

TABLE OF CONTENTS

	Page
ABSTRACT (THAI).....	I
ABSTRACT IN ENGLISH.....	III
ACKNOWLEDGEMENT	V
TABLE OF CONTENTS	VI
LIST OF TABLES.....	IX
LIST OF FIGURES.....	XII
LIST OF ABBREVIATIONS	XIII
CHAPTER	
I INTRODUCTION	1
1.1 Background of this study	1
1.2 Objectives of the study.....	2
II LITERATURE REVIEWS.....	3
2.1 Importance of sugarcane	3
2.2 Growth of sugarcane.....	3
2.3 Significant of sugarcane in Thailand	4
2.4 Limitation of sugarcane production.....	5
2.5 Importance of water to plants	5
2.6 Irrigation and crop evapotranspiration (ETc).....	6
2.7 Drip irrigation system	10
2.8 Fertigation	11
2.9 Fertigation in sugarcane	12
2.10 Ratooning ability of sugarcane	13
III MATERIALS AND METHODS.....	15
3.1 Experimental site description	15
3.1.1 Soil properties analysis.....	15
3.2 Experimental design.....	17

TABLE OF CONTENTS (Continued)

	Page
3.3 Fertilizer application	17
3.4 Irrigation practice	18
3.5 Sampling and data measurement.....	19
3.5.1 Plant cane (2018/19 growing season).....	19
3.5.2 First ratoon cane (2019/20 growing season)	21
3.6 Statistical analysis.....	22
IV RESULTS AND DISCUSSION	23
4.1 Crop water requirement, rainfall, and irrigation consumption.....	23
4.2 First year experiment : Effects of fertilizer application and irrigation method on growth and yield of sugarcane.....	25
4.2.1 Sugarcane growth parameters in PC.....	25
4.2.2 LAI and leaf SCMR	29
4.2.3 Leaf tissue nutrient of sugarcane	32
4.2.4 Yield and yield components.....	34
4.2.5 Irrigation water use efficiency (IWUE)	39
4.2.6 Fertilizer nutrient use efficiency (FNUE).....	40
4.2.7 Underground stubble fresh and dry weight in SCL soil.....	42
4.2.8 Total root length density (Total RLD) and RLD pattern in SCL soil.....	43
4.3 Second year experiment: Effects of Drip Fertigation on Growth, Yield, and Ratooning Ability of Sugarcane.....	45
4.3.1 The FRC germination (%)	45
4.3.2 Sugarcane growth parameters in FRC.....	47
4.3.3 Yield and yield components.....	52
4.3.4 Total RLD and RLD pattern in FRC in SCL soil.....	53
4.3.5 Ratooning ability	56

TABLE OF CONTENTS (Continued)

	Page
V CONCLUSION	63
REFERENCES	65
APPENDIX.....	73
BIOGRAPHY	77

LIST OF TABLES

Table	Page
2.1 The crop coefficient (Kc) value of sugarcane	9
2.2 Potential evapotranspiration (ETp) of Penman–Monteith monthly in northeast Thailand	10
2.3 Water use efficiency in tomato, cucumber, and bell pepper through furrow or drip irrigation.....	11
2.4 Explanation of loss pathways for nutrients.....	13
2.5 Fertilizer efficiencies of various application methods.....	13
3.1 Physical and chemical properties of soil.....	16
3.2 Rate of fertilizers recommended based on water balance model in each soil textures	18
4.1 Crop water requirement, rainfall, and irrigation water in PC in SCL soil.....	23
4.2 Crop water requirement, rainfall, and irrigation water in PC in LS soil	24
4.3 Crop water requirement, rainfall, and irrigation water in FRC in SCL soil.....	24
4.4 Crop water requirement, rainfall, and irrigation water in FRC in LS soil	25
4.5 Effects of irrigation and fertigation on the number of shoots in SCL soil.....	26
4.6 Effects of irrigation and fertigation on number of shoots in LS soil.....	26
4.7 Combined effects of site and fertigation on the number of shoots.....	27
4.8 Effects of irrigation and fertigation on plant height in SCL soil.....	27
4.9 Effects of irrigation and fertigation on plant height in LS soil	28
4.10 Combined effects of site and fertigation on plant height	28
4.11 Effects of irrigation and fertigation on LAI and leaf SCMR at 4 MAP in SCL soil.....	29
4.12 Effects of irrigation and fertigation on LAI and leaf SCMR at 4 MAP in LS soil.....	29
4.13 Combined effects of site and fertigation on LAI and leaf SCMR	30
4.14 Effects of irrigation and fertigation on leaf nutrients in SCL soil at 6 MAP.....	30

LIST OF TABLES (Continued)

Table	Page
4.15 Effects of irrigation and fertigation on leaf nutrients in LS soil at 6 MAP	33
4.16 Effects of irrigation and fertigation on yield and yield components at 12 MAP in SCL soil	35
4.17 Effects of irrigation and fertigation on yield and yield components at 12 MAP in LS soil	35
4.18 The interaction effects of site and fertigation on yield and components	36
4.19 Effects of irrigation and fertigation on IWUE of sugarcane	39
4.20 Effects of irrigation and fertigation on FNUE at 12 MAP in SCL soil	40
4.21 Effects of irrigation and fertigation on FNUE at 12 MAP in LS soil	40
4.22 The interaction effects of site and treatments on FNUE of sugarcane	41
4.23 Effects of irrigation and fertigation on Underground stubble weight in SCL soil at 12 MAP	43
4.24 Effects of irrigation and fertigation on Total RLD in PC in SCL soil at 12 MAP	43
4.25 Effects of PC residual management and FRC management on germination (%)	46
4.26 Effects of PC residual management and FRC management on number of shoots at 2, 4, and 6 MAH in SCL soil	48
4.27 Effects of PC residual management and FRC management on number of shoots at 2, 4, and 6 MAH in LS soil	49
4.28 Effects of PC residual management and FRC management on number of shoots at 2, 4, and 6 MAH in SCL soil	50
4.29 Effects of PC residual management and FRC management on number of shoots at 2, 4, and 6 MAH in LS soil	51
4.30 Effects of PC residual management and FRC management on yield and yield components in SCL soil at 12 MAH	52

LIST OF TABLES (Continued)

Table	Page
4.31 Effects of PC residual management and FRC management on yield and yield components of FRC in LS soil at 12 MAH.....	53
4.32 Effects of PC residual management and FRC management on Total RLD in FRC in SCL soil at 6 MAH.....	55
4.33 Effects of PC residual management and FRC management on RA (%) based on number of shoots, yield and yield component in SCL soil	57
4.34 Effects of PC residual management and FRC management on RA (%) based on number of shoots, yield, and yield component in LS soil.....	59
4.35 Correlations value among the treatments of PC on phenotypic traits yield and yield components in PC	61
4.36 Correlations value among the old residual structures of PC on phenotypic traits and RAs of FRC	62

LIST OF FIGURES

Figure	Page
2.1 The relationship between soil moisture and the determination of the water of plants.....	7
4.1 Interaction effects of site and fertigation on yield	37
4.2 Interaction effects of site and fertigation on plant height	37
4.3 Interaction effects of site and fertigation on the NMC	38
4.4 Interaction effects of site and fertigation on FNUEs.....	41
4.5 Effects of irrigation and fertigation on RLD pattern (cm/cm ³) in SCL soil.....	44
4.6 Interaction effects of PC residual management and FRC management on plant height in FRC in LS soil at 4 and 6 MAH	51
4.7 Effects of rainfed practices on RLD in FRC in SCL soil at 6 MAH (cm/cm ³).....	55
4.8 Effects of drip fertigation practices on RLD in FRC in SCL soil at 6 MAH (cm/cm ³).....	55
4.9 The interaction effects between PC residual management and FRC management on RA (%) based on number of shoots at 2 MAH	58

LIST OF ABBREVIATIONS

Av. P	=	Available P
AWHC	=	Available water holding capacity
DAH	=	Day after harvest
DR	=	Drainage
Dr	=	Root depth
EC	=	Electric conductivity
Epan	=	Class A Pan Evapotranspiration
ET	=	Evapotranspiration
Etc	=	Crop evapotranspiration
ETo	=	Amount of water consumed by standard or reference crop
Etp	=	Potential evapotranspiration
Ex. K	=	Exchangeable K
FC	=	Field capacity
FNUE	=	Fertilizer nutrient use efficiency
FRC	=	1 st ratoon cane
GA	=	Ground area
I	=	Irrigation
IWUE	=	Irrigation water use efficiency
Kc	=	Crop coefficient
Kp	=	Class A Pan coefficient
LA	=	Leaf area
LAI	=	Leaf area index
LS	=	Loamy sand soil
MAP	=	Month after planting
MAH	=	Month after harvesting
NB	=	Nutrient balance model
NMC	=	Number of millable cane

LIST OF ABBREVIATIONS (Continued)

NS	=	Nutrient supply
NR	=	Nutrient required for the target yield
NUE	=	Nutrient use efficiency for soil uptake
OM	=	Organic matter
PC	=	Plant cane
P	=	Precipitation
PWP	=	Permanent wilting point
RA	=	Ratooning ability
Re	=	Effective rainfall
RL	=	Root length
RLD	=	Root length density
RO	=	Surface runoff
RWC	=	Relative water content
SAN	=	Soil available nutrient
SCL	=	Sandy clay loam soil
SDI	=	Surface drip irrigation
SM	=	Minimum amount of soil nutrient
SMC _p	=	The predicted soil moisture content
SCMR	=	SPAD chlorophyll meter reading
SV	=	Soil volume
TVD	=	Top visible dewlap
WUE	=	Water use efficiency