

TABLE OF CONTENTS

CERTIFICATE.....	i
DEDICATION	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS.....	vi
LIST OF PLATES	ix
LIST OF TABLES.....	xi
LIST OF FIGURES	xii
ABBREVIATIONS	xv

CHAPTER I: INTRODUCTION

1.0 Introduction	1
1.1 Scientific Context	1
1.2 Conventional methods for agricultural land studies	2
1.3 Non- conventional methods for agricultural land studies	4
1.3.1 Application of Remote Sensing in Agriculture	4
1.4 Crop parameters: Biophysical and Biochemical parameters.....	5
1.5 Optical remote sensing and crop parameters.....	7
1.5.1 Empirical- statistical approach	13
1.5.2 Physical modelling approach.....	14
1.5.2.1 Radiative Transfer models.....	15
1.6 Microwave remote sensing and crop parameters.....	19
1.6.1 Empirical-statistical approach	21
1.7 Trend analysis of different crops	22
1.8 Vulnerability Assessment of agricultural fields	22
1.9 Crop mapping	24
1.10 Objectives.....	27

CHAPTER II: STUDY AREA

2.0 Description of the Study area	28
2.1 Geographical Location	28
2.2 Land Utilization Statistics	30
2.3 Geology	30
2.4 Soil	31
2.5 Climate	32
2.6 Water Management/ Irrigation Practice	33
2.7 Agriculture.....	33
2.8 Livestock Population.....	35

CHAPTER III: MATERIALS AND METHODOLOGY

3.0 Materials and Methodology.....	36
3.1 Trends Analysis	38
3.2 Vulnerability assessment.....	38
3.3 Conventional approach used in the study.....	40

3.3.1 Ground Data	40
3.3.2 Measurements of crop parameters	40
3.3.2.1 Biophysical parameters	40
3.3.2.2 Biochemical parameter.....	41
3.4 Non-conventional approach used in the study.....	42
3.4.1 Satellite Data.....	42
3.4.1.1 Optical Remote Sensing Data Used	42
3.4.1.2 Microwave Remote Sensing Data Used	43
3.5 RS & GIS analysis	44
3.5.1 Base Map preparation	44
3.5.2 Village Map Generation	44
3.5.3 Optical Data Processing	44
3.5.3.1 Georeferencing.....	45
3.5.3.2 Sub-setting.....	45
3.5.4 Synthetic Aperture Radar (SAR) data processing	45
3.5.4.1 Speckle filtering	45
3.5.4.2 Geo-referencing	46
3.5.4.3 Sub-setting	46
3.6 Retrieval of crop parameters from optical remote sensing	46
3.6.1 Extraction of spectral indices	46
3.6.1.1 Retrieval of spectral indices values for different crops.....	47
3.6.2 Establishment of optical RS based empirical-statistical relationships.....	47
3.7 Development of the composite vegetation health index	48
3.8 Retrieval of crop parameters from microwave remote sensing.....	50
3.8.1 Extraction of backscatter coefficient (Sigma Nought (σ^0)).....	50
3.8.1.1 Retrieval of backscatter values for crop parameters	51
3.8.2 Establishment of microwave RS based empirical-statistical relationships	51
3.9 Techniques used for Image Classification	51
3.9.1 Supervised Classification for optical and microwave data	51
3.9.2 Wishart Supervised Classification	52

CHAPTER IV: RESULTS

4.0 Results	53
4.1 Trend analysis in different crops	53
4.1.1 COTTON.....	54
4.1.2 CASTOR	57
4.1.3 BANANA	61
4.2 Crop Calendar.....	64
4.3 Vulnerability assessment.....	65
4.4 Advantages of microwave data in crop assessment.....	68
4.4.1 Land Use Classification using Optical Data.....	68
4.4.2 Crop Classification at microlevel using Optical Data.....	71
4.4.3 Land Use Classification using Radar Data.....	75
4.4.4 Crop Classification at microlevel using Radar Data.....	80
4.5 Conventional and Non-conventional approach for estimation of crop parameters	83
4.5.1 Retrieval of crop parameters using conventional technique.....	83

4.5.2 Retrieval of crop parameters using non-conventional technique	89
4.5.2.1 Crop parameters retrieval from Optical data	89
4.5.2.1.1 Spectral indices calculated from both Landsat 5 TM and LISS IV	90
4.5.2.1.2 Retrieval of Crop parameters using Optical RS based Empirical-statistical models	93
4.5.2.1.3 LAI retrieval in different crops using Landsat 5 TM and LISS IV.....	93
4.5.2.1.4 RWC estimation in different crops using Landsat 5 TM	105
4.5.2.1.5 CC estimation in different crops using Landsat 5 TM and LISS IV.....	108
4.5.2.1.6 Biomass estimation in different crops using Landsat 5 TM and LISS IV.....	119
4.5.2.1.7 Vegetation Health Index for the Selected Crops.....	126
4.5.2.2 Crop parameters retrieval from Microwave satellite data	131
4.5.2.2.1 Extraction of backscatter coefficient.....	131
4.5.2.2.2 Retrieval of crop parameters using Microwave RS based Empirical-statistical models	133
4.5.2.2.3 Retrieval of LAI in different crops from ASAR data.....	133
 CHAPTER V: DISCUSSION	
5.0 Discussion	136
 CHAPTER VI: CONCLUSION	
6.0 Conclusion.....	148
 CHAPTER VII: SUMMARY	
7.0 Summary	155
 REFERENCES	162
 ANNEXURE I	211