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Quantification of yield gaps and productivity difference in SRT and traditional paddy cultivation methods in Kolhapur district of Maharashtra

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Abstract

The present study is an attempt to analyze the “Quantification of Yield Gaps and Productivity Difference In SRT And Traditional Paddy Cultivation Methods In Kolhapur District Of Maharashtra”. For present study traditional method, and Saguna Rice Technology (SRT) method of paddy cultivation are studied. Yield gap III of traditional and SRT was 41.55 qtls and having yield gap per cent 50.59. The total productivity difference between the SRT paddy and traditional paddy was estimated to be 41.70 per cent.

Keywords: SRT method, yield gap, productivity difference

Introduction

Paddy having botanical name *Oryza Sativa* L. Family Poaceae. Rice is one of the most important staple food-grains, and ranks third in production among food-grain crops in the world next to maize and wheat. It is also the most irrigation-intensive crop in the world: more than two-thirds of irrigated area is under rice cultivation. However, it is the only cereal crop that can grow under both flooded and dry conditions. The practices of rice cultivation have undergone changes over time from simple broadcasting to systematic transplantation and direct seeding.

Objectives

1. To estimate yield gap of paddy in SRT and Traditional methods of cultivation
2. To estimate productivity difference between the SRT and Traditional paddy cultivation methods

Material and Methodology

For present paper area were selected in the Kolhapur district of Maharashtra. Two tahsils Kagal and Karveer were selected purposively. The three villages selected from Kagal and Kaveer tahsils. Total sample of 90 growers are selected who adopted traditional method, Saguna Rice Technology (SRT) method and char-suttri method. The comparison between 30 growers of SRT and 15 growers of Traditional and 30 growers of Char- Suttri are compared with 15 traditional growers which selected in same area for present study.

1) Yield Gap

Yield gap was estimated by using the methodology develop by International Rice Research Institute (IRRI), Manila, Philippine for different methods of paddy cultivations.

$$\text{Yield Gap I} = Y_p - Y_d$$

Where,

Y_p =Potential yield (Maximum yield obtained at farmers level)
 Y_d = Potential farm yield (Yield realized on demonstration plot)

$$\text{Yield Gap II} = Y_d - Y_a$$

Where,

Y_d =Potential farm yield (Yield realized on demonstration plot)
 Y_a = Actual yield (Yield realized on traditional sample farm)

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$$\text{Total Yield Gap} = Y_p - Y_a$$

Where,

Y_p = Potential yield (yield realized at research station)

Y_a = Actual yield (yield realized on sample farm)

2) Indices of yield gap

a) Index of yield gap refers to the percentage of yield potential unrealized i.e.

$$\text{Index of yield gap (YIG)} = \frac{(Y_p - Y_a)}{Y_a} \times 100$$

b) Index of realized potential yield is defined as the percentage of the yield potential achieved.

$$\text{Index of Realized Potential Yield (IRPY)} = \frac{Y_a}{Y_p} \times 100$$

c) Index of realized potential farm yield is defined as the ratio of actual yield to potential farm yield, expressed in percentage. Thus,

$$\text{Index of realized demonstration plot yield (IRPDY)} = \frac{Y_a}{Y_p} \times 100$$

It may not possible for all farmers to raise the crop productivity on their farms to the level of research station. However, it would be realistic to aim at demonstration plot yield (potential farm yield) level. Therefore, emphasis was given on yield gap-II and here in after simply referred as yield gap. For the computation of yield gap, simple tabular analysis was used.

3) Decomposition Analysis

The decomposition model was used for decomposing the productivity difference between the SRT method, char- suttri method and the traditional method of rice cultivation. The equation involves decomposing the logarithm of ratio of per hectare productivity of SRT, char- suttri and traditional method of rice cultivations. The approximate a measure of percentage change in per hectare output between the SRT cultivation and traditional cultivation was analysed. In following equations ‘S’ stands for SRT method, ‘T’ stands for traditional method and ‘C’ stands for Char-suttri method.

In logarithm form, Cobb-Douglas production function for SRT method of paddy is;

$$\ln Y_s = \ln b_{s0} + b_{s1} \ln X_{s1} + b_{s2} \ln X_{s2} + b_{s3} \ln X_{s3} + b_{s4} \ln X_{s4} + b_{s5} \ln X_{s5} + b_{s6} \ln X_{s6} + U_s$$

Logarithm form of Cobb-Douglas production function for traditional method of paddy is;

$$\ln Y_T = \ln b_{T0} + b_{T1} \ln X_{T1} + b_{T2} \ln X_{T2} + b_{T3} \ln X_{T3} + b_{T4} \ln X_{T4} + b_{T5} \ln X_{T5} + b_{T6} \ln X_{T6} + U_T$$

In logarithm form, Cobb-Douglas production function for Char- suttri method of paddy is;

$$\ln Y_c = \ln b_{c0} + b_{c1} \ln X_{c1} + b_{c2} \ln X_{c2} + b_{c3} \ln X_{c3} + b_{c4} \ln X_{c4} + b_{c5} \ln X_{c5} + b_{c6} \ln X_{c6} + U_c$$

By using logarithm rule equation for SRT and Traditional becomes;

$$\ln (Y_s/Y_T) = \{ \ln [b_{s0}/ b_{T0}] \} + \{ (b_{s1} - b_{T1}) \ln X_{S1} + (b_{s2} - b_{T2}) \ln X_{S2} + (b_{s3} - b_{T3}) \ln X_{S3} + (b_{s4} - b_{T4}) \ln X_{S4} + (b_{s5} - b_{T5}) \ln X_{S5} + (b_{s6} - b_{T6}) \ln X_{S6} \} + \{ b_{s1} \ln (X_{S1}/X_{T1}) + b_{s2} \ln (X_{S2}/X_{T2}) + b_{s3} \ln (X_{S3}/X_{T3}) + b_{s4} \ln (X_{S4}/X_{T4}) + b_{s5} \ln (X_{S5}/X_{T5}) + b_{s6} \ln (X_{S6}/X_{T6}) \} + [(U_2 - U_1)]$$

The same method was used for char-suttri and Traditional method for calculation of decomposition.

The summation of first and the second terms on the right-hand side of the decomposition model together represented the productivity difference between the SRT method and traditional method, attributable to the difference in the cultural practices. The third term provided the productivity difference between the SRT cultivation and traditional cultivation attributable to the differences in the input use.

Result and Discussion

1) Estimates of Yield Gap of Paddy in Different Methods of Cultivation

The potential yields were 85.00 qtls. While farm location trial yield of SRT was 65.71 qtl. Yield was obtained in char-suttri method was 59.52 qtl. Yield was obtained in char-suttri method based on adoption of all technology recommended by MPKV, Rahuri. Both yields taken from rice research station, vadagav Maval. These finding confirmed the results reported by Khade (2016) and Deokate (2014) [3, 1].

Table 1: Yield Gap I In Traditional and SRT Method of Paddy Cultivation

Potential yield gap		
Sr. No.	Particulars	Yield (Qtl.)
1	Potential yield	85.00
2	Demonstrated yield	65.71
3	Yield gap	19.29
4	Yield gap (%)	22.60

First yield gap was estimated to 19.29 qtl. Potential yield was 85.00 qtl and demonstrated plot yield was 65.71 qtl. Yield gap percentage was 22.60, here need of reduction of yield gap for increasing potential yield.

Table 2: Yield Gap II in Traditional and SRT Method of Paddy Cultivation

Demonstration yield gap		
Sr. No.	Particulars	Yield (Qtl.)
1	Demonstrated yield	65.71
2	Actual yield	43.45
3	Yield gap	22.26
4	Yield gap (%)	33.38

Yield gap obtained at demonstration level was 22.26 qtl. Demonstrated plot yield was 65.71 qtl and actual yield obtained was 43.45 qtl. This yield gap is more which shows that, at actual level yield of paddy was less. Yield gap per cent was 33.38 which was higher compare to yield gap I.

Table 3: Yield Gap III in Traditional and SRT Method of Paddy Cultivation

Total yield gap		
Sr. No.	Particulars	Yield (Qtl.)
1	Potential yield	85.00
2	Actual yield	43.45
3	Yield gap	41.55
4	Yield gap (%)	50.59

Yield gap III is total yield gap i.e. yield gap between potential yield minus actual yield. Yield gap III was 41.55 qtls and having yield gap per cent 50.59. This yield gap indicates that still yield of traditional Sample cultivators was less compare to SRT Sample cultivators. Yield gap of SRT method and traditional method was varied at different level of production as above mentioned, hence hypothesis was accepted.

3) Source Contributing to the Yield Difference Between Traditional and SRT Methods of Paddy Production.

Using the decomposition analysis, the productivity difference between the SRT paddy and traditional paddy (yield gap) was decomposed into its constituent sources and the results are presented in Table 4.

Table 4: Decomposition of Productivity Difference for Traditional and SRT Method of Paddy Cultivation

Sr. No.	Particulars	Percentage
A	Total difference observed in productivity	41.70
B	Due to difference in technology	48.76
C	Due to all inputs	-5.78
1	Seed	-4.35
2	N	-2.54
3	Intercultural operations	-0.66
4	Labours	1.19
5	PPC	0.01
6	Manures	-0.23
D	Total estimated difference in productivity	42.98

The total productivity difference between the SRT paddy and traditional paddy was estimated to be 41.70 per cent. Among the various sources responsible for total productivity difference, the difference in technology contribution was more and to the extent of 48.76 per cent. This implied that paddy productivity could be increased by about 48.76 per cent if the farmers could switch over from traditional method to SRT method with the same level of resource use as in traditional method. The contribution of difference in input use levels to the total productivity difference was -5.78 per cent. Total estimated difference in productivity was 42.98 per cent. The larger quantity of seeds used in traditional method of cultivation has helped to increase yield of paddy by 4.35 per cent in that method. Similarly, larger quantity of resources like N and intercultural operations used in SRT method caused yield increase of 2.54 and 0.66 per cent respectively. This implied that farmers practicing SRT method obtained higher output by spending slightly more on these two inputs compared to those practicing traditional method. These finding confirmed the results reported by Basavaraja *et al.* (2008), and Rama Rao (2011).

Conclusion

First yield gap percentage for SRT was 22.60, here need of reduction of yield gap for increasing potential yield. Second yield gap per cent was 33.38 which was higher compare to yield gap I. Third yield gap percentage was 50.59, this yield gap indicates that still yield of traditional Sample cultivators was less compare to SRT Sample cultivators.

The total productivity difference between the SRT paddy and traditional paddy was estimated to be 41.70 per cent and the difference in technology contribution was more and to the extent of 48.76 per cent.

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