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Integrated Plant Nutrient Management: Farmers' Practice at Field Level

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Abstract

The major focus of this study was to determine the extent of practice of IPNM approach by the farmers for their crop production. A sample of 120 farmers consist of landless, marginal, small, medium and large was selected randomly for data collection from a population of 805. Eight villages under four districts were the locale of the study. Data were collected through face-to-face interviews from December 2005 to January 2006. Four point scale such as 'do not practice', 'rarely practice', 'occasionally practice' and 'regularly practice by assigning the scores of 0, 1, 2 and 3 respectively for collection of data. The highest proportion of landless, marginal and small farmers were found with either do not practice or rarely practice categories regarding the practice of the components of IPNM approach for their crop production. Medium and large farmers, on the other hand, do practice these components either occasionally or regularly. Findings concerning overall practice of this approach by the farmers reveals that a little more than two-fifths (42%) of the farmers practice IPNM approach rarely followed by occasionally practiced category (41%), while a less than one-fifths (17%) practice regularly. Farmers' financial inability, high prices and unavailability of fertilizers during cropping seasons, farmers' lack of knowledge about IPNM approach, inadequate extension support, and shortage of bio-fuel and population pressure were identified as the major reasons among others that direct farmers towards inadequate practice of IPNM approach.

Keywords: *IPNM, practice, crop production*

Introduction

Limited availability of additional land for crop production, along with declining yield growth for major food crops have heightened concerns about agriculture's ability to feed the teeming population of Bangladesh (Anonymous, 1998). Therefore, the challenge for agriculture in this country over the coming decades will be to meet the increasing demand for food in a sustainable way. Integrated plant nutrient management (IPNM) is an advanced approach that can play an important role in ensuring food production keeps pace with population growth in an environmentally friendly way (Gruhn *et al.* 2000 and Lewandowski *et al.* 1999). As long as agriculture remains a soil-based industry, major increases in productivity are unlikely to be attained without ensuring that plants have an adequate and balanced supply of nutrients. Future strategies, therefore, for increasing agricultural productivity in Bangladesh will have to focus on using available nutrient

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resources more efficiently, effectively and sustainably than in the past.

In the past, soils of Bangladesh are fertile compared to other countries of the world. It has lost its fertility to great extent due to imbalanced use of chemical fertilizers as well as the soil organic matter status which has been reduced to 0.5 % and acidity of the land has increased (Anonymous, 1994). Declining soil fertility and mismanagement of nutrients have made the task of providing for teeming population of Bangladesh. On the other hand, in the next 25 years, food requirements are expected to increase at least 70 %, while it is not possible to expand the resource base of cultivated land rather it would likely to shrink (FAO, 1998). The challenge of Bangladesh is to increase agricultural production and productivity with maintaining soil fertility. This can be only possible by applying such approach that will not only ensure high yield in a sustainable way but also maintain and/or improve soil fertility in the long run. According to many crop production scientists, integrated plant nutrient management (IPNM) approach might be a better selection among others. This approach maintains soils as storehouse of plant nutrients that are essential for plant growth and integrates the use of all natural and man-made sources of plant nutrients, so that crop productivity increases in an efficient manner. Considering the above facts, the study was conducted to determine the extent of practice of different components of IPNM approach by different categories of farmers.

Methodology

Study area, population, sample and data collection

The study was conducted in eight villages of four districts namely, Mymensingh, Jamalpur, Sherpur and Netrokona in Bangladesh. According to BBS (2003) the yield of different agricultural crops remained stagnant or getting reduced since few years of the areas. Besides, soil fertility of the areas is declining gradually (BARC, 1999). The Department of Agricultural Extension (DAE), other agricultural organizations and Non-government organizations (NGOs) identified that improper management of soil fertility and plant nutrients is one of the important reasons for stagnating/reducing the yields as well as declining soil fertility. However, 805 farmers from different categories such as landless, marginal, small, medium and large farmers from eight villages were considered as the population of this study. About fifteen percent of total population i.e. 120 farmers (39 landless, 34 marginal, 19 small, 20 medium and 8 large farmers) were selected randomly from whom data were collected through face-to-face interviews from December 2005 to January 2006.

Measurement of farmers' practice of IPNM approach

According to FAO (1998) there are seven components of integrated plant nutrient management (IPNM) approach and farmers' practice of these components might improve/preserve soil fertility and increase crop yields. These are balanced fertilization, composting, crop residue management, crop rotations, cover crops, mixed cropping and green manuring. Farmers' practice of IPNM approach was measured in two ways: i) based on practice of different components by different categories of farmers; and ii) based on overall practice of this approach by farmers. To measure the extent of farmers'

practice of different components of IPNM approach, a four-point summated rating scale was employed. The respondents were asked to indicate their extent to which each of these components and approach itself was practiced with: 'do not practice', 'rarely practice', 'occasionally practice' and 'regularly practice'. These responses were assigned a score of 0, 1, 2 and 3, respectively. Thus, a farmer could receive a score ranging from 0 to 21 and 0 to 3 describing the practice of different components concerning IPNM approach and overall use of this approach respectively.

Findings and Discussion

Cropping patterns of the study areas

Cropping patterns are the arrangement of crops cultivated on a piece of land throughout the year. Anderson *et al.* (1997) reported that cropping patterns have different effects on soil properties and thereby govern the soil conditions. This may modify the soil characteristics and nutrient contents. An individual farmer's requirements and interests may also influence the cropping patterns he follows.

The data shown in Table 1 demonstrate that the major cropping patterns in the study areas are Potato-Boro-T. aman (34% of the total cultivated land) and Boro-Fallow- T. aman (24% of total cultivated land), practiced by 37% and 23% of farmers, respectively. Another important cropping pattern is Boro-T. aman- Mustard, which covers 13% of the study area's cultivated land, with 12% of farmers practicing this pattern. Almost all of the cropping patterns are rice-centered, and a negligible proportion of the farmers (8%) cultivate pulses. Although few farmers cultivate green manure crops in their fields, there was no established cropping pattern found in the study area involving these crops. Rice-centered cropping patterns, along with an unwillingness to cultivate leguminous and green manure crops, create a nutritional imbalance and reduce the organic matter content of the soil. This not only diminishes crop yields, it also reduces soil fertility.

Table 1. Existing cropping patterns, land allocation and farmers' practices in the study area

Land Type	Cropping patterns	Land allocation (%)	Farmers practicing (%)
High land (not flooded)	Boro-Fallow- T. aman	16	18
	Potato-Boro-T. aman	10	12
	Pulses- Jute- Fallow	5	4
	Wheat-Fallow-T. aman	5	5
	Tomato-Aus- Vegetable	3	3
Sub-total		39	42
Medium land (about half of the land is flooded)	Potato-Boro-T. aman	24	25
	Wheat-T. aman- Pulses	5	5
	Boro-T.aman- Mustard	13	12
	Tomato-Aus-Vegetable	6	5
Sub-total		48	47
Low land (most of the land is flooded)	Boro-T. aman- Fallow	8	5
	Boro-Fallow- Fallow	2	2
	Jute-T. aman- Fallow	3	4
Sub-total		13	11

Total	100	100

Note: T. aman indicates Transplant aman

Characteristics of different farmers' categories

Individual feelings, thoughts and understandings and predisposition etc., are dependent on various aspects of an individual's mental makeup and situational variations. It is said that adoption of improved technologies concerning integrated farm management practices by the farmers dependent on the individual's personal, socio-economic, socio-cultural and psychological characteristics (Rogers, 1995).

There are many researchers in the field of agricultural technology transfer opined that farmers' personal socio-demographic traits play a major role in practicing an innovation and its continuation by them. For the sake of the brevity, seven characteristics/traits of farmers were considered in the present study. A profile of personal and socio-demographic characteristics of different categories of farmers is presented simply in tabular form (Table 2).

Table 2. Salient features of personal socio-demographic characteristics of different categories of farmers

Characteristics and their opertionalization	Possible range	Mean value				
		Landless	Marginal	Small	Medium	Large
Age (exact year	-	37.20	35.75	39.54	38.34	43.16
Education (year of schooling	-	2.64	3.05	5.75	9.48	11.36
Family size (numbers)	-	7.03	6.86	5.73	5.01	4.46
Farming experience (rated score)	0-30	12.40	14.24	16.13	19.51	23.14
Family income ('000' Bd. Taka)	-	30.25	34.54	55.36	98.59	165.32
Extension contact (rated score)	0-54	23.15	26.38	30.14	40.54	46.91
Innovativeness (rated score)	0-20	8.26	10.12	12.54	16.34	18.10

Farmers' practice of the components of IPNM approach

Data in Table 3 indicates that the highest proportion of landless (72%) marginal (68%) and small (59%) farmers do not practice 'balanced fertilization' or practice rarely while, medium and large farmers practice this component to the extent of occasionally to regularly. Practice of composting by the large segment of landless, marginal farmers fall into 'do not' or 'rarely' practiced category, while the highest proportion (71%) of small farmers were found with the practice of composting either rarely or occasionally. Majority of the medium and large farmers, on the other hand, were found with mostly regular in terms of practice of composting.

Findings concerning practice of crop residue management, crop rotations, cover cropping, and green manuring shows that the highest proportion of landless, marginal and small farmers do not practice these components or practice rarely while a significant proportion of medium and large farmers practice these components either occasionally or regularly. This finding differs from Butterworth *et al.* (2003) that small farmers in Andhra Pradesh, India manage crop residues more properly than medium and large farmers. This may be because of an effect of a natural resource management project for improving livelihoods of the small farmers. Practice of mixed cropping by the landless, marginal and small farmers is comparatively higher than other components of IPNM approach though

it is not adequate. Thomas (2000) also found more or less similar findings in case of farmers of sub-Saharan Africa. However, although during field survey it was observed that the Department of Agricultural Extension (DAE) was running a project on integrated plant nutrient system (IPNS) for crop production, the above findings show that the DAE could not reach all categories of farmers with equal importance.

Table 3. Practice of components of IPNM approach by different farmers' categories

Components of IPNM system	Extent of practice	Farmers' percentage (%)				
		Landless	Marginal	Small	Medium	Large
Balanced fertilization	Do not	52	42	27	10	6
	Rarely	20	26	32	7	8
	Occasionally	22	23	25	37	29
	Regularly	6	9	16	46	57
Composting	Do not	19	14	10	4	0
	Rarely	43	40	37	8	7
	Occasionally	28	32	34	23	21
	Regularly	10	14	19	65	72
Crop residue management	Do not	64	60	51	9	3
	Rarely	10	17	10	5	7
	Occasionally	19	25	27	27	18
	Frequently	7	8	12	59	72
Crop rotations	Do not	31	27	20	7	0
	Rarely	25	23	26	4	3
	Occasionally	30	31	31	27	19
	Regularly	14	19	23	62	78
Cover cropping	Do not	51	46	39	10	2
	Rarely	8	7	8	6	6
	Occasionally	33	31	34	20	20
	Regularly	8	16	19	64	72
Mixed cropping	Do not	21	18	15	8	10
	Rarely	20	19	20	12	11
	Occasionally	35	43	47	42	33
	Regularly	24	20	18	38	46
Green manuring	Do not	72	70	58	16	10
	Rarely	10	9	12	9	4
	Occasionally	16	15	21	60	68
	Regularly	2	6	9	15	18

Overall practice of IPNM approach by the farmers

The possible score for overall practice of IPNM approach by a farmer ranged from 0 to 3 but the observed score ranged from 1 to 3 with an average being 1.34. Based on the observed score, the respondents were classified into three categories: rarely practice (1); occasionally practice (2); and regularly practice (3).

Data presented in Table 4 indicates that a little more that two-fifths (42%) of the farmers practice IPNM approach rarely followed by occasionally practiced category (41%). This finding is supported by the findings of

Negussie (1995) and he found that about half of the farmers of Ethiopia practice IPNM approach rarely. A less than one-fifths (17%) of the farmers practice that approach regularly. Due to the lack of adequate knowledge concerning IPNM approach for better crop production, combined with poor access to information, irregular contact with extension programs, poor marketing and distribution system of fertilizers, a large segments of farmers in the study areas could not practice IPNM approach properly.

Table 4. Farmers' overall practice of IPNM approach

Level of practice (score)	Farmers (120)		Mean	Standard deviation
	f	p		
Rarely (1)	50	42		
Occasionally (2)	49	41	1.34	0.29
Regularly (3)	21	17		

Note: 'f' indicates frequency and 'p' indicates percentage

Causes of inadequate practice of IPNM approach and its effect

It was observed during the field survey that there were several reasons of inadequate practice of components of IPNM approach by the farmers in the study areas which were presented in Figure 1. Some of the reasons were: i) farmers' financial inability; ii) high prices and unavailability of fertilizers during cropping seasons; iii) farmers' lack of knowledge; iv) inadequate extension support; and v) shortage of bio-fuel influence directly upon inadequate practice of IPNM approach. Excessive population pressure, on the other hand, reduces the quantity of cultivable land which indirectly influences soil fertility management by pressing farmers not to cultivate legume and green manuring crops.

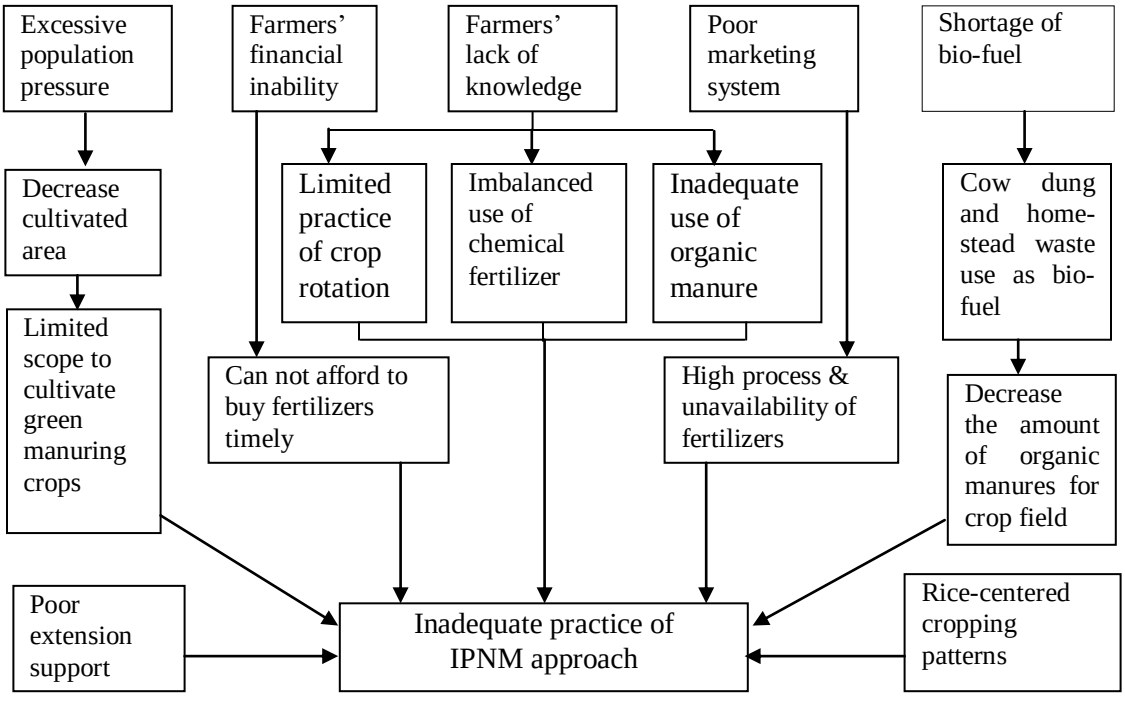

Fig 1. Probable causes of inadequate practice of IPNM approach and its components

Such inadequate practice of components of IPNM approach by the farmers declines soil fertility, reduce water holding capacity and create a situation of unavailability of essential plant nutrients. According to Gruhn, *et al*. (2000) all of these factors hamper crop yields either individually or collectively and reduce soil fertility. The loss of soil fertility from continual mining by crop removal without adequate replenishment combined with imbalanced plant nutrition practices, poses a threat to overall agricultural production. The reduced crop yield affects total crop production that leads to a situation of household food insecurity and reduces living standards of farming community (Vanlauwe *et al*. 2002). Agricultural policy planers should consider the above issues.

Conclusions

Although integrated plant nutrient management (IPNM) approach helps to obtain better crop yields and maintain/improve soil fertility, an overwhelming proportion of farmers (83%) of the study area practice this approach either rarely or occasionally. They mostly run their farms to cultivate crops intensively to meet food requirements rather than managing plant nutrients in soil. It is clear that landless, marginal and small farmer i.e. the resource-poor groups in the study area practice different components of IPNM approach less frequently than medium and large farm holders. The appropriate use of plant nutrients and management of soil fertility will be necessary to achieve the sustainable agricultural production that will increase crop yields and preserve/improve soil fertility now and in the future. Therefore, it is essential that the government extension organization, especially Department of Agricultural Extension (DAE) and non-governmental extension organizations in Bangladesh should take measures to motivate farmers, particularly the resource-poor group (about 80% of the farming community), to increase their knowledge base about the components of IPNM approach. Providing sufficient facilities to practice this approach would obviously help farmers to achieve better yields of different crops and preserve soil as one of the important natural resources for better crop production.

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