المالان المالا



Author No. _ wh

Acc. No. 3862

Estd. Library 1973

WATER, SOIL AND THE PLANT



Some other ELBS low-priced

	other ELBS lowers	
Bell and Woodcoo	THE DIVERSITY OF GREEN PLANTS	ons
Bleasdale	PLANT PHYSIOLOGY 11. 5	Edward
Chapman a Chapman	and THE ALGAE	Arnold Macmillan
Cobley and Steele	AN INTRODUCTION TO THE	Macmillan
Cooke	BOTANY OF TROPICAL CROPS FERTILIZING FOR MAXIMUM YIELD	Longman
Cutter	PLANT ANATOMY	Granda Technical
Fogg	PART 1. Cells and Tissues PHOTOSYNTHESIS	Edward Arnold Hodder &
Hall	PLANT STRUCTURE, FUNCTION AND ADAPTATION	Stoughton Macmillan
Ingold	BIOLOGY OF FUNGI	Hutchinson
Kershaw	QUANTITATIVE AND DYNAMIC PLANT ECOLOGY	$Educational \ Edward \ Arnold$
Marshall and Williams	PLANT ECOLOGY TEXTBOOK OF ZOOLOGY: INVERTEBRATES	Macmillan
Parker and Haswell	TEXTBOOK OF ZOOLOGY: VERTEBRATES	Macmillan
Purseglove	TROPICAL CROPS — DICOTYLEDONS	Longman
Purseglove	TROPICAL CROPS – MONOCOTYLEDONS	Longman
Russell	SOIL CONDITIONS AND PLANT GROWTH	Longman
Street and Opik	THE PHYSIOLOGY OF FLOWERING PLANTS	Edward Arnold
*** *	AGRICULTURE IN THE TROPICS	Longman
1171	An Introduction to Plant Diseases	John Wiley (U.K.)

All the rivers run into the sea, yet the sea is not full; unto the place whence the rivers come thither they return again.

Ecclesiastes 1:7



CONTENTS

Preface	facing page iii
Introduction	xi
	×iii
1 THE WATER BALANCE Annual rainfall distribution Precipitation rate Evaporation	2 1 1 8
Dew	8
Drainage	8
The water balance	9
Water need maps	ģ
Measuring the water balance	11
2 WATER SUPPLIES FOR HORTICULTURE'	23
Sources of water; pumping machinery	24
Abstraction points	24
Cross-stream dams and off-stream pounds	25
Artificial lakes and reservoirs	26
Wells and boreholes	26
Public water supplies	26
Land drains	27
Underground recharge	28 29
Estuarine barrages	29
The sea as a possible source of irrigation water	30
Water quality	31
Dissolved salts Accumulation of salts in the surface soil	31
	32
Assessing water supplies Regulating water abstraction	34
	35
THE SOIL RESERVOIR	35
Soil series	35
Soil texture	35
Soil horizons	36
Drainage	37
Pore space	37
Soil water potentials	38
Matric potential, or suction	

viii	
Osmotic potential, or suction	
nF	3.
Soil moisture characteristic	38 39 40
The upper limit of available water (field capacity)	40
The upper mines	
Available water capacity	42
Apparent specific gravity, or bulk density	43
The influence of structure on available water capacity	41 42 43 48 49
The energy concept of soil water	49
Measurement of soil moisture parameters	50
4 MOVEMENT OF WATER IN SOIL	
Erosion	61
Capping	61 62
Water movement in saturated soil	64
The wetted front	65
The water table	65
Impeded drainage	66
Water movement in unsaturated soil	66
Evaporation from soil	67
Measurement of soil water movement	67
5 THE HYDROLOGICAL STRUCTURE OF VASCULAR PLANTS	71
The water-conducting vessels	71
Roots	71
The root system	72
Stems and foliage	73
Stomata	74
The 'plumbing' system	74 74
General conformation	76
Organs which produce mechanical movement	76
Measurement of stomatal aperture Measurement of stem flow	78
6 ENTRY OF WATER INTO THE PLANT	81
Entry of water into the root	81
Root pressure	82
Supply of water to the root	83 84
Growth of roots towards water	84
The exploitation of soil available water Temporary wilting	88
Measurement of entry of water in a st	88
Measurement of entry of water into the plant Demonstration and measurement of root pressure	89
7 WATER WITHIN THE PLANT	
Transpiration rates	91 91
The water status of plant tiesus	91

The lower limit of available water (permanent wilting page (field capacity) Available water capacity Apparent specific gravity, or bulk density Apparent specific Apparent Specific Spe The energy concept of soil water Measurement of soil moisture parameters

4 MOVEMENT OF WATER IN SOIL

Erosion

Capping

Water movement in saturated soil

The wetted front

The water table

Impeded drainage

Water movement in unsaturated soil

Evaporation from soil

Measurement of soil water movement

5 THE HYDROLOGICAL STRUCTURE OF VASCULAR PLANTS

The water-conducting vessels

Roots

The root system

Stems and foliage

Stomata

The 'plumbing' system

General conformation

Organs which produce mechanical movement

Measurement of stomatal aperture

Measurement of stem flow

6 ENTRY OF WATER INTO THE PLANT

Entry of water into the root

Root pressure

Supply of water to the root

Growth of roots towards water

The exploitation of soil available water

Temporary wilting

Measurement of entry of water into the plant

Demonstration and measurement of root pressure

WATER WITHIN THE PLANT

	Water stress	ix
	Results of reduction in plant water potential	93
	Effects on stomata	94
	Gross physiological effects	94
	Effects on growth and development	95
	Transport	96
	Measurement of factors associated with movement of	96
	water within the plant	97
	MOVEMENT OF WATER OUT OF THE PLANT-SOIL	
8	SYSTEM	101
	Boundary layer	101
	Empirical determinations of evaporation	101
	Estimation of evaporation from physical measurements	102
	Potential and actual transpiration	104
	Root constant or crop constant	105
	Incomplete crop cover	106
	Soil moisture deficit	106
	Depletion of available water	106
	The significance of transpiration	107
	Measurement of transpiration	109
	Measurement and estimation of soil moisture deficit	109
0	HORTICULTURAL IMPLICATIONS	113
7	Effects of water stress on crop plants	113
	Limited irrigation	116
	Water stress and produce quality	116
	Water stress and growth	118
	Development of water stress	119
	Manipulating available water capacity	119
		121
	Water tables	121
	Soil water conservation	122
	Evaporation reduction in practice	122
	Exploitation of soil reservoir	124 127
	Glasshouse crop irrigation	128
	Outdoor irrigation	
	Water, soil and the plant	129
Ag	ppendix The Penman formula	133
8	bliography	137

bridge x