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Research article

YIELD GAPS AND CONSTRAINTS IN LOW LAND RICE ECOLOGY OF EASTERN UTTAR PRADESH

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ABSTRACT: In India, rice is cultivated under four different ecologies, with irrigated ecology accounting for the largest area (25 mha) and highest production (71 mt) and productivity (2.9 t/ha) closely followed by rainfed low lands with an area of 15.3 mha which account for about 40% of total rice cultivated area. The importance of lowland rice cultivation warrants for systematic assessment of yield gaps and production constraints. One of the districts in eastern Uttar Pradesh *viz.,* Faizabad was selected for the present study. Data were collected from 125 rice farmers through personal interview method and the data pertains to *Kharif* 2011. The difference between the potential and actual yield of the sample farmers was 1.5 t/ha. The Index of yield gap was found to be 29%. It was found that if production constraints experienced by farmers in this region are addressed, productivity can be increased to the tune of 29%. Garrett's ranking technique was used to prioritize the constraints in rice production. Major constraints in realizing the potential yield are; the problem of submergence, pests, weed infestation and nutrient deficiency (a Garrett score of 70, 60, 56 and 49 respectively). Adoption of location specific submergence tolerant varieties and recommended package of practices would help the farmers in realizing the potential yield in the study area. Since majority of the farmers in the study area have small and marginal land holdings, they need credit facilities to procure critical inputs blended with timely extension services.
Key words: Rice, Yield gaps, Low land ecology, Constraints

INTRODUCTION

India, the largest rice growing country, covers an area of 44 mha under rice with a production of 104.32 mt with yield levels still remaining low at around 2.37 t/ha of rice and 3.5 t/ha of paddy in comparison with world average paddy productivity of 4.4 t/ha. In India, rice is cultivated under four different ecologies, with irrigated ecology accounting for the largest area (25 mha) and highest production (71 mt) and productivity (2.9 t/ha) closely followed by rainfed low lands with an area of 15.3 mha which account for about 40% of total rice cultivated area. Region-wise, the predominantly rainfed eastern zone accounts for the largest area and production but with the lowest productivity, while the largely irrigated north and south zones together accounting for slightly less area produce one and a half times more than that of eastern India with a distinct yield edge [5].

Several studies show the existence of yield difference between the potential, the best practices and actual yields in different rice growing areas representing various agro-ecologies. [1,2]. Yield analysis further reveals that 30 to 40 per cent of the potential yield is yet to be tapped with available rice production technologies. [3]. In the rainfed shallow lowland ecology, the yield gap varies from 34.8 percent in Eastern Uttar Pradesh to 59.5 percent in Assam. [5]. Rice farming in the Uttar Pradesh is most vulnerable and risk prone due to complex ecological situations marked by frequent flood or drought or both. An analysis of the area, production and yield of rice during the last ten years shows that the yield is stagnating around ≤ 2.0 t /ha since 2001-2002 except in the year 2002-2003, 2004-2005 and 2009- 2010 due to erratic rainfall distribution which causes excess water stagnation/ drought or both in different years [4].

In view of the above challenges and opportunities, the present study was taken up to know the extent of yield gaps and constraints in low land rice production among the rice farmers of Faizabad district of Eastern Uttar Pradesh, with the following objectives:

- ❖ To estimate the magnitude of yield gaps
- ❖ To identify the constraints in realizing the potential yield as perceived by the farmers

Methodology

The major rice area under lowland and flood prone is located in eastern part of Uttar Pradesh covering 15 districts which constitutes about 30% area of total rice cultivated in the state. In the study conducted during 20011-12, Faizabad district of Eastern Uttar Pradesh was purposively selected, as it covers low land ecosystem. Etaura, Gongauli, Madhavpur and Durgapur villages of Purabazar block and Misrouli village of Masodha block of Faizabad district were selected. Twenty five farmers were selected from each of the sample villages forming a total sample size of 125 farmers.

A well structured interview schedule was constructed and data were collected from the respondents through personal interview method. The data on experimental station yield and frontline demonstration yield were collected from the office of the Crop Research station, Masodha of Faizabad district.

Various indices of yield gaps were worked out using the following formulae:

1. Yield Gap I (%) = $(Y_p-Y_d)/Y_p*100$
2. Yield Gap II (%) = $(Y_d-Y_a)/Y_d*100$
3. Total Yield Gap = Potential yield- Actual yield
4. Index of Yield Gap = $((Y_p-Y_a)/Y_p) *100$
5. Index of Realized Potential Yield = $(Y_a)/Y_p) *100$
6. Index of realised potential farm yield = $(Y_a)/Y_d) *100$

Where,

Y_p= Potential Yield/Experimental station yield

Y_d= Potential Farm Yield/Front line demonstration (FLD) yield

Y_a= Actual Yield realized by the sample farmers

The range was calculated by distributing the values of yield gap obtained using class intervals of 20 and the frequency of the respondents in each class interval was made to arrive at the range of yield gap in which majority of the respondents were distributed. The relative importance of the perception of the farmers regarding the major constraints in realising the potential were prioritized by using Garrett's ranking technique using the formula:

$$\text{Percent position} = \frac{100\,(Rij-0.50)}{Nij}$$

Where,

Rij is the rank given by i th item by j th individual

Nij is the number of items ranked by the j th individual

The percent position of each rank was converted into scores using Garrett's table. For each constraint, scores of individual respondents were added together and were divided by total number of respondents for whom scores were added. Thus mean score for each constraint was ranked by arranging them in descending order.

RESULTS AND DISCUSSION

i) Profile characteristics of sample farmers

As could be observed from the Table 1, large number of the respondents were old (47 percent) and 42 per cent were middle aged. Thirty eight percent of the respondents were illiterate, 30 percent were with primary education and 20 percent having secondary level of education. Ninety four percent of the respondents were having agriculture as their primary occupation. With regard to the area under rice cultivation, the low, medium and high categories were represented by (64.4 percent, 27.2 percent, and 6.4 percent respectively). As far as farming experience of the rice growers is concerned, 9.6 per cent of the farmers fell under low category, followed by 69.6 per cent in medium category and 20.8 per cent in the high category. With regard to the input availability, 53 per cent of the farmers fell in the category of medium input availability and 28 and 19 fell under low and high input categories respectively.

ii) Assessment of yield gap

The potential yield realized at research station was 5 t/ha, the yield obtained in the demonstration plot was 4.52 t/ha, whereas the average yield of the farmers was 3.59 t/ha (Fig 1). Yield gap I which is the difference between the potential yield and the potential farm yield is 9.6 % (Fig 2). Yield gap II which is the difference between the potential farm yield and actual yield realized by the sample farmers is 20.5 %. The total yield gap which is the difference between the potential yield and the actual yield worked out to be 1.41 t/ha and the Index of yield gap was found to be 29 % (Fig 3). The index of realized potential yield which is a measure of the extent to which the yield obtained at experimental station has been realized on the farmers field was 71 percent. The index of realized potential farm yield which is a measure of the extent to which the yield obtained at demonstration plots has been realized on the farmers' field was 79 percent. These results indicate that still there is an untapped yield of 29 percent which can be realized on the farmers' field with the existing technologies.

A perusal of the Table 2 shows that the majority of the respondents are distributed in the range of yield gap of 21 to 40%. Siddiq [5] also observed from his findings that the yield gap varies from 34.8 percent in Eastern Uttar Pradesh to 59.5 percent in Assam.

iii) Constraints in realizing the potential yields

The farmers were asked to rank the constraints in rice production. The relative importance of the perception of the farmers regarding the major constraints in realizing the potential were prioritized by using Garrett's ranking technique. The risk of submergence, incidence of pests like stem borer, gundhi bug and leaf folder and weed infestation (*Echinochloa crusgalli, E.colona and Cyperus rotandus*) were the major constraints in rice production with a garret score of 74.04, 60.56, 56.03 respectively. Nutrient deficiency of the soils, incidence of diseases like sheath blight, BLB and false smut and lack of extension services were the other major constraints in rice production as opined by the farmers. Also, many of the farmers were using Nitrogen and phosphate fertilizers only. Only progressive farmers used moon bean and dhaincha as green manure and FYM before transplanting for improving the soil fertility.

Table No.1 Profile characteristics of the sample farmers (n=125)

S.No.	Variables/Category	No.	Rice farmers percent
1	**Age**		
	Young	13	10.4
	Middle	53	42.4
	Old	59	47.2
2	**Education**		
	Illiterate	48	38.4
	Primary	38	30.4
	Secondary	25	20
	College	14	11.2
3	**Occupation**		
	Agriculture as primary	118	94.4
	Agriculture as secondary	7	5.6
4	**Area under rice cultivation**		
	Low	83	66.4
	Medium	34	27.2
	High	8	6.4
5	**Farming experience**		
	Low	12	9.6
	Medium	87	69.6
	High	26	20.8
6	**Input availability**		
	Low	35	28
	Medium	66	53
	High	24	19

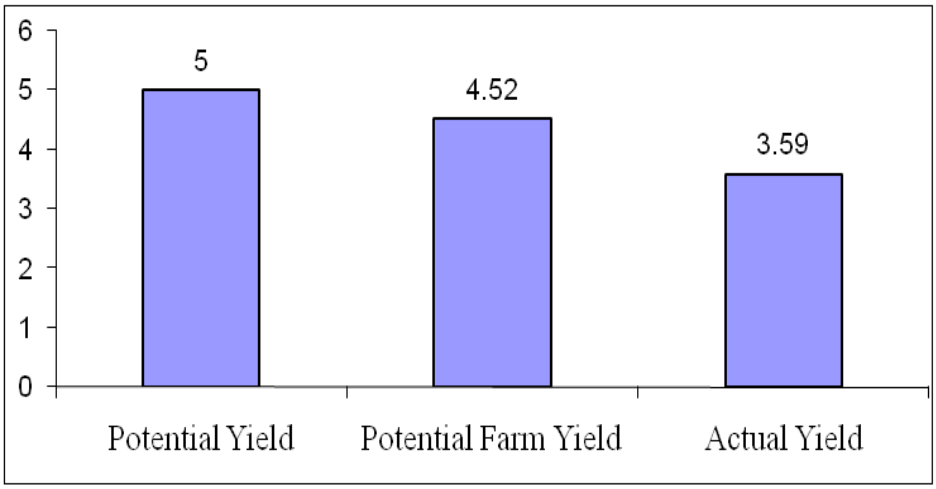

Figure-1: Yield levels in different situations (t/ha)

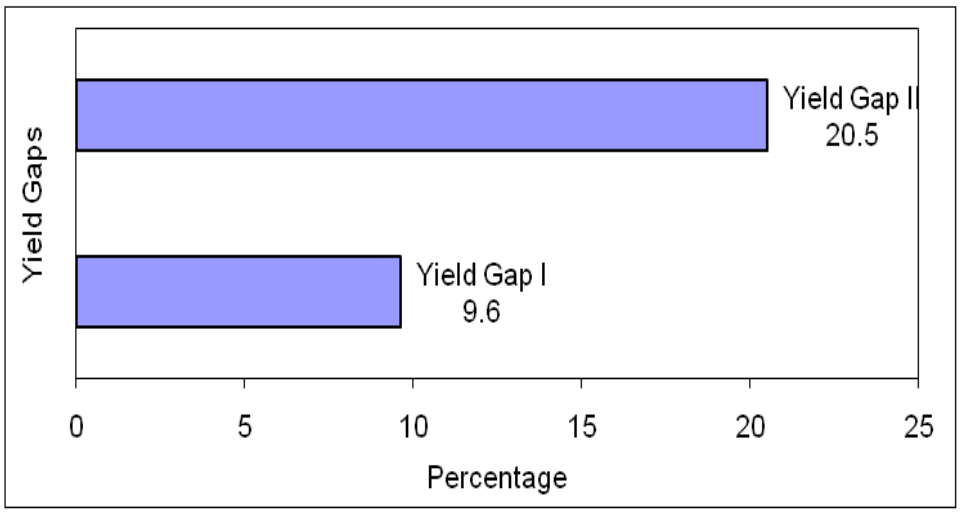

Figure-2: Yield gaps in the study area

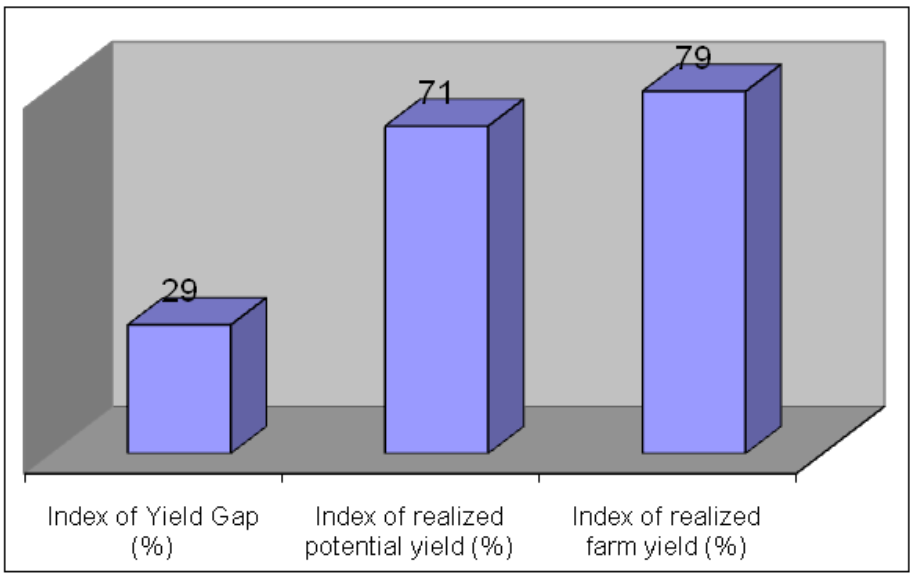

Figure-3: Indices of yield Gaps

Table 2- Range showing the distribution of respondents with respect to their yield gap (n = 125)

Range/Class interval	No	%
0-20	21	17
21 to 40	96	76
41 to 60	7	6
61 to 80	1	1
81 to 100	0	0
Total	**125**	**100**

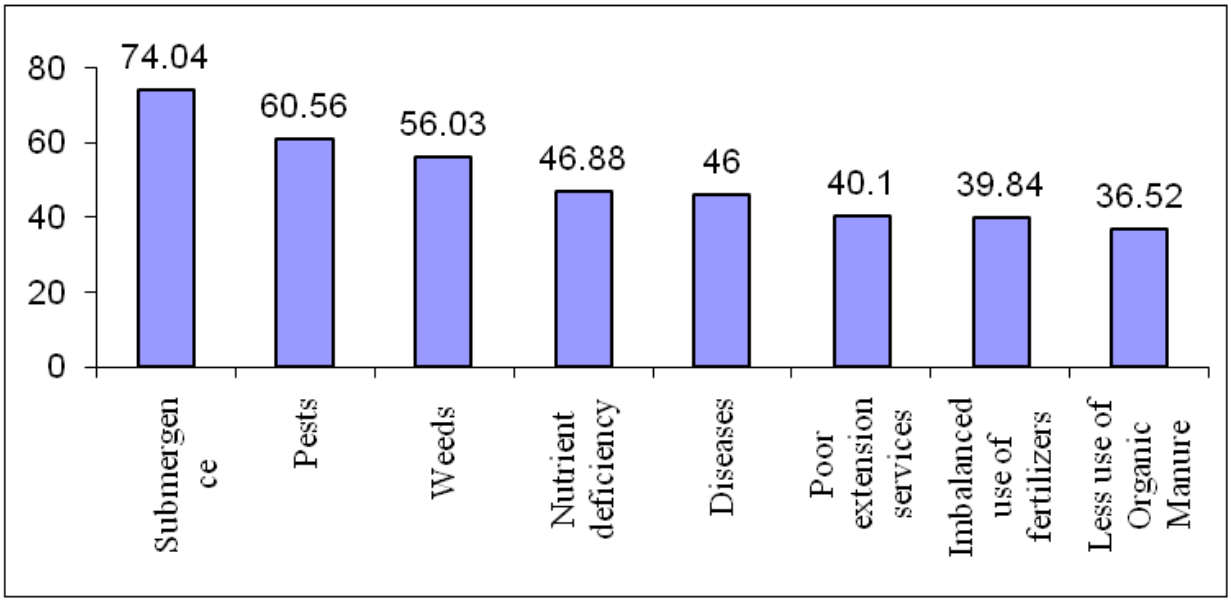

Figure-4: Garrett's ranking for constraints in rice production

CONCLUSION

The results revealed a considerable yield gap of 29% in the study area, implying that, if the production constraints experienced by the farmers in this region are addressed, productivity can be increased to the tune of 29 per cent. The major constraints in realizing the potential yield were the problem of submergence, pests, weed infestation and nutrient deficiency with a Garrett score of 74, 60, 56 and 46 respectively. Adoption of location specific submergence tolerant varieties and recommended package of practices would help the farmers in realizing the potential yield in the study area. Since majority of the farmers in the study area have small and marginal land holdings, institutional support in the form of provision of credit facilities to procure and use the recommended level of inputs may be considered to realize the potential yield on farmers' field.

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