

TABLE OF CONTENTS

1	INTRODUCTION	1
2	LITERATURE REVIEW	7
2.1	Role of rice-rice and rice-wheat cropping systems in Bangladesh.....	7
2.2	Native soil nitrogen supply	8
2.3	Nitrogen supply and crop nitrogen demand	9
2.4	Nitrogen losses from fertilizer applied to rice and wheat.....	10
2.4.1	Runoff loss.....	10
2.4.2	Leaching loss	11
2.4.3	Denitrification.....	11
2.4.4	Ammonia volatilization	12
2.5	Ways to minimize N losses and improve N use efficiency	13
2.6	Nitrogen fertilizer management through crop demand.....	15
2.7	Chlorophyll meter or SPAD (Soil Plant Analysis Development) meter and leaf color chart (LCC).....	15
2.7.1	Mechanism of SPAD meter.....	16
2.7.2	General guidelines for using SPAD meter	16
2.7.3	General guidelines for using LCC	18
3	MATERIALS AND METHODS.....	20
3.1	Experimental site	20
3.2	List of experiments	21
3.3	Experimental soils	23
3.4	Plant material.....	23
3.5	Crop management.....	26
3.6	Soil sampling and analysis	27
3.7	Plant sampling and analysis.....	27
3.8	Chlorophyll meter (SPAD) and leaf color chart (LCC) measurement	28
3.9	Treatment application.....	29
3.9.1	Evaluation of leaf color chart (LCC) and chlorophyll meter (SPAD) for estimating native soil N supply	29
3.9.2	Comparison of three types of LCC-based N managements in rice production.....	30
3.9.3	Estimation of critical leaf color chart (LCC) values for different crops and seasons	30
3.10	Data analysis.....	33

4	RESULTS AND DISCUSSION	35
4.1	Evaluation of leaf color chart (LCC) and chlorophyll meter (SPAD) for estimating native soil N supply	35
4.1.1	Soil N supplying capacity of rice fields	35
4.1.2	Correlation of rice grain yield and LCC/SPAD values	37
4.1.3	Correlation of rice N uptake and LCC/SPAD values	39
4.1.4	Soil N supplying capacity of wheat fields	42
4.1.5	Correlation of wheat grain yield and LCC/SPAD values	44
4.1.6	Correlation of wheat N uptake and LCC/SPAD values	46
4.2	Comparison of three types of leaf color chart (LCC)-based N managements in rice production.....	48
4.2.1	Yield and fertilizer nitrogen application.....	48
4.2.2	Yield components, straw yield, total dry matter yield and harvest index ..	51
4.2.3	Total N uptake, nitrogen harvest index, and internal N-use efficiency	52
4.2.4	Partial factor productivity, agronomic efficiency, physiological efficiency, and recovery efficiency	53
4.3	Estimation of critical LCC value for T-Aman rice varieties in rice-rice and rice-wheat systems.....	56
4.3.1	Yield and fertilizer nitrogen application (rice-rice system).....	56
4.3.2	Yield components, straw yield, total dry matter yield, and harvest index (rice-rice system)	58
4.3.3	Total N uptake, nitrogen harvest index, and N-use efficiencies rice-rice system)	62
4.3.4	Yield and fertilizer nitrogen application (rice-wheat system)	67
4.3.5	Yield components, straw yield, total dry matter yield, and harvest index (rice-wheat system)	69
4.3.6	Total N uptake, nitrogen harvest index, and N-use efficiencies (rice-wheat system).....	73
4.4	Estimation of the critical LCC values for rice varieties in the Boro season....	78
4.4.1	Yield and fertilizer nitrogen application.....	78
4.4.2	Yield components, straw yield, total dry matter yield, and harvest index	82
4.4.3	Total N uptake, nitrogen harvest index, and internal N use efficiency	85
4.4.4	Partial factor productivity, agronomic efficiency, physiological efficiency, and recovery efficiency	88
4.4.5	Relationship of the leaf N on a weight and area basis with SPAD reading.	93
4.4.6	Relationship of SPAD and three types of LCC readings	96

4.5	Estimation of the critical LCC values for selected wheat varieties in the Rabi (wheat) season of 2001-02	100
4.5.1	Evaluation of yield response to different N fertilizer levels and managements for selected wheat varieties.....	100
	Grain yield and fertilizer nitrogen application	101
	Yield components, straw yield, total dry matter yield, and harvest index	103
	Total nitrogen uptake, nitrogen harvest index, and nitrogen-use efficiency	105
	Relationship of the leaf N on a weight and area basis with SPAD reading at maximum tillering stage	108
	SPAD reading at maximum tillering stage and relationship of SPAD and three types of LCC readings.....	109
4.5.2	Estimation of critical LCC value for N fertilization at maximum tillering stage in different wheat varieties	112
	Grain yield and fertilizer nitrogen application	112
	Yield components, straw yield, total dry matter yield, and harvest index	114
	Total nitrogen uptake, nitrogen harvest index and nitrogen-use efficiency	116
	Relationship of the leaf N on a weight and area basis with SPAD reading at maximum tillering stage	119
	SPAD reading at maximum tillering stage and relationship of SPAD and three types of LCC readings.....	121
5	GENERAL DISCUSSION AND CONCLUSIONS.....	125
5.1	Native soil N supply	125
5.2	Grain yield	127
5.3	Nitrogen-use efficiency	129
5.4	Leaf nitrogen and SPAD meter	131
5.5	SPAD meter and LCC values	131
5.6	Conclusions	132
6	REFERENCES.....	135
7	APPENDICES	154