# Yield Gap Analysis Among Rice Growers in North Eastern Zone of Tamil Nadu

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India is still amongst the countries with the lowest rice yields, with the national average of 1,930 kg/ha. Seventy per cent of the 414 rice growing districts reports yields lower than the national average, clearly indicating that well, after the advent of High yielding technology, a sizable area is categorized as low producing. Sixty per cent of the low productivity rice areas are in Bihar, Orissa, Assam, West Bengal and Uttar Pradesh. Surprisingly 32 per cent of the irrigated rice areas revealed low yields. 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-environments (Moya and Pingali, 1989, Lansigal et. al., 1996). Yield analysis further reveals that 30 to 40 per cent of the potential yield is yet to be tapped with available HYV sown on highly productive irrigated soils.

This gap is likely due to degraded, less fertile soils, pockets of endemic cropping systems and a low adoption rate of high yielding technologies by farmers.

The yield gap, in India reveals the bridgeable gap to be quite wide. With the exceptions of Tamil Nadu (15 per cent) and Punjab (22 per cent) it is in the range of 35 to 75 per cent. (Better Crops International, 2002)

In view of the above challenges and opportunities, this paper attempts to study the Yield gap among rice growers in Kancheepuram District of North Eastern Zone, with the following objectives.

(i) To study the profile characteristics of farmers cultivating rice in specific agro-climatic zones.

(ii) To assess the yield gap prevailing in popular rice varieties, and

(iii) To study the factors influencing yield gap as perceived by the farmers.

## Methodology

Kancheepuram District of North Eastern Zone of Tamil Nadu, was purposively selected, as it formed a predominant paddy growing area of the state. Out of the total 13 blocks of Kancheepuram District, Kancheepuram block was selected for the study, as it had a substantial area under paddy cultivation having uniform distribution of marginal, small and big farmers. Out of the 43 villages

in Kancheepuram block, Damal village which has the maximum acreage of paddy in the entire block was selected. The total sample size selected was 60 consisting of 20 farmers each from marginal, small and big farmer category.

A well structured interview schedule was constructed; and data was collected from the respondents through personal interview method. A total of 16 independent variables and one dependent variable namely yield gap was used for the study.

The independent variables were measured using standardized scoring procedures and the dependant variable yield gap was measured using the formula

$$\text{Yield gap} = \frac{\text{Potential yield} - \text{Actual yield}}{\text{Potential yield}} \times 100$$

Yield gap was operationalised as the percent difference between potential yield (yield obtained at the Research Station) and the actual yield obtained in the farmers field.

The average yield gap was assessed for sornavari season, for ADT -43 variety, separately for marginal, small and big farmer category and the total average yield gap was found out.

The range was calculated by distributing the values of yield gap obtained using class intervals of 10 and the frequency of respondents in each class interval was made, to arrive at the range of yield gap in which majority of the respondents were distributed.

## Findings and Discussion

### (i) Profile Characteristics, of rice growers

As could be observed from Table 1, large number of the respondents were old (40.00 per cent), having higher secondary level of education (35.00 per cent and having Agriculture as their Primary occupation (95.00 per cent). It could be further observed from Table 1 that with respect to farm size, marginal, small and big farmers accounted for an equal percentage (33.34%, 33.33%, 33.33% respectively) as an equal number of respondents were selected purposively from each category. With regard to the area under rice cultivation, the low, medium and high

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categories were represented by (13.34 per cent, 43.33 per cent and 43.33 per cent respectively).

As far as the farming experience of the rice growers was concerned, it could be seen from Table 1 that 30.00 per cent of the farmer fell under low category, followed by 31.67 per cent in the medium category and 38.33 per cent in the high category of farming experience. Most of the farmers belonged to high level of annual income (38.33 per cent), followed by 35.00 per cent of farmers in the medium level of annual income, and 26.67 per cent in the low level of annual income.

With regard to the social participation of the rice growers, it could be noted that half the total number of respondents 50 per cent belonged to medium level of social participation, followed by 26.67 per cent in the low level of social participation, and 23.33 per cent in the high level of social participation. With respect to cropping, pattern, it could be observed that cent per cent of the rice growers practiced a single crop of rice 100 per cent (Sornavari season), followed by 46.67 per cent who practiced a double crop of rice. With respect to the economic motivation, it could be observed that 38.34 per cent fell under the high category of economic motivation, followed by 33.33 per cent in the low level of economic motivation and only 28.33 per cent belonged to the medium level of economic motivation.

As far as the farm power status was concerned; it could be seen from Table 1 that most of the farmers (38.33 per cent) belonged to high level of farm power status, followed by 31.67 per cent in the low level of farm power status and only 30.00 per cent of the respondents belonged to the medium level of farm power status.

The Extension participation was characterized by 41.67 per cent in the medium level of extension participation, followed by 38.33 per cent in the high level of extension participation, and only 20.00 per cent of the respondents belonged to the low level of extension participation.

As far as the input availability was concerned, it could be seen that 43.33 per cent of the rice farmers had a medium level of input availability, followed by 33.34 per cent in the high level of input availability and only 23.33 per cent fell in the low level of input availability. This could again be attributed to the active involvement of input agencies/dealers in the region.

As far as the information seeking behaviour was concerned, 36.67 per cent of the respondents belonged to high level of information seeking behaviour, followed by 33.33 per cent in the medium level of information; and only 30.00 per cent were in the low level of information seeking behaviour. With respect to the credit orientation behaviour 50.00 per cent of the respondents belonged to the medium category of credit orientation, followed by 40.00 per cent in

the high category of credit orientation, and only 10.00 per cent had a low level of credit orientation.

As far as the labour availability was concerned, it could be observed that most of the respondents (71.70%) had medium level of labour availability, followed by low level of labour availability (21.67 per cent) and only 6.63 per cent fell in the high level of labour availability.

*(ii) Assessment of Yield gap*

The average yield gap for the first cropping season (Sornavari) was studied, with the popular rice variety, ADT- -43 and the results are furnished in Table 2.

From Table 2 it could be observed that among the different categories of farmers, marginal farmers were found to have an average yield gap of 57.65 per cent followed by small farmers with an average yield gap of 28.35 per cent and for big farmers, the average yield gap was found to be 20.25 per cent.

This could be because, marginal farmers by virtue of their economic status, could not adopt the critical technologies in rice cultivation. Besides it was noted, during the study, that whereas big farmers and small farmers had access to irrigation facilities like bore wells, marginal farmers could not afford these facilities, and this could have contributed to the existence of a wide yield gap among this category.

A perusal of Table 3 shows that majority of the respondents are distributed in the range of yield gap of 31-40 and 41- 50 respectively. This implies that most of the respondents are distributed in the yield gap of 31- 50 per cent. Siddque (2000) also observed from his findings that the average yield gap in Paddy in India is within the range of 35 to 75 per cent. The non-adoption of improved Paddy practiced may be the reason for a wide yield gap.

**Assessment of the factors influencing yield gap**

In order to study the relationship between the factors contributing to yield gap in Paddy, the persons correlation co-efficient was worked out and the results presented in Table 4.

It could be seen from Table 4 that low fertility of soil had a positive and highly significant relationship with the yield gap of Paddy for Sornavari season. This means that, as the incidence of low soil fertility increased, it resulted in the increase in yield gap of Paddy. This could be because the soil has lost its inherent fertility due to repeated cultivation and also due to excessive use of Chemicals and fertilizers.

It is also interesting to note, that high cost of agriculture inputs maintained a positive and significant relationship with yield gap of Paddy. It shows that as the cost of agriculture inputs increased, it resulted in an increase

in yield gap of Paddy. Further it could also be seen that the non-availability of HYV seeds for Samba maintained a positive and highly significant relationship with the yield gap for Paddy.

A total of 17 factors, which were perceived by farmers as contributing to the yield gap in Paddy, were studied, and the influence of these factors on the yield gap of Paddy was studied by using multiple regression analysis; which is presented in Table 5.

A perusal of Table 5 indicates that out of the fourteen factors studied, factors such as high cost of agricultural inputs, non-availability of HYV certified in Paddy pest had a positive and significant influence on the yield gap in Paddy.

The results indicate that as the cost of agricultural inputs increases, yield gap of Paddy also increases, as the farmers cannot afford to purchase the highly priced inputs such as fertilizers, pesticides, seeds and bio-fertilizers. Similarly as the insecticidal resistance of Paddy pests increases, it results in a corresponding increase in the yield gap of Paddy. It could be further seen from Table 5, that all the fourteen factors together explained 52.60 per cent of variation in the yield gap of rice for Sornavari season, variety ADT-43. Further, it could be seen that factors such as low fertility of soil, non availability of human labour during peak season of planting, lack of proper supply of electricity to oil engines, and micro nutrient deficiency in soil had a negative influence on the yield gap of Paddy.

The F-test conducted indicated a significant contribution of the fourteen factors on the yield gap of Paddy.

**Conclusion**

It was observed during the survey that majority of the farmers depend on input dealers such as fertilizer and pesticide dealers for information on usage of improved technologies. These informal sources of information mainly give instructions on use of improved technology based on hands-on-experience. In other words the intervention of technically sound, well trained and equipped extension personnel at the grass root level is lacking. Private extension can complement and supplement the efforts of public extension services, and farmers can rely on the timeliness of services provided by them. Public extension services should focus on imparting skill based technologies in rice cultivation.

With respect to the average yield gap in paddy, category wise, it was observed that the marginal farmers had a yield gap of 57.65 per cent when compared to small farmers and big farmers who had an average yield gap of only 28.35 and 20.25 per cent respectively. This again is an indicator of the gross inequalities in the agrarian economy of the country. Abiotic factors such as drought restricts the growth of paddy and adversely affects the yield.

Resource poor farmers such as the marginal farmers suffer on account of low income: and do not have the means to construct bore wells, in the onslaught of a drought.

Further, it has been observed that high cost of Agricultural inputs has positively influenced the yield gap of Paddy. This again points to the capital starvation in the farm sector. There is a need to make rational distribution of crop loans, among all categories of rice growers, to enable the farmers to use it for construction of bore wells and for the purchase of agricultural inputs. With the existing technology the farm production can be raised two fold or more, if proper attention is paid by the government towards capital investment in the agricultural sector and also by improving the efficiency of public extension services.

## REFERENCES

(1) Moya, P.F. and P.L. Pingali, 1989 can we close the yield gap between the "best" and "ordinary" farmers in Luzon? Unpublished seminar paper. IRRI, Los Banes, Phillipines.

(2) Lansigan, F.P., B.A.M. Bouman and P.F. Aggarwal, 1996. Yield gaps in selected rice. Producing areas in the Phillipines, In : Aggarwal. P.K., et al., (Editors), 1996. Towards Integration of models in rice research SARP Research Proceedings, Wageningen and Los Barios, PP. 11-18.

(3) Tiwari K. N. rice production and Nutrient Management in India. Better crops International vol. 16, Special supplement, May 2002.

TABLE 1—PROFILE CHARACTERISTICS OF RICE GROWERS

(n=60)

| Sl. No. | Variable/Categories | Rice growers No. | Percent |
|---|---|---|---|
| 1. | **Age** | | |
| | Young | 18 | 30 |
| | Middle | 18 | 30 |
| | Old | 24 | 40 |
| 2. | **Education** | | |
| | Illiterate | 10 | 16.67 |
| | Can read only | 3 | 5.00 |
| | Can read and write | 1 | 1.67 |
| | Primary level | 8 | 13.33 |
| | Middle level | 6 | 10.00 |
| | Secondary level | 0 | 0.00 |
| | Higher Secondary level | 21 | 35.00 |
| | Collegiate level | 11 | 18.33 |
| 3. | **Occupation** | | |
| | Agriculture as Primary | 57 | 95.00 |
| | Agriculture as Secondary | 3 | 5.00 |

## TABLE 1—Profile Characteristics of rice growers —Contd.

(n=60)

| Sl. No. | Variable/Categories | Rice growers No. | Percent |
|---|---|---|---|
| 4. | **Farm Size** | | |
| | Marginal ( < 2.5 acres) | 20 | 33.34 |
| | Small ( 2.5 - 5.0 acres) | 20 | 33.33 |
| | Big ( > 5.00 acres) | 20 | 33.33 |
| 5. | **Area under rice cultivation** | | |
| | Low | 8 | 13.34 |
| | Medium | 26 | 43.33 |
| | High | 26 | 43.33 |
| 6. | **Farming experience** | | |
| | Low | 18 | 30.00 |
| | Medium | 19 | 31.67 |
| | High | 23 | 38.33 |
| 7. | **Annual Income** | | |
| | Low | 16 | 26.67 |
| | Medium | 21 | 35.00 |
| | High | 23 | 38.33 |
| 8. | **Social participation** | | |
| | Low | 16 | 26.67 |
| | Medium | 30 | 50.00 |
| | High | 14 | 23.33 |
| 9. | **Cropping Pattern** | | |
| | Single crop rice | 60 | 100.00 |
| | Double crop rice | 28 | 46.67 |
| 10 | **Economic motivation** | | |
| | Low | 20 | 33.33 |
| | Medium | 17 | 28.33 |
| | High | 23 | 38.34 |
| 11. | **Farm Power Status** | | |
| | Low | 19 | 31.67 |
| | Medium | 18 | 30.00 |
| | High | 23 | 38.33 |
| 12. | **Extension Participation** | | |
| | Low | 12 | 20.00 |
| | Medium | 25 | 41.67 |
| | High | 23 | 38.33 |
| 13. | **Input availability** | | |
| | Low | 14 | 23.33 |
| | Medium | 26 | 43.33 |
| | High | 20 | 33.34 |
| 14. | **Information seeking behaviour** | | |
| | Low | 18 | 30.00 |
| | Medium | 20 | 33.33 |
| | High | 22 | 36.67 |
| 15. | **Credit orientation** | | |
| | Low | 6 | 10.00 |
| | Medium | 30 | 50.00 |
| | High | 24 | 40.00 |
| 16. | **Labour availability** | | |
| | Low | 13 | 21.67 |
| | Medium | 43 | 71.70 |
| | High | 4 | 6.63 |

## TABLE 2—Average yield gap in paddy among the various categories of farmers.

( n = 60)

| Sl. No. | Category | Season | Variety | Avg. yield gap in % | Total avg. yield gap |
|---|---|---|---|---|---|
| 1. | Marginal farmers | Sornavari | ADT-43 | 57.65 | |
| 2. | Small farmers | Sornavari | ADT -43 | 28.35 | 35.42 |
| 3. | Big farmers | Sornavari | ADT-43 | 20.25 | |

## TABLE 3—Range showing the distribution of respondents with respect to their yield gap

(n = 60)

| Range (Class intervals) | No. | Percentage |
|---|---|---|
| 0 - 10 | 10 | 16.67 |
| 11 - 20 | 8 | 13.33 |
| 21 - 30 | 7 | 11.67 |
| 31 - 40 | 12 | 20.00 |
| 41 - 50 | 12 | 20.00 |
| 5 1 - 60 | 6 | 10.00 |
| 61 - 70 | 2 | 3.33 |
| 71 - 80 | 2 | 3.33 |
| 81 - 90 | 0 | 0.00 |
| 91 - 100 | 1 | 1.67 |
| Total | 60 | 100.00 |

## TABLE 4— Correlation Co-efficient of Factors Contributing for Yield Gap, and Yield gap for Sornavari Season.

| Sl. No. | Factors | Yield gap (Sornavari Season) (Variety, ADT 43) |
|---|---|---|
| 1. | In adequate irrigation water | 0.038 |
| 2. | How fertility of soil | 0.567** |
| 3. | Saline and alkaline problem soil | 0.046 |
| 4. | High cost of agriculture inputs | 0.298 * |
| 5. | High rate of interest for credit | 0.025 |
| 6. | High cost of labour | 0.135 |
| 7. | Non-availability of human labour during peak season | -0.305* |
| 8. | Lack of proper and assured supply of electricity to oil engine | -0.057 |
| 9. | Non-availability of HYV certified seeds for samba season | 0.363** |
| 10. | Using own seeds for a number of years | 0.144 |
| 11. | Using aged seedlings | 0.132 |
| 12. | Low plant population | 0.158 |
| 13. | Micro nutrient deficiency in soil | 0.007 |
| 14. | Contract system for transplanting weeding and harvesting operations | 0.194 |
| 15. | Application of fertilizers not based on soil testing recommendation | 0.144 |
| 16. | Insecticides resistance in Paddy pests | 0.158 |
| 17. | Lack of adequate demonstrations in Paddy technologies | 0.058 |

* * - Correlation is significant at 0.01 level (2 - tailed)

* - Correlation is significant at 0.05 level (2 - tailed)

TABLE 5—MULTIPLE REGRESSION ANALYSIS OF FACTORS CONTRIBUTING FOR THE YIELD GAP AND YIELD GAP IN PADDY

| Sl. No. | Factors | Partial reg.Co-effi-cient (b) | SE (b) | 't' value |
|---|---|---|---|---|
| 1. | Low fertility of soil | -0.170 | 30.60 | 0.005NS |
| 2. | Saline and alkaline problem soil | 0.061 | 6.36 | 0.0095NS |
| 3. | High cost of Agricultural inputs | 0.580 | 0.197 | 2.94** |
| 4. | High rate of interest for credit | 0.196 | 7.87 | 0.025NS |
| 5. | High cost of labour Non-availability of | 0.206 | 9.36 | 0.022NS |
| 6. | human labour during peak period | -0.094 | 13.22 | 0.0071NS |
| 7. | Lack of proper supply of electricity to oil engine Non availability of HYV | -0.247 | 11.70 | 0.0211NS |
| 8. | certified seeds for Samba season | 0.306 | 0.115 | 2.67** |
| 9. | Low plant population | 0.222 | 24.87 | 0.0089NS |
| 10. | Micro nutrient deficiency in soil Contract system for | -0.022 | 12.82 | 0.0017NS |
| 11. | transplanting, weeding operations | 0.161 | 6.22 | 0.026NS |
| 12. | Application of fertilizer not based on soil testing | 0.065 | 7.27 | 0.0089NS |
| 13. | Insecticide resistance in Paddy pest Lack of adequate | 0.322 | 0.106 | 3.05** |
| 14. | demonstrations in Paddy technologies | 0.032 | 21.75 | 0.0015NS |

NOTE : * - Significant at 5 percent level

* *- Significant at 1 percent level

$R^2$=0.526

F=3.408**