training

Skill oriented training plays an important role in the adoption of an innovation or any new idea by the farmers. It may be defined as retained information concerning facts, concept and relationship. Knowledge seeking is initiated by an individual and greatly influenced by one's predisposition.

Gain in knowledge

It is assumed that the knowledge of a farmer to a larger degree depends upon the extent of exposure given to him about the technology. The gain in knowledge by the beneficiaries about the improved package of practices of scented rice was measured in terms of percentage. Knowledge of beneficiaries was assessed under two major aspects i.e., knowledge before training and knowledge after training programmes. Similarly, front line demonstrations carried out during the course of study proved to be further speedy adoption of fine and scented rice production technologies. The results so obtained are presented in Table 1. The data reveals that the beneficiary farmers of the training programmes on rice production technologies gained highest knowledge about high yielding scented variety i.e. Narendra Lalmati (100.0 %) followed by establishment method (60.83 %), time of sowing (53.33 %), nutrient management (58.7 %), seed rate (50.00%), weed management (39.17%), land preparation (30.83%), harvesting techniques (28.33%), plant spacing (27.50%) and plant protection measures (13.33%). The findings of the study revealed that the beneficiaries gained knowledge ranging from 13.33% in case of plant protection measures to 100.00% in case of high yielding variety after attending training programmes. This might be due to the fact that the beneficiary respondents possessed more knowledge about technologies due to trainings and demonstrations programme. The contents of these training programmes were designed and perceived in such a manner that easily understood by the trainees and ultimately resulted into a substantial gain in knowledge through work experience. The findings are line with the findings of Joseph (2008) and Singh *et al.* (2014) who reported a significant difference in the knowledge between trained and untrained farmers.

Extent of adoption

The data presented in Table 2 revealed that the majority of farmers used traditional method of agronomic practices viz., use of local cultivars/races (100%), late sowing (86.67%), poor weed management (85.83%), traditional establishment methods ie. 30 days old seedling transplanted (85.00%) and poor nutrient management due to rainfed condition (82.50%) before acquiring training, whereas, after attending training programmes 95.00% beneficiaries adopted high yielding short duration variety of scented rice ie. Narendra Lalmati, 78.33% timely sowing, 59.17% proper weed management, 85% establishment method *ie.* direct seeding and 82.50% adopted appropriate method of nutrient management. Such a higher level of adoption in case of scented variety Narendra Lalmati coupled with other improved practices had actually paved the way for its wider spread at speedy rate. In case of other technologies, 31.67.% farmers were practicing plant protection measures before attending training programmes and 57.50% started after acquiring training programmes. Maximum gained in adoption level was found with high yielding variety (100%), followed by establishment method (70.00%), time of sowing (65.00%), nutrient management (65%), seed rate (57.50%), weed management (45.00%) and spacing (32.50%). Due to short duration scented variety, Narendra Lalmati was accepted by all the farmers of the locality. Adoption level of beneficiaries increased more than 50% with all the improved practices. However, plant protection measures and weed management practices required further need of trainings as the adoption level were less as compared to other agronomic practices. These findings were in agreement with Patel *et al*. (2003) and Singh et al. (2014). After attending training programmes, the farmers started adopting the improved technologies ranging from 22.50% for harvesting techniques to 95.00% for high yielding variety i.e. Narendra Lalmati. This might be due to the fact that gain in knowledge, skills and confidence level of farmers through training programmes on different production technologies such as high yielding variety, establishment method, time of sowing, nutrient management, seed rate, weed management, plant spacing, plant protection measures and harvesting techniques has helped in improving the productivity under rainfed condition and consequently its speedy adoption among the farmers.

Impact of Frontline Demonstrations

Selection of suitable crop varieties for limited irrigated conditions in different agro climatic zones of India can improve productive of respective crop. Further, selection of suitable crop varieties also comes under good agronomic practices, which can overcome the effects of biotic and abiotic stresses. The gap between the existing and recommended technologies of rice in district Faizabad is presented in Table 3. Full gap was observed in case of use of HYVs, seed treatment, sowing method and weed management, while partial gap was observed in fertilizer dose and plant protection measure, causes the reason for low yield. Farmers were not aware about the recommended technologies. Farmers in general used local or old-age long duration varieties instead of the recommended high yielding short duration varieties. Unavailability of seed in time and lack of awareness were the main reasons. Farmers followed nursery method of sowing and transplanted old age nursery (25-30 days) seedlings of paddy and closer spacing (15X15cm) against the recommended direct seeding either wet seeded or dry seeded and proper spacing (20-25 cm row to row spacing).

Yield Analysis

Results of 125 front line demonstrations (Table 4) conducted during *kharif*, 2009 to *kharif*, 2013 in 50 ha area on farmers' fields of five villages of Faizabad district under rainfed conditions indicated that average paddy yield was recorded 35.08 q/ha under demonstrated plots as compared to existing farmers practice of 23.54 q/ha. The highest yield was 37.1 q/ha in plots of FLDs and in farmers practice 25.8 q/ha during 2013. These results clearly indicated higher average grain yield in demonstration plots compared to local check was due to knowledge and adoption of full package of practices. The yield of newly introduced rice variety Narendra Lalmati was increased successively over the years in demonstrated plots. The maximum demonstration yield (37.1 q/ha) was achieved during 2012, which was 43.80% higher than the existing farmers' practice yield of 25.8 q/ha. The yield of rice could be increased over the yield obtained under farmers practices (use of non-descriptive local variety, no use of the balanced dose of fertilizer, untimely sowing, delayed transplanting and no control measure adopted for pest management) of paddy cultivation. The above findings are in similarity with the findings of Singh (2002) and Singh *et al.* (2015).

Five consecutive years (2009 to 2013) of front line demonstration with the rice variety Narendra Lalmati revealed that increase in yield over existing farmers' practice was 39.85 to 61.24% with the mean of 49.02% towards the enhancement of yield of rice with its positive effects on yield attributing characters (Table 4). The variation in yield in the successive years could be attributed to variation in climatic condition prevailing during the crop growth period. Depending upon the farming situation specific interventions may have greater implication in enhancing system productivity (Mukherjee, 2003 and Mitra *et al.*, 2014).

Technology gap analysis:

The data depicted in Table 5 revealed that the scented short duration rice variety Narendra Lalmati produced average yield of 35.08 q/ha under demonstrations as against the potential yield of 37.5 q/ha. Thus, there is average technology gap of 2.4 q/ha between the demonstrations yield and potential yield. However, demonstrations were conducted under close supervision of scientists but the technology gap was found there. It might be due to varied agro-ecosystems, soil fertility status and weather conditions of the area. Though technology gap decreases from 3.8 q/ha to 0.4 q/ha in due course of demonstrations conducted.

The highest extension gap ranged from 10.4 to 12.8 q/ha during the period indicates that there is a gap existed between the yield of demonstrations and local check (farmers' practice). It was observed that the farmers did not apply herbicide and plant protection measures properly, local medium duration varieties were sown without seed treatment and optimum plant population, which was not maintained under conventional system. Thus, the farmers were failed to adopt recommended package of practices under conventional system and lead to extension gap. The extension gap in the yield indicates that there is big scope to increase the yield of rice under rainfed conditions at farmers' fields by adopting the

recommended package of practices. Therefore, to bridge the extension gap, there is a need to give due emphasis on transfer of improved technologies and management practices of rice through strengthening of extension network. The extension gap for crop was higher as compared to the technology gap, which also indicates that there is a need to train and educate to the farmers about improved technologies. More and more use of latest production technologies during further years with high yielding varieties will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old existing practices and to adopt new technology.
The technology index shows the feasibility of the evolved technology at the farmers' fields. The lower the value of technology index more is the feasibility of the technology. Technology index was minimum (1.07%) during the later year of demonstrations (i.e. 2013) compared to early demonstration programme of 2009 (10.13%). Technology index shows the feasibility of the demonstrated scientific technological interventions at the farmers' field. Therefore, technology index ranging from 1.07 to 10.13% (Table 5) indicates of higher scope for further improvement in productivity of rice in eastern plain zone of Uttar Pradesh. Similar findings were also observed by Mitra *et al.* (2014) and Singh *et al.* (2015).

Economics analysis:

The use of improved techniques required more cost for crop production than farmers practice in the crop under studied (Table 6). Increase in expenditure due to improved techniques over conventional system was lowest of Rs. 17,250/ha during the year 2009 and gradually increased during the subsequent years due to rise in prices of inputs. The use of improved techniques increased net economic gain of crop under demonstrations considerably. Maximum increase of Rs. 26,125/ha in net profit was observed in the crop during the year 2013. On an average, net profit of Rs. 17,905/ha and B:C ratio of 1.95 was found with demonstrations and was much higher when compared with farmers' practices (Rs. 8,900/ha and 1.56, respectively) in the crop under studied. It might be attributed to quantity wise highest increased in yield with improved techniques over conventional system of rice. Benefit cost ratio on improved techniques was worked out highest of 2.29 during the year 2013. These results showed that investment on improved cultivation techniques is more profitable on rice under rainfed lowland in eastern plain zone of Uttar Pradesh. This finding is in corroboration with the findings of Singh *et al.*, (2015). The crops, which gave higher profitability, proved economically beneficial.

CONCLUSION

Thus, it can be concluded that training programmes backed by the field demonstrations conducted at Faizabad district with the apparent objective for popularization of Narendra Lalmati have proved to be the most effective and come up as an effective tool in the result oriented speedy dissemination of knowledge and technical skills to the farmers. Agricultural extension activities have resulted in increase in area under recommended variety Narendra Lalmati and other agronomic practices. Further efforts are being made by way of organising different extension activities for motivation of the farmers for further popularization and adoption of Narendra Lalmati.

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Table 1: Impact of training programmes on gain in knowledge level of beneficiaries

S.No.	Improved technology	Knowledge level of beneficiaries				Gain in knowledge level	Rank
		Before training	Rank	After training	Rank		
1.	Land preparation	83 (69.17)	I	120 (100.0)	I	37 (30.83)	VII
2.	Establishment method	21 (17.50)	VIII	94 (78.33)	III	73 (60.83)	II
3.	High yielding variety (Narendra Lalmati)	00 (0.00)	X	120 (100.0)	I	120 (100.0)	I
4.	Time of sowing	18 (15.00)	IX	82 (68.33)	V	64 (53.33)	III
5.	Seed rate	34 (28.33)	V	94 (78.33)	III	60 (50.00)	V
6.	Spacing	48 (40.00)	IV	81 (67.50)	VI	33 (27.50)	IX
7.	Nutrient management	27 (22.50)	VII	90 (75.00)	IV	63 (52.50)	IV
8.	Weed management	32 (26.67)	VI	79 (65.83)	VII	47 (39.17)	VI
9.	Plant protection measures	53 (44.17)	III	69 (57.50)	VIII	16 (13.33)	X
10.	Harvesting techniques	65 (54.17)	II	99 (82.50)	II	34 (28.33)	VIII

Figures in parenthesis indicate percentage

Table 2: Impact of training programmes on adoption level of beneficiaries

S.No.	Improved technology	Adoption level of beneficiaries				Gain in adoption level	Rank
		Before training	Rank	After training	Rank		
1.	Land preparation	76 (63.33)	I	108 (90.00)	II	32 (26.67)	VII
2.	Establishment method	18 (15.00)	VII	102 (85.00)	IV	84 (70.00)	II
3.	High yielding variety (Narendra Lalmati)	00 (0.00)	X	114 (95.00)	I	114 (95.00)	I
4.	Time of sowing	16 (13.33)	IX	94 (78.33)	VI	78 (65.00)	III
5.	Seed rate	34 (28.33)	V	103 (85.83)	III	69 (57.50)	IV
6.	Spacing	39 (32.50)	III	78 (65.00)	VII	39 (32.50)	VI
7.	Nutrient management	21 (17.50)	VI	99 (82.50)	V	78 (65.00)	III
8.	Weed management	17 (14.17)	VIII	71 (59.17)	VIII	54 (45.00)	V
9.	Plant protection measures	38 (31.67)	IV	69 (57.50)	IX	31 (25.83)	VIII
10.	Harvesting techniques	51 (42.50)	II	78 (65.00)	VII	27 (22.50)	IX

Figures in parenthesis indicate percentage

Table 3: Package of practices adopted for demonstration and existing practice in rainfed lowland conditions

Particulars	Improved practices demonstrated	Existing practices	Gap analyzed
Farming situation	Rainfed condition	Rainfed condition	-
Variety	Narendra Lalmati	Sarjoo 52	Full gap
Land preparation	Three ploughing	Three ploughing	Nil
Planting method	Direct seeded rice under wet condition	Transplanting rice under puddle condition	Full gap
Seed rate	40-50 kg/ha	25-30 kg/ha	Higher seed rate
Seed treatment	Streptocycline @ 8.0 g per 50 kg seed for BLB & carbendazim @ 100 g/50 kg seed for ShB & blast	No seed treatment	Full gap
Time of sowing/ transplanting	25-30 June	10-20 July	Early sowing
Seedling age at transplanting	-	28-30 days	Full gap
Fertilizer application	100:40:40 (NPK); Zn ($ZnSO_4$@ 25 kg/ha) during final land preparation	150:60:0 (NPK); no application of K and micronutrients	Partial gap
Weed management	Integrated weed management	No weeding or delayed manual weeding	Full gap
Plant protection	Need based plant protection measures with special attention on bacterial leaf blight & sheath blight	Indiscriminate use of pesticides as prescribed by local pesticide retailers	Partial gap
Harvesting	110-115 days	125-145 days	Early harvesting

Table 4: Yield performances of scented variety Narendra Lalmati under demonstration

Year	No. of demonstrations	Area (ha)	Potential yield (q/ha)	Demo yield (q/ha)	Local check (q/ha)	Yield increment (%)
2009	25	10.0	37.5	33.7	20.9	61.24
2010	25	10.0	37.5	34.2	23.5	45.53
2011	25	10.0	37.5	33.9	21.4	58.41
2012	25	10.0	37.5	36.5	26.1	39.85
2013	25	10.0	37.5	37.1	25.8	43.80
Mean	**125**	**50.0**	**37.50**	**35.08**	**23.54**	**49.02**

Table 5: Technology gap, extension gap and technology index in rice (var. Narendra Lalmati) under FLDs

Year	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
2009	3.8	12.8	10.13
2010	3.3	10.7	08.80
2011	3.6	12.5	09.60
2012	1.0	10.4	02.67
2013	0.4	11.3	01.07
Mean	**2.4**	**11.5**	**6.5**

Table 6: Comparative economics of rice cultivation between demonstration and farmers' practice

Year	Demonstration				Farmers' practice (control)			
	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
2009	17250	30330	13080	1.76	15100	18810	3710	1.25
2010	18200	34200	16000	1.88	15750	23500	7750	1.49
2011	19500	33900	14400	1.74	15800	21400	5600	1.35
2012	19500	39420	19920	2.02	16250	28188	11938	1.73
2013	20250	46375	26125	2.29	16750	32250	15500	1.93
Mean	**18940**	**36845**	**17905**	**1.95**	**15930**	**24830**	**8900**	**1.56**

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