

Contents

<i>Foreword</i>	(vii)
<i>Preface</i>	(ix)
<i>Acknowledgement</i>	(xi)

Chapter 1 : Weather – Agriculture – History

1.1 Introduction.....	1
1.2 History of Ancient Indian Agriculture with Reference to Agricultural Meteorology	2
1.3 Rainfall Prediction in Ancient India	4
1.3.1 By Astrology	4
1.3.2 By Panchanga	5
1.3.3 Ancient Models for Prediction/ Forecasting Seasonal Rainfall in Ancient India	6
1.4 Indigenous Technical Weather Knowledge (ITWK).....	6
1.4.1 Evaluation of ITWK on Rainfall Forecasting.....	6
1.4.2 Examples of Agrometeorological Services using ITWK	7
1.5 India Meteorological Department.....	8
1.5.1 Agrometeorological Services in India	9
1.6 World Meteorological Organisation	17
1.6.1 Scope of World Meteorological Organisation.....	17
1.6.2 Functions of WMO.....	17
1.6.3 Applications.....	20
1.6.4 Sharing Expertise and Building Capacity.....	23

Chapter 2 : Weather Elements – Measurement

2.1 Solar Radiation	24
2.1.1 Effects of Surface Geometry on Solar Radiation	25
2.1.2 Crop Management and Layout	26
2.1.3 Measurement of Solar Radiation and Sunshine.....	26

(xiv) Contents

2.2	Temperature	28
2.2.1	Air Temperature	28
2.2.2	Soil Temperature	31
2.3	Atmospheric Humidity	37
2.3.1	Measurement of Humidity.....	39
2.3.2	Soil and Grain Moisture	40
2.3.3	Leaf Wetness and Dew	43
2.4	Wind	44
2.4.1	Measurement of Wind	44
2.5	Atmospheric Pressure	46
2.5.1	Measurement of Atmospheric Pressure.....	46
2.6	Rainfall/Precipitation	47
2.6.1	Measurement of Rainfall/Precipitation.....	47
2.7	Evaporation and Water-Balance	49
2.7.1	Evaporation	49
2.7.2	Irrigation.....	50
2.8	Weather- Soybean (Glycerine max (L.) Merr)	50
2.8.1	Introduction	51
2.8.2	Material and Methods.....	52
2.8.3	Micrometeorological Studies.....	53
2.8.4	Results	55
2.8.5	Conclusions	59

Chapter 3 : Weather – Disasters – Management

3.1	An Overview of Disasters.....	61
3.1.1	Major Types of Disasters	62
3.1.2	Disasters based on “Set on Time”	62
3.1.3	Disasters based on “Response Time”	62
3.1.4	Impact of Disasters on People	62
3.1.5	Scale of Disaster	63
3.1.6	Assessment of Agricultural Losses due to Disasters.....	63
3.1.7	Disaster Management	63
3.1.8	Disaster Management Vision	63
3.1.9	Community based Disaster Management.....	64
3.2	Cyclones	64
3.2.1	Formation and Movement of Cyclones	65
3.2.2	Life Cycle of a Tropical Cyclone	66

3.2.3	Structure of Cyclone.....	66
3.2.4	Classification of Cyclones.....	67
3.2.5	Effects of Cyclones	68
3.2.6	Beneficial/Positive Effects of Cyclones	69
3.2.7	Management of Agricultural Systems affected by Cyclones	70
3.2.8	Protection of Animals during Cyclones	71
3.2.9	Cyclone Mitigation Measures in Agricultural Systems	71
3.2.10	Advisory for Hudhud Cyclone affected Districts in Andhra Pradesh and Odisha.....	72
3.3	Floods	76
3.3.1	Classification of Floods.....	77
3.3.2	Types of Floods.....	77
3.3.3	The Causes of Floods	78
3.3.4	The Negative Impacts of Floods on Agriculture.....	78
3.3.5	The Positive Impacts of Floods on Agriculture.....	79
3.3.6	Flood Management.....	79
3.4	Droughts	80
3.4.1	The Causes of Drought.....	80
3.4.2	The Severity of Drought.....	80
3.4.3	Classification of Drought	80
3.4.4	The Negative effects of Drought	82
3.4.5	The Positive effects of Drought.....	82
3.4.6	Response of Plants to Drought Conditions.....	82
3.4.7	Mitigation Measures.....	83
3.4.8	Drought relief Measures Relating to Livestock.....	84
3.5	Other Disasters, Risks and uncertainties that Effect Agriculture	84
3.5.1	Temperature.....	85
3.5.2	Wind	89
3.5.3	Thunderstorms, Dust Storms and Hail Storms and Cloud Bursts	90
3.5.4	Excessive or Defective Insolation	91
3.5.5	Tornado	92
3.6	Agrometeorological Services for Disaster Management	92
3.6.1	Preamble.....	92

3.6.2	The role of Indigenous Technical Weather Knowledge (ITWK) in Agrometeorological Services	94
3.6.3	The Role of Contemporary Technological advances in Agrometeorological Services.....	95
3.6.4	Strategies to Improve the Agrometeorological Services to Cope with Risks and Uncertainties	98
3.6.5	Improving the Agrometeorological Services.....	99
3.6.6	Improving the Support Systems of Agrometeorological Services	106
3.7	Conclusions.....	107

Chapter 4 : Weather – Erosion – Remote Sensing – Crop Growth Models

4.1	Soil Erosion	110
4.1.2	Role of Weather Elements in Soil Erosion.....	111
4.1.3	Erosion Control and Adaptive Measures.....	112
4.2	Remote Sensing	119
4.2.1	Geo-spatial Information and Communication Technology	122
4.2.2	Uses of Space Observations	122
4.2.3	Application of Remote Sensing in Agriculture	125
4.3	Crop Growth Modelling.....	134
4.3.1	Weather Data for Modeling.....	135
4.3.2	Weather as in Input in Models.....	135
4.3.3	Role of Weather in Decision Making.....	136
4.3.4	An Example.....	137

Chapter 5: Climate Change – Agriculture

5.1	Climate Change.....	141
5.1.1	Climate Change - Global Processes and Effects	142
5.1.2	Earth's Climate.....	144
5.1.3	Relationship between Climate Change and Weather	144
5.1.4	The Greenhouse Effect.....	145
5.1.5	Temperature Changes on the Earth	146
5.1.6	Precipitation Changes on Earth	146
5.1.7	Changes in Extreme Events.....	147

5.1.8	Sea Level Rising.....	147
5.1.9	Tackling Climate Change.....	148
5.2	Impacts of Climate Change on Agriculture	153
5.2.1	Tropical Regions	153
5.2.2	Temperate Regions.....	158
5.2.3	Tackling Climate Change in Agriculture	160
5.3	Climate Neutral.....	162
5.3.1	Reasons for Climate Neutral	162
5.4	Advises for Major Crops under Climate Change and Variability Scenarios under Asian Conditions.....	164
5.4.1	Rice (<i>Oryza Sativa</i>)	164
5.4.2	Maize (<i>Zea mays</i>).....	165
5.4.3	Jowar (<i>Sorghum vulgare</i>).....	166
5.4.4	Bajra (<i>Pennisetum typhoides</i>).....	166
5.4.5	Ragi (<i>Elusine Corocana</i>).....	167
5.4.6	Korra (<i>Setaria italica</i>)	167
5.4.7	Redgram (<i>Cajarus cajan</i>)	167
5.4.8	Blackgram (<i>Vigna mungo</i>).....	168
5.4.9	Greengram (<i>Vigna radiata</i>).....	168
5.4.10	Bengalgram (<i>Cicer arietinum</i>).....	169
5.4.11	Soybean (<i>Glycine max</i>)	169
5.4.12	Groundnut (<i>Arachis hypogaea</i>)	169
5.4.13	Castor (<i>Recinus cammunis</i>).....	170
5.4.14	Sesamum (<i>Sesamum indicum</i>)	170
5.4.15	Sunflower (<i>Helianthus annus</i>)	170
5.4.16	Cotton (<i>Gossypium</i> sps.)	171
5.4.17	Mesta (<i>Corchorus</i> sps).....	171
5.4.18	Sugarcane (<i>Saccharum officianarum</i>)	172
5.4.19	Chillies (<i>Capsicum fruitisense</i>)	173

Chapter 6 : Weather Health – Crops – Farmers

6.1	Weather Health	174
6.1.1	Murthy’s “Weather Health” Concept	174
6.1.2	Murthy’s “Daily Weather and Agriculture” Concept	175
6.1.3	Murthy’s Comparison Concept	176
6.1.4	Growing Degree Days	176
6.1.5	The Canonical form for Calculating GDD is.....	176

(xviii) Contents

6.2 Crops.....	178
6.2.1 Rice (<i>Oryza sativa</i> (L.)).....	178
6.2.2 Groundnut (<i>Arachis hypogaea</i> L.).....	208
6.2.3 Sugarcane (<i>Saccharum officinarum</i> (L.)).....	213
6.3 Farmers.....	215
6.3.1 Roving Seminars on Weather, Climate and Farmers – Special Reference to Rice Crop.....	215
References	229
Index	237