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WESTERN AUSTRALIA.

The Handbook
of
Horticulture and Viticulture
of
Western Australia

By A. DESPEISSIS, M.R.A.C.

THIRD EDITION

PERTH.

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FOREWORD TO THE RE-PUBLICATION OF THE THIRD EDITION 2007.

The reprinting of this handbook was undertaken by me in the first place simply because my copy, (a 1921 edition) had literally fallen apart. I have often referred to Despeissis' Handbook during the establishment of my organic vineyard in the Swan Valley and having realised that this wonderful tome is for its appreciators more than merely a handbook as described by its title, I decided to re-publish it.

This book is principally an historical document which discusses the concerns and problems facing new horticultural and viticultural producers in WA in the 1920's. Written under the auspices of the West Australian Department of Agriculture, Adrien d'Espeissis (anglicised to Adrian Despeissis) wrote with not only great practical intent but also empathy and commitment to the endeavours of the collective populace of his adopted home; the state of Western Australia.

Adrien d'Espeissis was born in Mauritius in 1860. He became a professional agriculturalist, having graduated with honours M.R.A.C.- Member of the Royal Agricultural College, at Cirencester, Gloucestershire, England. He also qualified as a Member of the Royal Agricultural Society of England. In 1889 he studied fermentation and distillation at the National Agronomic Institute in Paris and completed a course in microbiology and fermentation at the Pasteur Institute. He toured the famous wine producing areas of France, particularly the Medoc, and basing himself in Bordeaux, made an intensive study of the varieties and methods used there, as being comparable to many parts of Australia.

It was good luck on the part of the Western Australian wine industry rather than planning on Adrien's part it seems that this young man arrived in depression-struck Australia in 1890 He was sent to Western Australia in 1894 as advisor during the formation of the Department of Agriculture in the fledgling colony, having worked in the NSW Department of Agriculture for 4 years.

During his first year in Western Australia Adrien d'Espeissis travelled widely throughout the state giving lectures and demonstrations of fruit tree and vine pruning as well as assessing the potential for further development. He prepared and delivered a series of lectures on Agriculture and expanded these into a "Handbook of Horticulture and Viticulture of Western Australia" which was printed that same year. A second edition was released in 1902 and some years later the need for

agricultural instruction, revived by the settling of returned soldiers and the Group Settlement Scheme prompted the W.A. government to commission Adrien to prepare an expanded and revised third edition. This was published in 1921. Adrien remained with the department of Agriculture for 17 years, writing extensively in scientific journals on many varied aspects of agriculture.

Upon retirement from the Department, Adrien turned to the development of the Santa Rosa vineyard, winery and cellars he had jointly established in Caversham in 1895 (originally named Carlisle, then Santa Rosa Wine & Distilleries Ltd. and later, Valencia). Jack Mann, who was born on the Santa Rosa Vineyard went on to win many top awards and establish a reputation as an outstanding winemaker and industry leader, once said in a speech to the Perth Wine and Food Club, that, in his opinion, Adrien d'Espeissis was the father of the wine industry in Western Australia.

It becomes immediately evident that this encyclopaedic missive is a product of its time in history when for example one considers the sections in which widespread land clearing is advocated, despite there already being signs of soil salinity in some regions. The handbook was produced however under great pressure of the need for practical information and advice for new farmers.

Adrien d'Espeissis died at Wyndham in 1926. His legacy to the West Australian wine industry is incalculable and many of the methods that he describes in this handbook are still used today. This reprint is a direct copy of the Despeissis third edition of the handbook apart from several adaptations and corrections of errata.

Thanks to Adrien's grand-children John and Jeanne who provided valuable material for this reprint.

Duncan Harris
Baskerville WA 2007

PREFACE TO THE THIRD EDITION.

The increasing demand for the "Handbook of Horticulture and Viticulture of Western Australia," and the fresh stimulus given to land settlement under the scheme of the Repatriation of Returned Soldiers, have made it desirable for the Department of Agriculture to bring out a new edition.

The subject matter dealt with in the first two editions has in the third been carefully revised, and much additional information included.

In collating the mass of information which will be found grouped within the several chapters of this Handbook I have, as far as possible, acknowledged the sources whence that information was derived; and the value of those sources, together with the personal experience I have been able to gain in questions dealt with in the following pages, will, I hope, be of some benefit to those who may consult this book.

A. DESPEISSIS, M.R.A.C.

Department of Agriculture,
Perth, W.A., 10th February, 1921.

Bartletto. Hay Street, Perth, W. A.

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THE HANDBOOK

OF

HORTICULTURE AND VITICULTURE

OF

WESTERN AUSTRALIA.

BY A. DESPEISSIS, M.R.A.C.

THE awakening of Western Australia as a fruit-producing State dates only from the beginning of the gold rush a couple of decades ago. It is concurrent with the development of the wonderful gold belt which has since been proved to run through it, from the Great Australian Bight, in the South, to Cambridge Gulf and the tropical Kimberleys, in the North.

Previous to that epoch, sufficient had been achieved by the older colonists to show that Western Australia could produce grapes and fruit of great excellence, but, the gardens of the State were few in number and far apart. Yet, fruit was then more easily procurable than it has since been, and the requirements of the 50,000 odd consumers were liberally satisfied; indeed, fruit was then so cheap that no market value was attached to it. It was mostly consumed on the spot, and the surplus rotted under the trees, and was not worth carting away. In those days consumers were producers themselves; long distances and lack of rapid communication militated against the marketing of fruit, and methods of picking and packing for distant markets were not familiar to fruit-growers, nor had they any experience regarding those varieties which, better than others, lend themselves to long keeping and travelling.

With the discovery of gold came the rush of gold-seekers. The constant stream of population which then set in soon taxed the resources of the farming districts; supplies of all sorts were soon exhausted, and all the commodities of life had to be largely imported. The ever-increasing flow of population continued its course to the inland goldfields.

Every new-comer proved a consumer. Even the settlers deserted their farms and rushed to the arid interior in quest of gold. Famine prices were offered and given for all products of the soil. Then a new current set in, and whilst the main stream of population continued to pour into the Coolgardie and the Murchison gold fields, a smaller stream spread over the moister coastal districts. Gold was to be won from the ploughed fields as well as from the quartz reefs.

A great many may claim to have first discovered that Western Australia was teeming with gold, but the pride of having discovered that the State was teeming with latent horticultural and agricultural wealth must belong to the proprietors of the *West Australian* newspaper. At their instigation, the late Mr. L. Lindley Cowen set out on a voyage of discovery through the agricultural districts of what is known as the South West Division of Western Australia—a province covering an area of country 350 miles from North to South by 100 to 200 miles from West to East. From every point of that territory which he visited Mr. Cowen, in a series of articles which at the time attracted attention, as well as enlightened the settlers, old and new, described the achievements of the pioneer agriculturists of the country, and prognosticated the era of wonderful development which every branch of agriculture has since entered upon.

That Western Australia bids fair to eclipse the other States of the group as a fruit-producing territory is firmly believed by all who have paid any attention to the circumstances which favour or retard fruit-growing as an industry. Its soil is virgin, and for ages without number has supported gum trees and shrubs of various sorts without a rest, and been fouled by their residues, until at last it welcomes fruit trees, with the same eagerness as does a corn sick field some other crop in the course of the rotation.

Its climate is consistent and not capricious. When going beyond well defined and moist zones, for the purpose of starting fruit-growing, the settler has himself to blame for courting failure melons he can counteract the unreliable rainfall by artificial irrigation. Anyhow, his crops are not periodically threatened of destruction by hail-storms, such as are at times experienced in other parts of Australia.

Untrammelled by errors which, in the Eastern States, have defeated the aims of the earlier fruit growers, and proved a source of loss to them, Western Australian growers start with the experience of others, and are reaping the fruit of the knowledge dearly bought. Thus they are able with comparatively few faults to start a clear course on embarking into fruit-growing on commercial lines.

This State besides possesses amongst all Australian States the incalculable advantage of being from 1,200 to 2,000 miles nearer the European markets; or, in other words, its perishable fruit crops, because

of its geographical position, are produced from four to eight days nearer the consumer's table.

Another advantage of no mean importance is that the population of Western Australia—very small until the discovery of gold—has since been increasing steadily and rapidly, as the mineral and agricultural resources of the country are being developed. Such indeed are the demands of the local market that a ready sale, at a profitable price, in obtained for all fruit of good quality; and, whilst preparing for extensive fruit export, the grower is enabled to dispose locally at highly remunerative prices of small parcels of fruit he may gather from his young trees.

WEST AUSTRALIAN FRUIT LAND.

From Cambridge Gulf, in the tropical North, to the Great Australian Bight, in the temperate Southern regions, Western Australian unfolds a coast line of over 1,200 miles capable of growing, according to latitude or elevation, some sort of fruit or other.

Under the regulating influence of the monsoons, the rainy season follows the dry one with almost clockwork precision; and thus, within the coastal zone, the grower knows what to expect, nor is he confronted either by a sweeping deluge or a prolonged drought from one season to the other.

Farther inland great waterless tracts of fertile land occur, which, with the spread of settlement, disclose favoured spots without number where artificial irrigation is rendered possible, and where fruit-growing offers great possibilities.

In this handbook no reference will be made to that part of Western Australia extending from the Kimberley districts on the North to the latitude of the Murchison River 28 deg. S.

Few settlers, hitherto, in that vast stretch of country, until recently given almost entirely over to pastoralists, have paid systematic attention to horticulture. The cause is easy to discover. Few, if any one, of those who in the past have lived at the Nor'-West and the North of this State have had any idea of permanently settling down. Whilst there their whole attention has been engaged in more or less nomadic occupations; the small cultivated patch has proved sufficient to supply the requirements of the homestead, and no inducement had until now offered to plant largely, owing to the lack of frequent and quick means of communication with the markets of the South. Sufficient is, however, known to state that at several places where facilities offer for irrigation, or where the soil is naturally moist, the cultivation of tropical plants and fruit trees has been attended with such success as points to great possibilities in that direction.

One of the most successful undertakings of that nature is that of the Trappists' Mission at Beagle Bay, about 21 deg. lat. S., where some 10

acres have been planted, chiefly with bananas, mangoes, guava, figs, tamarind, date palm, coconut trees, oranges, and lemons, which all thrive well.

In a report on the capabilities of the East Kimberley district, Mr. R. Helms, then biologist of the Bureau of Agriculture, said:—

"The greatest prosperity of the country will begin when the cultivation of specially tropical products is taken up in earnest. It will then be that the country becomes populated, for a couple of hundred acres, well tilled and planted with suitable crops, enables a man to acquire an independency. The country possesses not only the rare advantage of being perfectly healthy, but the land best suited for the growth of tropical products is free from timber. It therefore, requires no coloured labour to produce cotton, sugar, cocoa, tobacco, rubber, or fibre, and other profitable articles of commerce. Europeans can do the work, and no great capital is required to prepare the land, the grubbing of trees in a tropical forest being always a great expense. Moreover, irrigation can be carried out at a minimum of expense. In a number of places it will be found that water can be conserved in such a way as to enable large areas to be watered by gravitation; but where that method is impracticable, windmills may effectively be employed, as a steady breeze generally blows throughout the day."

My own observations made in the course of official explorations to ascertain the agricultural capabilities of the Nor'-West and of the tropical Kimberleys lead me, with some reservations, to support these views, and whenever population is attracted to these little known provinces of Australia important settlement may be looked forward to in favourable places where easy transport and communication are provided.

The section of Western Australia that will be more particularly considered in this handbook is that comprised between the Murchison River, 50 miles North of Champion Bay, lat. 28deg. S., to King George's Sound, lat. 35deg S., and an imaginary line enclosing a somewhat triangular-shaped territory, about 50 miles broad at the Murchison end to 300 miles at its base, from the Leeuwin to Esperance.

Such area is shown on the maps issued by the Lands Department of Western Australia as the South West Division.

That a great extent of this country is admirably suited for vine and fruit-growing is abundantly demonstrated by the success which has accompanied the enterprise of settlers in the various districts of the State.

The variety of climatic conditions and soil make it possible to grow in this division of Western Australia almost any fruit of the cool temperate as well as semi tropical climates.

A better understanding of the requirements which underlie the pursuit of modern fruit-growing—one of the most interesting and profitable branches of agronomy—brings out several features in the West Australian

climate which point to the particular suitability of this country for fruit-growing.

For the purpose of illustrating this statement, no more convincing means offer than comparing the climate of the South West Division of this state with the climate of some of the most noted fruit districts in the world, and especially California, in—1st, temperature; 2nd, light; 3rd, air humidity; which are all climatic conditions, absolutely necessary to fruit ripening. According as these three conditions are met with in a more or less suitable degree the fruits ripen with greater or less perfection.

TEMPERATURE

When compared with the chief growing districts of California, the West Australian climate shows to advantage, its chief characteristics being—1st, freedom from extremes of low and high temperature; 2nd, an abundance of sunshine; 3rd, summer atmosphere, with a low percentage of humidity.

The following table, which gives the *lowest* thermometric readings, during a period of five years, at six places which can well serve as land marks in dealing with the fruit-growing districts of this state, compares favourably with some Californian stations where fruits of the citrus tribe, for instance, are known to attain to great perfection:—

	Deg. Fahr.		Deg. Fahr.
Geraldton	38	San Francisco	28
Perth	32	San Jose'	22
Bunbury	35	Los Angeles	28
Albany	32	San Diego	32
York	29	Sacramento	19
Katanning	27	Fresno	18

If, on the one hand, temperature must not be too low for the profitable cultivation of trees such as those belonging to the citrus tribe, which retain their foliage all the year round, it must not, on the other, rise to too high a degree in the summer months without exposing the trees to sun scald.

Careful experiments made tend to demonstrate the fact that "a temperature above a certain minimum of heat is found necessary for germination, another for chemical modification, and a third for flowering, a fourth for the ripening of seeds, a fifth for the elaboration of the saccharine juices, and a sixth for the development of aroma or bouquet."

The same botanist who laid down the above rule (Boussingault) determined that, in the case of the grape vine, while a mean of 59 deg. Fahr. during the growing months will allow the plant to flourish, a much higher mean temperature is necessary during the summer and autumn months from the time the seeds are formed until full maturity to bring the

fruit to perfection, and there must be a month the mean temperature of which should not fall below 66.2 deg. Fahr.

The following table gives the *average summer* temperature during the growing months at various Western Australian and Californian points:—

	Deg. Fahr.		Deg. Fahr.
Geraldton	75.5	San Francisco	59.4
Perth	72.9	San Jose	56.2
Bunbury	70.5	Los Angeles	69.7
Albany	67.3	San Diego	68.4
York	77.2	Sacramento	71.4
Katanning	72.1	Fresno	84.1

These tables show that, compared with other most noted Californian fruit-growing centres, the South Western Division of Western Australia is possessed of a summer climate warm enough for the growth of any of the fruits of temperate zones; while the winter never severe enough to frost kill these fruits, is, however, sufficiently cold to insure for them the three or four months of rest they need.

With the exception of Albany and similarly situated localities, abundant warmth occurs for the ripening of all kinds of grape vines, of all temperate climate fruit, a most exacting one as regards warmth. Even in Albany, the early grapes do ripen, unless exposed to the chilling Southern breeze; while only a few miles inland the later growing grapes as well reach maturity. Elsewhere, such as in the northern portion of the Eastern division on the eastern side of the Darling Ranges, the great excess of summer temperature over that absolutely required for the proper maturing of the grapes results in higher sugar formation in the juice. When to this higher summer temperature is associated a longer growing season, we find combined the elements conducive to the production of a second crop.

LIGHT.

Light also plays an important part in the prefect maturation of fruit, and an abundance of it, in conjunction with a congenial degree of atmosphere, results in better flavoured fruit, and in the better development of the colour, bouquet, and aroma.

Reference to the information supplied in the meteorological reports of the State, for a series of years, testifies abundantly to the fine and bright state of the atmosphere during the summer and autumn months at the stations mentioned above. On the faith of the same reports, we find that Albany is the locality with the smallest number of cloudless days during those growing months; while Bunbury, which comes next as regards a low mean summer temperature, as given in the above tables, is reported to have during the growing months an almost continuous succession of bright, cloudless days, which are conducive to sugar production. Thus it is seen that, although the temperature in the district around Bunbury is fairly cool in the summer months, yet the great pureness of the atmosphere is

favourable to the perfect maturation of grapes as the plant profits during those months by its full share of the chemical effect of the direct rays of the sun.

Viewed in the light of practical fruit-growing, abundance of cloudless days in connection with high and protracted heat, results in high sugar production, which is of great advantage in the production of raisin and prunes, and also in the successful ripening of a second crop of grapes in a season.

It is thus shown why wine for instance, made from grapes produced from cuttings of the same varieties, and perhaps obtained from the same parent vines, but grown in a hot and clear district, in the one instance, to another wine from similar variety of grapes grown in a cooler locality processed of an atmosphere not so bright and clear, will present to the palate and to laboratory tests quite different characteristics. If, for instance, we take Malbec or Cabernet, as an example, they will produce a rounder and stronger wine in the first district, and a wine of a lighter character and more of the claret type in the cooler localities; for, in the process of winemaking, sugar means alcoholic strength.

In order to continue the parallel between Western Australian and Californian climates, and also the climate of other States of America, the following table is given to compare the relative degree of sunshine at various places mentioned below.

In this table cloudiness is rated from 0 to 10; two observations are taken daily at 9 a.m. and 3 p.m.

Geraldton	2.7	Sacramento, Cal.	2.0
Lawlore	3.1	San Francisco, Cal.	4.0
Kalgoorlie	3.4	Fresno, Cal.	2.1
York	3.0	San Diego, Cal.	4.2
Perth	4.4	New York, N. Y.	5.0
Bunbury	5.5	Philadelphia, Pa.	5.0
Katanning	5.2	New Orleans, La.	4.5
Albany	5.0	Jacksonville, Fla.	4.5

VALUE OF DRY AIR.

For the purpose of fruit-growing, it can safely be stated that a moderately dry air, especially during the summer and autumn months, is in many respects more desirable than a vapour laden atmosphere.

In the first case, pests, and blights of fungus origin—moss, lichens, etc.—are not anything like so troublesome as in more humid localities.

The oidium of the vine, for instance, is much more troublesome in moist than in dry seasons; and, for the same reason, in the moist air districts close to the sea, than in districts situated further inland, where the atmosphere is drier.

For another reason is dry air of value to the fruit grower. It favours the better penetration through the atmosphere of heat and light, and their access to the plant. The effect of the chemical rays of the sun, which, although not appealing to our senses in the same measure as its thermal rays, are nevertheless essential in bringing about the perfect ripening of fruit. Now, a layer of vapour laden atmosphere floating over the earth acts as a screen, which, although pervious to the heat rays, shuts off in a great measure the chemical rays of the sun. A practical illustration of this fact has been noticed by everyone. However hot the season, fruit will ripen slowly and rot on the plant if the atmosphere is dull, moist, and muggy; whereas in a dry and bright autumn, fruit will be correspondingly luscious and richly flavoured, and will put on the brightest of those tints of colour by which each variety is differentiated from the other.

MEAN MONTHLY RELATIVE AIR HUMIDITY AUGUST TO APRIL AND MEAN ANNUAL. (SATURATION =100.)

—	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	Mean Annual (12 Mths).
Geraldton ...	74	74	72·6	70	75	73·6	67	72·6	67	71·6
York	71·6	73	66	53·3	59	54·3	53·3	63·6	54	63
Perth	73·6	69	69	63·6	63·3	61·6	62·3	60·3	61·3	66·2
Bunbury ...	75	76	73	67·6	65·3	68·3	68	71·3	72·3	73
Albany ...	77·3	77·6	77	72·6	80·3	74·3	80·6	75	75·3	76

—	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Mean Annual (12 Mths).
Los Angeles	73·1	75·2	73	75·4	76·2	72·9	74·3	66·6	73·3
Fresno ...	59·3	52·7	42·7	34·7	31·7	43·6	55·1	64·1	48·3
Sacramento	67·6	67·6	66·1	58·9	59·8	59	62·4	66·8	63·6

THE RAINFALL AND WATER SUPPLY.

The rainfall of the zone running along the sea coast of Western Australia for a distance of 80 to 100 miles from the coast is regular and reliable. More abundant in close proximity to the seashore, and also on the higher tableland of the Darling Ranges which fringes the coast line some twenty miles inland for a distance of about 300 miles, the rainfall gradually decreases the farther inland we go.

Practically, there are only two seasons, the "dry" and the "wet." Both are influenced by monsoonal action. In the Northern part the wet season sets in during the summer months, commencing in November and lasting till April. During that time smart cyclones, locally called "willy willies" and "cock eyed bobs," at times sweep over the land, causing occasionally

damage to stock and property. Those cyclones are more frequent north of Broome than south of that place, where they mostly strike the coast and do not extend their influence far inland. In the South, from the Murchison River to the Leeuwin, the wet season, on the other hand, sets in after Easter, generally May, lasts through the winter and ends in October, with a few occasional showers during the summer months. During those winter months the weather is made up alternately of heavy showers and clear intervals. Ninety per cent. of the rain falls on an average in these six or seven months. In the South Western corner the moisture laden clouds which are carried on one side over the Southern Ocean and the other over the Indian Ocean, impinge over the range of mountains which rise a few miles from the coastline, and runs parallel with it for a distance of over 300 miles, and there dissolves into heavy rain. Once blown over these ranges farther to the Eastward, these moisture laden clouds meet with no obstruction to bring about their precipitation, and thus are carried away into the vast unsettled interior, where the farther from the coast the drier is the climate.

The following table gives the average rainfall in Western Australia at points located in the several divisions of the State:—

Locality.	Height above Sea Level.	Average No. of Wet days.	Average Rainfall, in Inches.	No. of Years of Average.
East Kimberley -				
Wyndham	...	55	27	32
Hall's Creek	...	...	21	28
West Kimberley -				
Derby	...	...	27	33
Broome	...	65	24	29
North-West Division -				
Wallal	...	...	13	22
Port Hedland	...	24	13	21
Roebourne	...	20	12	32
Onslow	...	25	8·7	33
Gascoyne Division—				
Carnarvon	...	...	9·3	36
Sharks Bay	...	...	9·2	25
Hamelin Pool	...	...	7·9	33
Wooramel	...	...	8·9	20
S.W. Division—				
Abrolhos	25	50	13·4	22
Northampton	...	52	20	37
Geraldton	15	80	18·6	41
Dongara	30	70	19	26
Yandanooka	...	...	18	11
Carnamah	880	66	16	31

Average RAINFALL—continued.

Locality.	Height above Sea Level.	Average No. of Wet days.	Average Rainfall, in Inches.	No. of Years of Average.
Dandaragan	...	80	26	31
New Norcia	600	...	21	36
Moora	...	75	18·5	21
Wongan Hills	...	...	17	6
Gingin	...	...	30·5	30
Rottnest	...	94	32	10
Perth	...	110	34	43
Kalamunda	...	...	42	10
Guildford	30	91	33	39
Rockingham	...	95	33	21
Toodyay	470	...	21	39
Dowerin	...	...	15	14
Northam	491	80	16·7	38
Kununoppin	...	...	13·3	6
Tammin	730	...	14·3	7
Kellerberrin	807	68	13	26
York	580	88	17·5	42
Narrogin	1,114	...	19·5	...
Wickepin	...	...	16·7	7
Williams	...	...	21	34
Wagin	840	80	17·5	28
Katanning	1,022	90	18	27
Kojonup	...	90	22	34
Bridgetown	505	...	33·7	31
Canning Waterworks ...	...	...	41	31
Jarrahdale	128	...	45·8	36
Pinjarrah	28	...	38	40
Marradong	...	80	28	21
Wickepin	...	92	17	7
Collie	604	...	38	19
Bunbury	18	...	36	42
Busselton	...	...	31·4	38
Cape Leeuwin	...	...	37	22
Boyanup	123	...	33	23
Karridale	...	...	49	25
Cape Leeuwin	30	160	38·5	17
The Warren	...	168	41	15
Mt. Barker	...	105	29·5	31
Pallinup	...	74	14·5	...
Albany	...	170	36	42
Eastern Division—				
Lawlers	...	40	8	22
Kalgoorlie	...	40	9·7	23
Boorabbin	...	60	7·5	...
Eucla Division—				
Esperance	...	100	25·3	39
Israelite Bay	...	60	15	34
Balladonia	...	44	9·7	25
Eyre	...	65	11·2	15
Eucla	...	60	10	43

Apart from the rainfall, which is thus seen to be fairly well distributed all over the coastal zone, the country is watered by means of springs, swamps and brooks. Rivers are few, and, except in the South West corner of the State, do not run all the year round; but they all form along their course chaplets of pools, which afford a supply of water for stock or for irrigation.

Although the country as a whole, looks somewhat lacking in fresh running streams, there is underground an immense store of water which is reached by sinking wells varying in depth from 5ft. to 100ft. Many of those wells, however, more especially in the inland districts are often too highly mineralised to be of any use for the purpose of watering plants.

Soaks abound over the country, and almost invariably follow on the process of clearing land of trees prior to cultivation; wherein their presence is made manifest on the surface by the look of the green patches during the dry months, when all vegetation looks brown and languishing around; there water may be obtained by shallow excavations. Indeed in the Eastern districts, some 100 miles or more from the coast, and until wells and dams are sunk, soaks constitute the chief source of water supply.

In those drier districts, strewed over the surface of the country, occur bold, bore outcrops of cap slab granite, from 10 to 100 feet in height, covering from 10 to 60 or 80 acres. These outcrops rise from sandy and loamy flats. They seem to have been provided by Nature for the conservation of water in that arid region. After even the lightest rainfall they shed water like a house roof; in very many cases, somewhere at the foot of those denuded rocks, freshwater soaks occur in natural dams or basins filled with sand, which, when cleaned, supply for stock or for trees a valuable supply of fresh water.

Nowhere in the South West Division of Western Australia need fruit-growing be checked by dearth of water, as, apart from natural sources of supply, any amount commensurate with the requirements of the orchardist can, at a reasonable cost and with little trouble, be impounded in tanks and dams excavated by means of a plough and an earth scoop.

But, apart from the source of visible water, attempts made of late years to obtain fresh water by artesian boring have proved eminently successful. The first bore put down was in 1894, at Midland Junction, when, by means of a hand plant, an abundant supply was struck at a depth of 500 ft., and the bore now discharges through a 4 in. lining 260,000 gallons of water per day.

Since then many more bores have been put down along the coastal plateau from the Greenough Plains to the Preston River. Brackish and mineralised water has been struck in several instances, but, as a rule, pure, fresh artesian water, suitable for all domestic purpose and for irrigation, is

struck at depths varying from 230 to 1000 feet. Around Guildford alone, four or five bores have been successfully sunk, the details of which are thus given in the Western Australian Year Book, published by the Registrar General:—

"The *Woodbridge Estate* bore, completed in 1896, depth 236ft cost £418; discharges at the surface 150,000 gallons per day. The *Bebo Moro* bore, 1896, put down to a depth of 308ft., cost £286; yield, 86,000 gallons per day. The *Waterhall Estate* bore cost £474, depth 691ft., with a daily supply of 194,000 gallons. The *Lockeridge* bore, at a depth of 798ft daily supply 123,000. *Guildford Municipal* bore, 1,202 ft., supply 1,000,000 gallons per diem. These figures are given to show that, almost anywhere on the plains stretching between the hills and the sea artesian water can be struck at a moderate cost, wherein the height of the surface of the ground does not exceed 30ft. to 40ft. above the sea-level."

In many cases, however, especially in those districts with a scanty rainfall, more highly mineralised soil and indifferent drainage facilities, the advisableness of using artesian water or any water at all for the purpose of irrigation is one which should receive careful consideration, as it is well known that under such conditions irrigation almost invariably raises the salt line to an extent which may prove injurious to fruit-trees.

SELECT VARIETIES OF FRUIT ACCORDING TO CLIMATE.

In broad lines, the temperature and the rainfall of various regions of the State have been rapidly mapped out. In both respects they are shown to be favourable to the successful cultivation of fruit-trees, from tropical as well as from temperate climates. The physical or the chemical characteristics of soils can be altered, but the main features of climates are always the same, and cannot be disregarded in the selection of crops. Thus, soil supplying the requirements of the grape vine may be met within Scotland, as well as in the most renowned districts of the south of Europe; yet malt liquors and whisky contribute to the wealth of the Scotch farmers, and brandy and wines that of the vine-growers of the sunny south.

But apart from the influence of latitude, altitude and aspect also tend to modify climate. Snow is met with under the equator on mountains of high altitude. According to the explorer Humbolt, the thermometer falls one degree for every 340ft. of elevation, and under the influence of this law the climate is cooler, and consequently fruits ripen later on the hills than they do in the low land. An instance of this is afforded along the trunk railway line running from the sea over the hills to the eastward. There we see that under the influence of otherwise similar climatic conditions the maturation of fruit crops and grapes is retarded by two or

three weeks on the Darling Range, at Mundaring or Chidlow's Well, at an altitude of about 1,400ft. above the valley of the Swan.

If we proceed another 100 miles seaward, we notice that this period of maturation of fruit is entirely reversed under the influence of intervening causes.

At Tammin and Kellerberrin for instance, with an altitude of 200ft. only less than at Mundaring or Chidlow's Well, and some 750ft. above the Swan, grapes and fruits come to maturity a week or two earlier than they do on the coast. There the retarding influence of altitude is counterbalanced by the more active light, the lesser degree of air humidity and probably by the greater degree of heat absorbed by the soil.

Due consideration to local climatic conditions should, therefore, influence fruit-growers in the selection of what to plant, with the idea of avoiding a glutted market. Thus the settlers at a greater altitude within the influence of the coastal climate should cater for the later market, whereas those located further inland in the brighter but drier regions will, with earlier varieties, have a good hold of the early market. But here, again, other points have to be considered, and good carrying capabilities must not entirely be overlooked when seeking for earliness in ripening.

Aspect will also modify the climate to some extent. Many tender plants will thrive in sheltered spots which would succumb to exposure to the rigours of the climate only a short distance away. Low lying damp hollows subject to late ground frosts often prove fatal to potatoes or to those vines which break into leaf early in the season, although these would have been quite safe on a warmer slope only a stone's throw distant. Then again an eastern aspect, other things being equal, will generally hasten the ripening of fruit by several days. Clay bands or ridges of rocks running across a field will, by throwing up the water, often modify the climatic conditions either for good or evil within a row or two.

Exposure to winds, the colour and the texture of the soil, or in other words, its power of absorbing and of retaining heat and moisture are all factors which to some extent modify a local climate.

OUR SOILS.

Great stress has been laid on the merits of the climate of the several districts of Western Australia capable of producing fruit, but, before pronouncing on the suitability of any given area, either for agricultural purposes, or more especially fruit-growing a branch of agriculture which is being more particularly discussed in these pages the fact that the soil is in some measure suitable for the purpose one has in view, must be ascertained.

In the pursuit of fruit-growing, soil must give precedence to climate in as much as the first can, by means of judicious manuring and