Bangladesh Journal of Extension Education *ISSN 1011-3916*
Volume 20, No. 1&2, 2008:91-97 *Research Article*

Management Gap in *Boro* Rice Cultivation at Farmers' Fields

M.A. Islam[1], M.A. Kashem[2], M.A.M. Miah[3] and M.Z. Rahman[4]

Abstract

The main focus of this paper was to determine gap in management between recommended and actual practices followed by the farmers in Boro rice cultivation that resulted a gap between potential and actual yield. The management practices included in this study were: nursery fertilization, seed rate, time of transplanting, seedling age, number of seedling/hill, line to line and hill to hill spacing, doses of urea, TSP, MoP and gypsum, time of urea top dressing at the different phases of growth, measure against insect and pest, irrigation, weeding and time of harvesting. Data were collected from randomly selected 250 farmers of six villages of Fulbari Upazila under Kurigram district from December 2005 to July 2006. Results indicated that 72% of the farmers had medium gap (24 to 51% gaps) in their overall management while 17%of the farmers had low gap (4 to 23%) i.e. they applied a little less than the full package of the recommended selected 18 practices in modern boro rice cultivation. But 11% of the farmers had high gap (52 to 64%) in management resulted a lower yield. Among the characteristics of the farmers farming experience, knowledge, attitude towards modern Boro rice cultivation, information source use, and decision making ability showed significant negative relationship with the management gap resulting to yield gap.

Keywords: *Practice, yield gap, farmer, rice cultivation*

Introduction

High yielding varieties (HYVs) of rice are very much responsive to crop husbandry (Salam *et al.*, 2006). It means, grain yield of rice is dependent as to the level of crop management. Thus, the ignorance of proper crop management, its application in time and hardship of acquiring the necessary inputs are the causes of gradual increase in yield gap between research station and farmers' fields. Proper management covers the practices that outset at the seedbed and wind up with the post harvest operations. Managing all the practices at optimum level might produce the highest yield of a certain variety. But due to prevailing socio-economic conditions in Bangladesh, farmers are not in a position to manage all the practices in a full swing rather they often apply sub-optimal level of the recommendations in rice cultivation that resulted a gap between potential yield and actual farmer's yield. On the other hand, under the globalization of the world economy, rice producers are exposed to competition not only among themselves but also with the producers of other crops. In this regard, Duwayri *et al*., (1998) reported that future increase in rice production, therefore, requires improvement in productivity and

[1] Senior Scientific Officer, Bangladesh Institute of Nuclear Agriculture, Mymensingh, [2,3&4] Professors, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh

efficiency. It can be mentioned here that the innovative technologies such as hybrid rice, new plant type and possibly trangenic rice can play an important role in raising the yield ceiling but there may also exist a yield gap between research station and farmers' fields. So, narrowing of this gap could improve not only the productivity but also the efficiency of rice production. Before narrowing of the yield gaps it was equally important to know how much management gap was prevailed compared to recommendation and if there was any influence of this management gap on yield gap. Because in Bangladesh context, improvement of crop management practices at farmers' level is often not an easy task. Although there were several improved crop management practices, their dissemination has proven to be more complicated than that of seed based technologies. Crop management practices are seldom statistic and often must be adjusted to the environmental factors. In this context, the study was undertaken with the following objectives: (i) to determine the gaps in management practices of modern boro rice cultivation, (ii) to ascertain the influence of these gaps on yield gap, and (iii) to explore the relationships of these management gaps with the characteristics of the farmers.

Methodology

Six villages of Chandrakhana union of Fulbari upazila under Kurigram district were selected by multistage random sampling procedure. Among the selected villages, 250 farmers were selected out of 2016. Data were collected through pre-tested interview schedule by face-to-face interview procedure during December 2005 to July 2006. Farmers' management was dependent variable and 11 selected characteristics of the farmer were considered as the independent variables. The selected characteristics of the farmers were: age, level of education, family education, family size, farm size, farming experience, knowledge on modern Boro rice cultivation, attitude towards modern Boro rice cultivation, information source use, and decision making ability. These independent variables were measured with the available scales developed by earlier authors with necessary modification whenever needed. As yield of rice depends on some packages and practices, a total of 29 of such practices relevant to modern rice culture were selected initially, through consultation of different published sources and rice experts. A schedule was prepared with these preliminary 29 selected practices with 5-point continuum of importance and was sent to judges that comprising 30 selected senior rice experts and extension specialists. They were requested to select the practices as per importance for higher yield in cultivation of modern boro rice at farmers' conditions. Based on judging, a total of 18 modern rice cultivation practices were selected under management for the study. The selected practices were: nursery fertilizing, seed rate, time of transplanting, seedling age, seedlings/hill, hill to hill distance, line to line distance, amount of urea/ha, amount of TSP/ha, amount of MoP/ha, amount of gypsum/ha, irrigation, insect pest control, time of first top-dressing, time of second top-dressing, time of 3rd top-dressing, weeding and time of harvesting. The practice gap index for a particular practice of a farmer was measured by the following formula:

$$\text{Practice gap index for a particular practice}(P_i) = \frac{\sum_{i=1}^{n} A_i \times D_i}{\sum_{i=1}^{n} A_i} \times 100$$

Where,

A_1 = Area of 1st plot appplied with a particular practice

A_2 = Area of 2nd plot appplied with a particular practice

A_n = Area of nth plot appplied with a particular practice

D_1 = Deviation proportion for the area A_1

D_2 = Deviation proportion for the area A_2

D_n = Deviation proportion for the area A_n

On the other hand, deviation proportion for a particular practice was ascertained by the formula used by Das *et al*. (1998) was as:

$$\text{Deviation proportion}\langle D\rangle = \frac{R - A}{R}$$

Where,

R= Recommendation for a practice

A= Actual practice

Thus, management gap of a respondent was calculated by the formula used by Ray *et al.* (1995):

$$\text{Management gap} = \frac{\sum_{i=1}^{18} P_i}{\sum_{i=1}^{18} N_i} \times 100$$

Where,

P_i = Practice gap index for ith practice (i = 1, 2 - - - 18)

N_i = Number of practices (18)

However, in case of practice gap for weeding, a slightly different procedure was followed. In computing practice gap index in time of transplanting of a farmer 10 January to 30 January was considered as recommended time of boro rice transplanting in the study area. A maximum score of 20 was given for transplanting with the recommended time and each day delay than the recommended time, the score decreased by one point for actual practice.

Yield gap of a variety was measured on the basis of the difference between the potential yield (kg/ha) of demonstration plot and the actual yield (kg/ha) obtained at the farmer's plot and then compared it to the percentage of potential yield. Thus, the yield gap of a variety could vary from 0 to 100%.

Findings and Discussion

The management gap in cultivation of modern varieties of Boro rice of the farmers ranged from 4.44 to 64.44 with the mean of 37.47. This revealed the facts that about two-fifths of the overall requirements were remain undone in cultivation of modern boro rice. It is observed from the Table 1 that a little less than the three-fourths (72%) of the farmers had medium practice gap (24 to 51%), while 17% of the farmers had low gap (4 to 23%), i.e. they applied a little less than the full package of the selected 18 practices in modern boro rice cultivation. On the other hand, 11% had high gap (52 to 64%) that might cause a lower yield in boro rice cultivation.

Table 1. Distribution of farmers according to their gaps in the selected practices for modern boro rice cultivation

Inadequacy of the practices	Mean	St. dev.	Categorization of the farmers with their gaps (%)			
			No	Low	Medium	High
1. Nursery fertilizing	58.48	16.98		25	50	25
				(0 – 39.81)	(39.82 – 60.04)	(60.05 – 80.27)
2. Seed rate	38.24	28.06	22	19	23	36
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 81.20)
3. Time of transplanting	23.28	20.21	30	35	24	11
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
4. Seedling age	50.61	31.11	16	14	11	59
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
5. Number of seedling/hill	46.08	25.12	8	22	27	43
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
6. Spacing for hill to hill distance	18.16	18.92	48	16	34	2
			(0)	(0.01 – 20.00)	(20.01 – 40.00)	(40.01 – 60.00)
7. Spacing for line to line distance	11.68	15.97	61	10	9	20
			(0)	(0.01 – 13.00)	(13.01- 26.00)	(26.01 – 40.00)
8. Dose of urea	37.34	23.37	11	28	39	22
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
9. Dose of TSP	46.40	25.89	7	17	21	55
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
10. Dose of MoP	51.10	23.32	7	13	40	40
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
11. Dose of gypsum	49.09	25.35	10	10	30	50
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
12. Irrigation	50.08	14.81		52	40	8
				(20.01 – 40.00)	(40.01 – 60.00)	(60.01 – 80.00)
13. Insect-pest control	12.32	9.74	39	20	20	21
			(0)	(0.01 – 12.00)	(12.01 – 24.00)	(24.01 – 37.00)
14. Time of first top-dressing	39.30	23.47	13	15	47	25
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.01 – 80.00)
15. Time of second top-dressing	29.76	22.92	20	30	33	17
			(0)	(0.01 –27.00)	(27.01 – 54.00)	(54.01 –80.00)
16. Time of third top-dressing	50.89	15.00		7	42	51
				(0.01 –27.00)	(27.01 – 54.00)	(54.01 –80.00)
17. Weeding	39.76	22.43	12	20	35	33
			(0)	(0.01 – 27.00)	(27.01 – 54.00)	(54.00 – 80.00)
18. Maturity of harvesting	22.72	13.38	16	24	30	30
			(0)	(0.01 – 13.00)	(13.01 – 26.00)	(26.01 – 40.00)
Overall management gap	37.47	13.84		17	72	11
				(4.44 – 23.63)	(23.64 – 51.31)	(51.32 – 64.44)

Figures in the parenthesis indicate percent of practice gap

It is also evident from the Table1 that among the selected 18 practices, the highest gap was in nursery fertilization (58.48%). This indicates that farmers are yet to be well acquainted with the benefits of nursery fertilization. gap in application of MoP was next to the nursery fertilization revealed that more than half (51.10%) of the required amount was not supplied to the soil. While potassium is one of the luxurious elements

for rice yield, this wide gap might decrease the growth and thus the yield of rice. The similar proportion (50.61%) of the farmers was found having wide gap due to use of over aged seedlings. It was also observed that with the increase of seedling age yields of the farmers were decreased. Ahmed *et al.*, (2006) reported the similar findings where the highest yield was obtained with 54 days of seedlings but the yield decreased at the rate of 2.4 to 124 kg/day with the increase of each of the days beyond this limit. Unlike to this, the highest proportion (61%) of the farmers was found maintaining recommended line to line distance during transplantation. Although a few of the farmers could harvest higher yields than that of the demonstration yields with a certain variety from a particular piece of land, but the averaged yield of that variety was lower in every cases of the respondents. The reason might be that a farmer could not put equal attention for all of his cultivating varieties. It is also seen from the Table 2 that yield gap occurred up to 39% of the potential yield with an average of 15%.

Table 2. Distribution of farmers depending upon their overall yield gap

Yield gap category	Number of respondents	Percent
1. Low yield gap (0.50 – 6.73%)	39	16
2. Medium yield gap (6.74 – 23.27%)	172	68
3. High yield gap (23.28 – 39.10%)	39	16
Total	250	100

The Table 2 indicates that a little less the three-fourths (68%) of the respondents had medium yield gap compared to 16 percent had low yield gap and 16 percent had high yield gap in cultivation of modern boro rice.

In order to find out farmers factors associated with management gap, a correlation analysis was done. It was found that knowledge, experience and risk orientation of the farmers had significant but negatively correlated with management gap (Table 3). Thereafter, multiple regression analysis was done to ascertain the precise contribution of each of the component of management gaps on yield gap. For doing so, all the management practices were included in regression analysis. Then the significantly contributed practice gaps of management for instance, gap in dose of MP/ha, gap in irrigation, gap in 1st top-dressing of urea, gap for using over aged seedling and gap in time of harvesting were included for further analysis. However, it was observed through step-wise multiple regression (Table 4) that the gaps of these five management practices altogether explained 89.2% of yield gap because the R^2 value was 0.892 with a corresponding F value of 404.28 which was significant at 0.000 level.

The unique contribution of these five practice gaps were also determined by observing the change in multiple R^2 value for entry of a particular variable in stepwise regression model. The Table indicates that practice gap for amount of MoP/ha contributed 81.5%, while gap in irrigation 5.5% percent, gap in days for 1st top-dressing 0.7%, over aged of seedlings 0.8% and for delayed harvesting had 0.7% to the yield gap.

Table 3. Correlation co-efficient between the selected characteristics of the farmers and their management gaps in modern rice production

Characteristics	"r" value
Age	-.077
Level of education	-.032
Family education	.022
Family size	.033
Farm size	-.008
Farming experience	-.134*
Knowledge on modern boro rice cultivation	-.695**
Innovation proneness	-.401**
Attitude towards modern rice cultivation	-.667**
Decision making ability	-.634**

Table 4. Summary of multiple regression and step-wise regression analysis of the independent variables to management gaps of the farmers

Variable entered	R^2	R Square change	Variance explained (%)	Level of significance
Practice gap in dose of MoP/ha	.815	.815	81.5	.000
Practice gap in irrigation	.870	.055	5.5	.000
Practice gap in time of 1st top-dressing	.877	.007	0.7	.000
Practice gap for using over aged seedling	.885	.008	0.8	.000
Practice gap in time of harvesting	.892	.007	0.7	.000

Conclusion

Sustainable increase of rice yield per hectare in near future requires substantial improvement of management at farmers' level. The major issues of management *viz.* recommended dose of MoP, intermittent irrigation, recommended age of seedlings, times of 1st top-dressing and timely harvest are need to be addressed immediately. Because minimizing of these issues of management not only enhance rice productivity but also efficiency in production systems, resulting in high economic outputs as well as high income for farmers. Although, the causes of yield gaps of rice differ widely from season to season and place to place, it is essential, therefore, to promote closer collaboration between research, extension, local authorities, non-government organization and private sector, in order to identify specific constraints to high yield and adopt appropriate technologies and solutions and concerted actions to bridge yield gap of boro rice.

References

Ahmed, G.J.U., J.C. Biswas, B.C. Roy, M.B. Rahman, M.S. Islam, M.A.A. Mahbub and J.K. Biswas. 2006. Contribution of seedling age and planting time for bridging yield gap in rice. In *Proceeding of twenty first BRRI-DAE joint workshop held in Gazipur, 19-21 September, 2006 on bridging the rice yield gap for food security.* Bangladesh Rice Research Institute, Gazipur-1701.

Das, R., N.S. Verma, and S.P. Singh. 1998. Technological gap in sorghum production

technology: A regression analysis. In proceedings of the national conference on frontiers of extension education in 21st century, held at Lucknow, 8-11 November, 1997.

Duwayari, M., D.V. Tran, and V.N. Nguyen. 1998. Reflection on yield gaps in rice production: how to narrow the gaps. *International Rice Commission*, 98 / 7-12, Cairo. Egypt.

Ray, G.L., P. Chatterjee and S. N. Banerjee. 1995. *Technological Gap and Constraints in Agricultural technology Transfer*. Calcutta: Naya Prokash.

Salam, M. A., S. Khatun, H.U. Ahmed, T.L. Aditya, P.S. Biswas, M.A.R. Bhuiyan, M.A. Rahman and M. Khatun. 2006. Progress of stop-gap variety development and premium quality rice improvement. In *Proceeding of International Year of Rice – 2004: Rice research at Bangladesh Institute of Nuclear Agriculture for sustainable livelihood – past, present and future.* Bangladesh Institute of Nuclear Agriculture. 33-38.