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Increasing Paddy (*Oryza sativa* L.) Productivity Through HYV Seed and Balanced Dose of Fertilizer

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Abstract Rice *(Oryza sativa)* is the world's second most important cereals and is staple food for one third population of the world. Paddy is also one of the major cereal crops of Ghazipur district. Productivity of paddy is low in Ghazipur due to imbalanced use of fertilizer and no use of HYV. And they are not aware about micronutrient zinc sulfate. This study focused on impact assessment of front line demonstrations (FLDs) on Integrated Nutrient Management through recommended paddy production technology. KVK Ghazipur selected 100 farmers for conducting FLDs on paddy during years 2013 to 2017. Twenty farmers selected each year for conducting from line demonstrations. During demonstration, critical input such as balanced dose of fertilizer (NPK) with zinc sulfate ($ZnSO_4$) with HYV seed was given to selected farmers. The result revealed that application of 120 kg N/ha, 60 kg P/ha, 40 kg K/ha and 25 kg $ZnSO_4$/ha recorded significant growth in production of paddy. Results described the positive impact of front line demonstrations on adoption of paddy production technology by the respondents. The average yield was recorded 46.60 q/ha, 40.82 q/ha, 41.03 q/ha, 61.60 q/ha and 40.78 q/ha in year 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18 *kharif* season respectively. The highest yield was recorded in year 2016 which was 39.93% higher than farmers practice. The beneficiary farmers were much appreciated recommended paddy production technology. Front line demonstration revealed significant increase in production of paddy.

Keywords Front line demonstration, Paddy production technology, Yield, Nitrogen, Phosphorus.

Introduction

Paddy (*Oryza sativa* L.) is the food crop in most of the area of the world. It provides food for over half the world's population. Paddy is grown in nearly 115 countries and it is the major source in the field of agriculture for more than 100 million families in Asia. As a cereal grain it is the most widely consumed staple food for a large part of the world's human population, especially in Asia.

It is the predominant dietary energy source for 17 countries in Asia and the pacific, 9 countries in North and South America and 8 countries in Africa. Rice provides 20% of the world's dietary energy

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Table 1. Year wise crop detail demonstrated fields.

Year	Sowing date	Harvesting date	Rainfall
2013-14	14, 15, 16 and 17 July 2013	25, 26 and 28 October 2013	687.0
2014-15	05, 06, 07 and 08 July 2014	04, 05 and 06 November 2014	770.0
2015-16	14, 15, 16 July 2015	16, 17, 18 and 19 November 2015	650.0
2016-17	07, 09, 10, 11 July 2016	05, 07 and 09 November 2016	690.0
2017-18	13, 15, 16 and 18 July 2017	28, 29, 30 October 2017 and 01-November 2017	710.0

supply, while wheat supplies 195 and maize (corn) 5%. Cooked, unenriched, white, long-grained rice in a 100 g serving provides 130 calories and contains no micronutrients in significant amounts, with all less than 10% of the daily value (DV). Cooked, white, short-grained rice also provides 130 calories and contains moderate amounts of B vitamins, iron, and manganese (10-17% DV) per 100 g amount (FAO 2004).

India is one of the world's largest producers of rice and brown rice, accounting for 20% of all world rice production. Rice is India pre-eminent crop, and is the staple food of the people of the estern and southern parts of the country. Verma et al. (2014) production increased from 53.6 million tons in FY 1980 to 74.6 million tons in year 1990, a 39% increase over the decade. By year 1992, rice production had reached 181.9 kg, second in the world only to China with its 182 kg (FAO 2004). Since 1950 the increase has been more than 350%. Most of this increase was the result of an increase in yields; the number of hectares increased only 0% during this period. Yields increased from 1,336 kilograms per hectare in FY 1980 to 1,751 kilograms per hectare in FY 1990. The per-hectare yield increased more than 262% between 1950 and 1992 (FAO 2004).

In India, productivity of paddy is still low in comparison to worlds average productivity. Balanced dose of fertilizer, proper selection of variety and agronomic practices plays vital role in increasing paddy productivity. In Ghazipur district average paddy productivity is 21.79 q/ha, which is far less from national average.

Krishi Vigyan Kendra is the farm science center at the district level provided by Indian Council of Agricultural Research (ICAR) as an institutional project to demonstrate the application of Science and Research Technologies, input of agricultural research and education at the farmer's field in the rural area with the help of multidisciplinary team of scientists. Front Line Demonstration is one of the major mandatory activities of KVK to demonstrate latest technology in the field and agriculture.KVK organizes FLD in various crops to generate production data and feedback information. The baseline survey was conducted by Krishi Vigyan Kendra, Ghazipur and it was revealed that farmers are using imbalanced dose of chemical and fertilizer and not using zinc sulfate. Keeping in view of these constraints Krishi Vigyan Kendra, PG College Ghazipur conducted from line demonstration during 2013 to 2017 in *kharif* season. The main theme was to demonstrate balanced dose of fertilizer with zinc sulfate.

Materials and Method

Krishi Vigyan Kendra, PG College Ghazipur has conducted FLDs at the farmers' field in villages of Ghazipur district during 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18 *kharif* seaons. Twenty farmers were selected randomly from the villages in each year and the area under each demonstration was 0.25 ha. The farming situation of demonstration fields was irrigated, low in nitrogen, medium in phosphorus and

Table 2. No. of tillers per square meter.

Year	Demonstration	Farmers practice	Percentage increase in tillers/Square meter
2013-14	310	250	24
2014-15	280	230	21
2015-16	320	230	39
2016-17	330	220	50
2017-18	340	210	61

Table 3. Yield analysis of front line demonstrations of paddy on farmers' field.

Year	No. of demons-trations	Technology demonstrated	Demonstration on yield (q/ha)	Farmers practice (q/ha)	Percent increase
2013-14	20	HYV seed MTS-7029 + Balanced dose of fertilizer and use of zinc sulfate ($N:P:K:ZnSO_4$@120:60:40:25 kg/ha)	46.60	33.50	39.10
2014-15	20	HYV seed BPT-5204 + Balanced dose of fertilizer and use of zinc sulfate ($N:P:K:ZnSO_4$@120:60:40:25 kg/ha)	40.82	30.18	35.26
2015-16	20	HYV seed Moti + Balanced dose of fertilizer and use of zinc sulfate ($N:P:K:ZnSO_4$@120:60:40:25 kg/ha)	41.03	30.06	36.52
2016-17	20	HYV seed BPT-5204 + Balanced dose of fertilizer and use of zinc sulfate ($N:P:K:ZnSO_4$@120:60:40:25 kg/ha)	61.60	44.20	39.93
2017-18	20	HYV seed BPT-5204 + Balanced dose of fertilizer and use of zinc sulfate ($N:P:K:ZnSO_4$@120:60:40:25 kg/ha)	48.66	40.78	19.32

potash and the soil was sandy loam (Table 1). The crop rotation was rice wheat. The study was conducted to observe the performance of HYV seed + balanced dose of fertilizer i.e. $N:P:K:ZnSO_4$@120:60:40:25 kg/ha against imbalanced dose of fertilized used in farmers paractice. Kamlesh et al. (2018)the crop was grown with recommended package and practices. The critical input i.e. nitrogen, phosphorus, potash and zinc sulfate was applied in 120 kg/ha nitrogen, 60 kg/ha phosphorus and 40 kg/ha potash with 25 kg/ha zinc sulfate with HYV seed (Lathwal 2010). The demonstrations were monitored from sowing to harvesting by scientists of Krishi Vigyan Kendra, PG College Ghazipur. To disseminate the technology in large area, the outcomes of demonstration were depicted through trainings, kisan gosthies and field days. The results in terms of productivity and profitability per unit area appreciated by the farmers in FLD and farmers practice were observed and economically analyzed.

Results and Discussion

The balanced dose of fertilizer $N:P:K:ZnSO_4$@120:60:40:25 kg/ha was used for demonstration as it has benefits over farmers practice: Paddy HYV with balanced dose of fertilizer is more disease resistant, It has erect, medium tall plant with more grain, No of tillers per square meter increases up to 61%, High average yield up to 44.40 q t/ha.

Grain yield

The results of all FLDs plots over different periods are given in Table 2 and Table 3. The HYV seed + balanced dose of fertilizer with micronutrient zinc sulfate performs better in comparison to farmers practice in different years. The grain yield of paddy increased by 46.60 q/ha (2013-14), 40.82 q/ha (2014-15), 41.03 q/ha (2015-16), 61.60 q/ha (2016-17) and

Table 4. Economic analysis of front line demonstration of paddy on farmers' field.

Year	Cost of cash input (Rs/ha)		Total returns (Rs/ha)		Net return over variable cost		Additional return over farmers' practice	B:C ratio (Gross return/Gross cost)	
	Demo	FP	Demo	FP	Demo	FP		Demo	FP
2013-14	33123	30291	59648	42880	26525	12589	13936	1.80	1.42
2014-15	31961	29575	52249	38630	20288	9055	11233	1.63	1.30
2015-16	37190	33760	55814	40881	18623	7121	11502	1.50	1.21
2016-17	35463	31650	89936	64269	54473	32619	21854	2.53	2.03
2017-18	36450	32630	71773	60150	35323	27520	7803	1.96	1.84

48.66 q/ha (2017-18) over the yield obtained under farmers' practice (Table 3). These results clearly show that due to balanced dose of fertilizer with zinc sulfate, the yield of paddy increased between 40.82 and 61.60% over the yields obtained under farmers practice (Lathwal 2010).

Economic Analysis

Economic returns were observed to be a function of grain yield and Minimum Support Price (MSP) announced by the Govt. of India which varied with the year. Different variables like seed, fertilizer, insecticide and pesticide were considered as cash input for FLD demonstration as well as for farmers practice. (Raj et al. 2014) the additional return of demonstrated plots under HYV seed + balanced dose of fertilizer with zinc sulfate ranged between Rs 7803 to Rs 21854 per ha during different years in comparison with farmers practice. The highest average net return Rs 54473.00 was observed during the year 2016-17. The benefit cost ratio was observed higher under balanced dose of fertilizer than the farmers practice during all the years (Table 4) (Singh et al. 2016). The trainings, field days, mobile advisories and regular monitoring of the field by the KVK scientists were done to the change the attitude, skill and knowledge of farmers towards improved /recommended practice of paddy cultivation (Singh et al. 2016).

Conclusion

The increase in yield of paddy is encouraging to motivate the farmers to adopt the technology, FLD conducted with trainings, field days, mobile advisories and regular monitoring of field by scientists was sufficient to change the attitude, skill and knowledge of farmers towards recommended practice of paddy cultivation. The FLD at farmers' field was as primary source of information for dissemination of recommended technology. The concept of FLD may be applied to other members of farming community for imporvement in productivity of paddy. Hence the farmers convinced to adopt balanced dose of chemical fertilizer with micronutrient zinc sulfate through Krishi Vigyan Kendra.

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