Research article

Evaluation of Soil Nutrient Level in Naypyitaw Agricultural Land

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Abstract Being one of the portions of land degradation, fertility depletion is a major barrier in crop productivity in agricultural sector. While we made attempt to increase crop productivity for food security, this study focused on investigating the fertility status of the soil and the major factors that influenced the nutrient level. The studies were carried out in Naypyitaw Union Territory during 2016 - 2017. The first study emphasized on major nutrient level in Naypyitaw region. A total of 240 soil samples were collected from 8 townships of 2 districts and analyzed. Soil analyses were performed for soil acidity, organic carbon, total Nitrogen, available P and K. Using descriptive statistic, the nutrient levels were evaluated in study area. The objective of second study was to evaluate the major and minor nutrient status in prominent specific rice fields in two townships. (Pobbathiri and Zeyar Thiri). Soil samples were collected from 22 farmer's fields and analyzed to identify soil macro and specific micro nutrients content. The Chi-square test was used to analyze for different location and different cropping patterns. First study showed that about 50% of Naypyitaw agricultural lands is low in Organic Carbon, 82% and 90% of land were also deficient in total N and available P, respectively. The second study showed that the deficiencies of total N, available P, S and Zn were detected in all rice fields. These nutrient deficiencies are not totally dependent on grown crops. It may be due to insufficient application of nutrients amount and type. It was also found that no farmers apply sufficient amount of organic and inorganic fertilizers. The results of the present study suggested that the effective education system was essential for farmers to adopt the advanced fertility technology regarding balanced fertilization of macro and micro nutrient..

Keywords balanced fertilization, degradation, macro, micro, fertility depletion

INTRODUCTION

Being an Agricultural country, Myanmar tries to develop Agricultural sector through increased crop productivity. Of the two approaches to achieve the crop productivity, where there are limited in land for area expansion, increased yield is more common in Agricultural sector. Main pillar of increased yield are Varietal improvement, Agricultural practices, Systematic nutrient supply and Protection of pest and disease and post-harvest losses. Today the yield of crops especially in rice of Myanmar is lower than that of neighboring countries. The basic technique of systematic nutrient management is balanced fertilization that for plant nutrient requirement in right time and right dose. Although grower applied their land in high intensity, they never noticed removal amount of nutrient from their land. It made the soil nutrient minus day by day resulting in nutrient depletion

in Agricultural land. At present, it may be great challenges for crop productivity and its negative effect on future land too. Even growing soil improved crops such legumes need to supply required macro and micro nutrient at right dose in right time. Today Myanmar face with land degradation due to soil erosion and fertility depletion .Major causes of fertility depletion may be due to insufficient apply of nutrient in Agricultural land.

Naypyitaw, in middle part of Myanmar, was selected for this study. It consists of 8 town ships, namely Tatkon, Lewe, Pyinmana, Zeyar Thiri, Pobba Thiri, Dekkhina Thiri, Zabuthiriand Oattara Thiri. The total land area is (706,009.72 ha) and net sowing area is about (135,978 ha). Major crops grown in this area are rice, sugarcane and pulses. Most of lands are used for growing rice and cropping intensity of this area is above 150% and 176.51% in Oattara Thiri district and 169.34% in Dekkhina Thiri. Some rice growing areas have Cropping Intensity (C.I) up to 300% since farmers adopt triple cropping system where water is available. Majority of farmers depend on rice growing in this area with high C.I and improved varieties including hybrid rice and corn which are those heavy eater crop in nutrient point of view. Even then, farmer didn't apply sufficient nutrients and amount on rice land let alone in upland crop resulting in nutrient depletion in soil. Although farmers apply fertilizer in substantial amount in rice field, it doesn't cope with the removal of nutrient by grown crops especially in minor nutrients. It may be remarkably deficient. The Cropping Intensities of these area shown in Table 1.

Table 1 Cropping Intensity of Naypyitaw region

District	Crop land (ha)	1st crop	2nd crop	3rd crop	Total	C.I (%)
Oattarathiri	71359.2	71359.2	53531.6	1062.8	125953.6	176.51
Dekkhina Thiri	64619.6	64619.6	39076.8	5752.8	109427.6	169.34
Total	135978.8	135978.8	92608.4	6815.6	235381.2	173.1

Source: –Department of Agriculture, Naypyitaw Region (2016)

OBJECTIVES

The study on nutrient status in Naypyitaw region was conducted in 2016, and study of macro and micro nutrient status in rice field was conducted in Pobba Thiri and Zeyar Thiri in 2017. Two main objectives are to evaluate the nutrient status in Naypyitaw Agricultural land, to assess the macro and micro nutrient level in rice growing area of two townships, and to assess the nutrient level based on cropping pattern.

METHODOLOGY

In this study, both primary and secondary data were collected. The primary data were collected from the selected farmers who are growing rice in two town ships (Pobbathiri and Zeyar Thiri). The survey was carried out with 22 farmers and soils from 4 kwins (cadastral boundary of agricultural land parcels) of their rice field were analyzed. The study was conducted to investigate soil macro and specific micro-nutrient status in rice field in these townships. The Chi-square test was used to analyze for different location and different cropping pattern.

The secondary data included land utilization of Naypyitaw, net sown area and cropping intensity. The major source of secondary data was taken from soil analytical data of fertility status in Naypyitaw. A total of 240 soil samples were collected and analyzed from 160 villages, 8 townships of 2 districts. Soil samples were analyzed for soil acidity, organic carbon, total Nitrogen, available P and K. Using descriptive statistics, the nutrient levels were evaluated in study area. Organic carbon ranged 2-4%, which was considered medium. Total N ranged 0.2-0.5%, considered medium, available P range was determined as medium (15-50 ppm) and level for K2O was determined as medium (10-20 mg/100g).

RESULTS AND DISCUSSION

Nutrient Status of Soils in Naypyitaw Region

Forty seven percent of land was low in organic carbon content and 52% of soil had medium level of organic carbon (Table 2) and Fig. 1. Eighty two percent of soils in Naypyitaw was low in total N content as expressed in Fig. 2. And available P content was low in 90% of soil samples (Fig. 3). In this area, level of available K was found to be medium in most soil samples (53%) as shown in Fig. 4. Also, nutrient status of study areas based on district were presented in Table 3 and Fig. 5.

Table 2 Nutrient status of soils in Naypyitaw region

	No of Organic C level			No of Total N level		No of Avail P level		No of Avail K level		
	Low	Medium	High	Low	Medium	Low	Medium	Low	Medium	High
Dekkhina Thiri	40	47	2	68	21	78	11	24	43	22
Oattara Thiri	72	78	1	128	23	138	13	28	85	38
Total	112	125	3	196	44	216	24	52	128	60

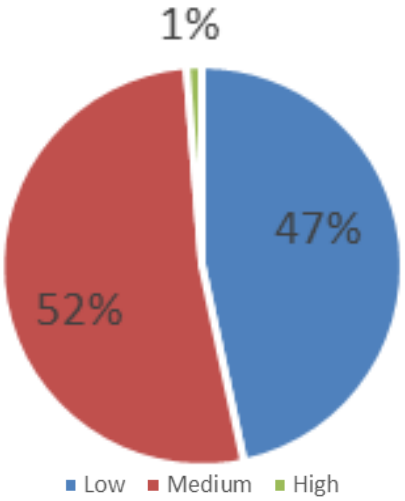

Fig. 1 Organic carbon level of agricultural land in Naypyitaw

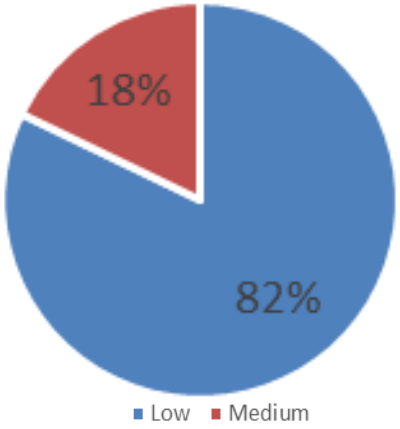

Fig. 2 Total nitrogen level of agricultural land in Naypyitaw

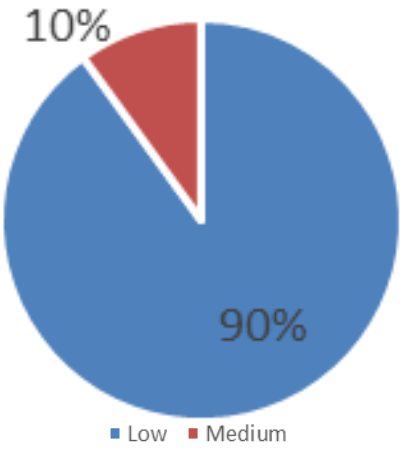

Fig. 3 Available P level of agricultural land in Naypyitaw

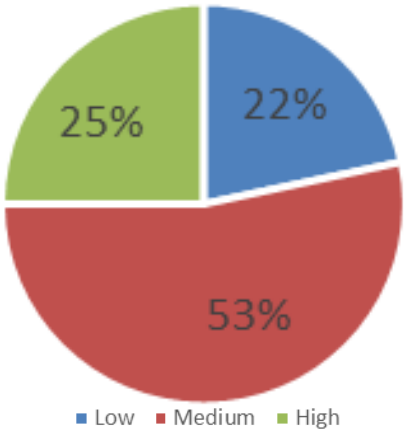

Fig. 4 Available K level of agricultural land in Naypyitaw

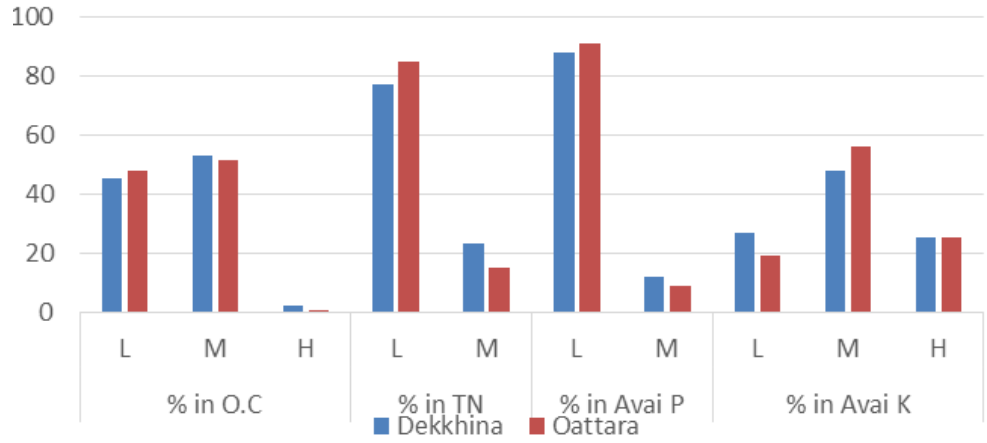

Fig. 5 Nutrient status of agricultural land in two districts in NPT

Table 3 Nutrient level percent based on district

	% in O.C level			% in N level		% in avail P level		% in avail K level		
	Low	Medium	High	Low	Medim	Low	Medium	Low	Medium	High
Dekkhina	45	53	2	77	23	88	12	27	48	25
Ottra	48	51.4	0.6	85	15	91	9	19	56	25

Macro and Micro Nutrients in Rice Field

The study was carried out in 2017 based on farmer survey and soil analytical data of their rice fields located in Oattathiri District. There are 5 major soil types in rice growing areas.

Fertility status of study areas: Fertility level based on location is shown in Table 4. Moreover, soil fertility level based on cropping system is shown in Table 5. Total Nitrogen, available S and Zn were deficient in all samples. Deficiency of organic carbon was significantly different in two areas at 0.05% level. Available P were found in low level but not significantly different between two locations. Available B was found to be in medium level in all soils of Zeyar Thiri and about 30 % of Pobba Thiri rice growing lands. Therefore, B deficiency varied with the regions and its difference was significant at 0.01 level.

Table 4 Fertility level based on location

No.	Parameter	No of soil sample Pobba Thiri		No of soil sample Zeyar Thiri		χ^2 test
		Medium	Low	Medium	Low	
1	O.C	6(8.18)	6(3.82)	9(6.82)	1(3.18)	4.01*
2	Total N	-	12	-	10	
3	Avail P	2(2.18)	10(9.82)	2(1.81)	8(8.18)	ns
4	Avail K	12	-	10	-	
5	Avail S	-	12	-	10	
6	Avail Zn	-	12	-	10	
7	Avail B	4(7.64)	8(4.36)	10(6.36)	- (3.64)	7.81**

Findings of this study indicate that fertility status in rice fields of Naypyitaw is not totally dependent on the cropping pattern. Major factors that influence fertility level may include high cropping intensity and insufficient application of nutrients as it is shown in Table 5. Bacon et al.

(1990) stated that balanced input and output is important in long-term sustainability. Although pulses help improved soil fertility, remaining nutrient is not enough to maintain fertility level unless nutrients were not applied to cover its use. Pattanayak et al. (2008) pointed out that applying inadequate and unbalanced nutrient is a major factor responsible for low productivity.

Table 5 Fertility level based on cropping pattern

No.	Parameter	No of soil sample						
		Rice, Pulses system		Rice, Rice system		Rice, Pulses, Rice system		X^2
		M	L	M	L	M	L	test
1	O.C	9(8.86)	4(4.14)	1(1.36)	1(0.64)	5(4.77)	2(2.23)	ns
2	Total N	_	13	_	2	-	7	
3	Avail P	3(2.36)	10(10.64)	_(0.36)	2(1.64)	1(1.27)	6(5.73)	ns
4	Avail K	13	_	2	_	7	_	
5	Avail S	_	13	_	2	_	7	
6	Avail Zn	_	13	_	2	_	7	
7	Avail B	8(8.27)	5(4.73)	1(1.27)	1(0.73)	5(4.45)	2(2.55)	ns

The findings showed that all farmers are lack of knowledge in soil fertility. They never know nutrient removal and recommended fertilizer rate for their crops. They apply substantial amount of fertilizers in rice field but in pulses in general. Organic matter utilization has been never met the needs of plant's micronutrients.

CONCLUSION

This study showed that about 50% of Naypyitaw Agricultural lands were low in Organic Carbon. In terms of major nutrients, 82% and 90% of land were also deficient in total N and available P respectively. It contained only K in substantial amount. In the study, Total N, available P, S and Zn were deficient in all fields. Rice fields in Zeyar Thiri had more O.C and B compared to that of Pobba Thiri. Some nutrient deficiencies were significantly different in two locations but not dependent on cropping pattern. Deficiency of nutrient in study area was not totally dependent on grown crops. It may be due to insufficient application of nutrients amount and type. According to the study no farmers apply sufficient amount of organic and inorganic fertilizers and the results of the present study pointed out that the effective education system was required for farmers to adopt the advanced fertility technology regarding balanced fertilization of macro and micro nutrients.

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