TABLE OF CONTENTS

Sl. No	Contents	Page No
	Title	i
	Cirtificate of Supervisors	ii–iii
	Abstract	iv–v
	Declaration	vi
	Dedication	vii
	Curriculum Vitae	viii–x
	Acknowledgement	xi–xiii
	Table of Contents	xiv–xviii
	List of Tables	xix–xx
	List of Figures	xxi–xxiii
	List of Abbreviation	xxiv–xxvii
I	**GENERAL INTRODUCTION**	**1–8**
1.1	Introduction	2
1.2	Aims and objectives of the study	6
1.3	Outline of the thesis	7
II	**REVIEW OF LITERATURE**	**9–30**
2.1	Introduction	10
2.2	History and distribution of Potato Late Blight	10
2.3	Economic importance of the disease	12
2.4	Symptomatological study of Potato Late Blight disease	14
2.5	Potato Late Blight disease development and spread	14
2.6	Environmental factors responsible for Potato Late Blight disease development	15
2.7	The integrated 3S technology of Information Communication Technology (ICT) for disease monitoring and management	18
	2.7.1 Application of remote sensing technology for disease detection and	19

monitoring
2.7.2 Application of Geographic Information System for disease monitoring and management 24
2.7.3 Application of Global Positioning System for disaese monitoring and management 25
2.8 Estimation of disease severity 26

III GENERAL DESCRIPTION OF THE STUDY AREA 31–41
3.1 Location 32
3.2 Climate 32
3.3 Physiography and soil 36
3.4 Drainage system 37
3.5 Flora and Fauna 38
3.6 Agriculture 39
3.7 Demography 40

IV ASSESSMENT OF SPATIO-TEMPORAL PHENOLOGY DYNAMICS OF POTATO CROP 42–66
4.1 Introduction 43
4.2 Materials and methods 46
4.2.1 Data used 46
4.2.2 Methodology 48
4.2.2.1 MODIS data processing 48
4.2.2.2 Time series NDVI data interpolation and reconstruction 48
4.2.2.3 Identification of cropping systems 49
4.2.2.4 Identification of potato crop phenology 50
4.2.2.5 Extraction of areas under potato crop 51
4.2.2.6 Phenological metrics of potato crop 51
4.2.2.7 Estimation of Fractional Crop Canopy Cover using Improved Pixel Dichotomy Model 52
4.2.2.8 Field validation 55
4.3 Result and discussion 55
4.3.1 Performance of phenology detection and extraction of potato crop 55

phenological pattern
4.3.2 Phenological metrics of potato 57
4.3.3 Spatial pattern of potato crop phenology 60
4.3.4 Relationship between NDVI, RVI, and potato crop canopy fraction 61
4.3.5 Spatial pattern of potato crop canopy fraction (PCCF) 62
4.3.6 Field validation 64
4.4 Conclusion 65

V HYPERSPECTRAL OBSERVATION FOR POTATO LATE BLIGHT STUDY 67–94

5.1 Introduction 68
5.2 Objectives 71
5.3 Materials and methods 71
5.3.1 Locations of field based hyperspectral data collection 71
5.3.2 Field hyperspectral measurements 72
5.3.3 Signature file overlap/matching 73
5.3.4 Noise removal and data smoothening 73
5.3.5 Data normalization 74
5.3.6 Continuum removal and characterization of spectral absorption features 74
5.3.7 Hyperspectral indices 76
5.3.7.1 Red-edge and Red-edge Position 76
5.3.7.2 Red-edge Normalized Difference Vegetation Index ($NDVI_{705}$) 77
5.3.7.3 Normalized Difference Water Index (NDWI) 77
5.3.7.4 Normalised Difference Infrared Index (NDII) 77
5.3.7.5 Moisture Stress Index (MSI) 78
5.3.7.6 Plant Stress Detection Index (PSDI) 78
5.3.7.7 Disease Water Stress Index (DWSI) 78
5.3.8 Field measurement of Potato Late Blight disease severity 79
5.3.9 Predictive ability 80
5.4 Results and discussion 81
5.4.1 Generation of reference spectra 81
5.4.2 Spectral profile of disease plants and spectral transformation 81

5.4.3 Spectra discrimination of PLB affected potato crops 83
5.4.4 Location based spectral variables 87
5.4.5 Spectral absorption features 88
5.4.6 Sensitivity of Spectral Variables to Potato Late Blight disease 89
5.4.7 Relationship between spectral variables and disease severity index 91
5.4.8 Field validation 93
5.5 Conclusion 94

VI MODELING OF POTATO LATE BLIGHT DISEASE USING MULTISPECTRAL MULTI-TEMPORAL SATELLITE DATA 95-142

6.1 Introduction 96
6.2 Objectives 98
6.3 Materials and methods 99
6.3.1 Data used 99
6.3.2 Methodology 99
6.3.2.1 AWiFS data pre-processing 99
6.3.2.2 Calculation of spectral vegetation indices 100
6.3.2.2.1 Normalized Difference Vegetation Index 101
6.3.2.2.2 Normalized Difference Water Index 101
6.3.2.2.3 Angle Based Drought Index (ABDI) 101
6.3.2.2.4 Potato Crop Canopy Fraction (PCCF) estimation using Dimidiate Pixel Model (DPM) 102
6.3.2.3 Field measurement of Potato Late Blight disease severity 103
6.3.2.4 Segregation of potato crop pixels 104
6.3.2.5 Field validation 104
6.3.2.6 Estimation of model accuracy 104
6.4 Result and discussion 106
6.4.1 Spectral reflectance of diseased and healthy potato crops 106
6.4.2 Sensitivity analysis of vegetation indices towards discrimination of diseased crops from healthy crops 108
6.4.2.1 Discrimination between healthy and diseased crops on the basis of NDVI 108

6.4.2.2 Discrimination between healthy and diseased crops on the basis of NDWI 111
6.4.2.3 Discrimination between healthy and diseased crops on the basis of ABDI 114
6.4.2.4 Discrimination between healthy and diseased crops on the basis of PCCF 116
6.4.3 Estimation of Late Blight disease affected area 118
6.4.3.1 Visual interpretation of imageries 118
6.4.3.2 Rule based classification for delineating PLB affected areas 119
6.4.3.3 Validation of the results 121
6.4.4 PLB disease intensity or severity model 122
6.4.5 Progression and spatial temporal pattern of PLB disease 138
6.5 Conclusion 141

VII SUMMARY AND CONCLUSION 143-147
7.1 Summary and Conclusion 144
7.2 Future scope of the study 146
BIBLIOGRAPHY 148-170
APPENDIX 171-190