



Department of
Primary Industries and
Regional Development

Journal of the Department of Agriculture, Western Australia, Series 3

Volume 5
Number 6 *November-December, 1956*

Article 3

11-1956

Agriculture in Southern Africa - Part 1—Mauritius and South Africa (including Basutoland)

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AGRICULTURE IN SOUTHERN AFRICA

Part 1—Mauritius and South Africa (including Basutoland)

By G. H. BURVILL, M.Ag.Sc., Commissioner of Soil Conservation (now Chief Plant Research Officer), Department of Agriculture, Western Australia.



Fig. 1.—New £A400,000 building for Faculty of Agriculture, University of Natal, Pietermaritzburg.

THE Fifth International Congress of Soil Science was held in Belgian Congo in August, 1954, because the International Society of Soil Science felt it was important for greater attention to be devoted to the problems of soils and agriculture in the tropics. The author, with three other Australian soil scientists, represented Australia at the Congress. While in Africa the opportunity was taken to spend several weeks in South Africa, and the Rhodesias, seeing various phases of agriculture, and particularly noting the methods used for soil conservation and extension (advisory services). Funds for this trip were made available from Commonwealth Extension Services Grant.

MAURITIUS

The trip to and from Africa was made by air via Cocos Island and Mauritius. Department of Agriculture officers were met at Mauritius, and during the 18-hour stop, they provided a most interesting glimpse of the island's agriculture. Mauritius was formerly a French possession but has been a British Colony since early in the last century. Schooling is still given in French, with English as a second language. The coinage is in rupees and cents. This island is about the latitude of Port Hedland and Townsville. Basalt mountains rise to 5,000 feet, and the extreme dimensions are 49 miles by 39 miles. Yet it supports half a million people and produces half a million tons of sugar per year. (South Africa now produces three quarters of a million tons and Australia one and a half million tons.) Many of the sugar fields have numerous neat mounds and lines of stones gathered together to allow planting and cultivation of sugar between them.

The rainfall varies from 40 inches to 150 inches per year, falling mainly in summer. The soils are of medium to heavy texture

and mainly formed from the basalt. They are mostly dark brown or chocolate, but red soils occur in lower rainfall parts. Near the coast are some sandy fringes and beaches associated with the coral ring round the island. Tea, tobacco and hemp (from "aloe" *Fucraea gigantea*) are important crops, as well as sugar, but agricultural officers have been concerned about a decline in production of food crops, and the dominance of sugar in the island's economy. They would like to see more rotation of food crops with sugar, and enquired about Australian wheat varieties.

Interesting information was obtained about *Paspalum vaginatum*, a salt-tolerant grass which is proving of value in wet salt-affected areas in Western Australia. This grass grows in brackish swamps and marshes in Mauritius, and it is hoped to obtain seed from this source. The grass at present growing in Western Australia flowers freely in summer, but fails to produce seed.* It must, therefore, be planted from roots and runners. This grass is

*Early in 1955 a few viable seeds were collected, but in general it may be regarded as non-seeding.

called "salt water couch" in Mauritius and in America is called "sea shore Paspalum." The latter name is to be preferred in Western Australia, as the name "salt water couch" is commonly applied to *Sporobolus virginicus*. The *Paspalum vaginatum* in Western Australia is believed to have come originally from South Africa, but no officer was met who was familiar with it in that country.

SOUTH AFRICA (INCLUDING BASUTOLAND)

General Information.

Going to, and returning from Belgian Congo, a total of nearly five weeks was spent in South Africa. The Director of Soil Conservation and Extension (Dr. P. D. Henning) organised a most comprehensive programme, including a day in Basutoland with officers of the British Colonial Service, who administer that native territory.

The Union of South Africa includes the four provinces, Cape of Good Hope, Natal, Transvaal and Orange Free State. Together they cover 472,000 square miles, or somewhat less than half the total area of Western Australia. (See map Plate 1.) From Cape Town to the Limpopo River on the northern boundary of Transvaal is about 1,000 miles; from Durban north-west to Mafeking is 500 miles. Under the Treaty of Versailles, the Union also administers South West Africa, a large area of dry country on the west extending 700 miles north of the Orange River.

The south-western part of Cape Province has a close similarity of coastal shape and latitude to the south-western part of Western Australia. It has likewise, a winter rainfall. The remainder of the Union is more comparable in coastline and latitude and rainfall with New South Wales and Queensland from Sydney to Rockhampton. But while high mountains and plateaux are restricted in Australia, they make up most of South Africa, where only a narrow coastal fringe has elevations less than 1,000 feet. The bulk of the farming and grazing land is 3,000-6,000 feet above sea level. The Drakensberg, on the borders of Natal and Basutoland, reach 11,000 feet. The inland winter climate is much colder than in Australia,



Fig. 2.—Erosion gully about 30 feet deep in overgrazed land. Senekal-Marquard area, Orange Free State.

and the mountain snows feed many rivers which can be used to irrigate dry areas. The rainfall varies from 4 inches in some of the desert areas to 70 inches in the mountains; a large area receives 20 to 60 inches, but most of the Cape Province gets less than 20 inches.

Wool is Second only to Gold.

South Africa is the world's greatest gold producer, and uranium is now also recovered along with gold. Gold exports are valued at £A200,000,000*, with wool at £A75,000,000 the next largest export item. The gross value of agricultural production, including animal products, in 1951-52, was about £A300,000,000.

Table 1 gives a general comparison of South African and Australian agriculture. Maize (called mealies in Africa), tobacco, groundnuts (peanuts) and citrus fruits are relatively much more important than in Australia. Wheat production is, however, relatively small at about 19 million bushels. Grape production in South Africa goes mainly into wine rather than dried fruits.

Though the Union has only 3 million white people, the total population is 13 millions. Most of the foodstuffs produced are consumed in the Union, so that apart from wool and skins and hides, agricultural exports are relatively small. Fresh, preserved, and canned fruit and vegetables, wines, tobacco, tannin extract, peanut oil and dairy produce are the most notable.

*Western Australia £A12,000,000.

Table 1.

COMPARISON OF AGRICULTURAL STATISTICS FOR SOUTH AFRICA, AUSTRALIA AND WESTERN AUSTRALIA, 1952-53.

Compiled from various sources in consultation with R. J. Little, Government Statistician, Western Australia.

Product.	Units.	South Africa.	Australia.	Western Australia.
Sheep	No.	36 million	123 million	12 million
Wool (total production)	Lb.	273 million	1,281 million	128 million
Cattle (beef and dairy)	No.	12 million	15 million	0.85 million
Butter	Lb.	74 million	375 million	15 million
Cheese	Lb.	23 million	104 million	2 million
Wheat	Bushels	19 million	195 million	35 million
Maize	Bushels	117 million	5 million	Very small
Sugar	Long tons	639 thousand	949 thousand	None
Groundnuts (peanuts)	Long tons	106 thousand	9 thousand	Very small
Tobacco	Lb.	44 million	6.5 million	1 million
Grapes (all purposes)	Long tons	480 thousand	560 thousand	17 thousand
Raisins and Currants	Long tons	10 thousand	98 thousand	3 thousand
Wine	Gallons	63 million	30 million	731 thousand
Citrus Fruits	Long tons	236 thousand	129 thousand	11 thousand
Apples and Pears	Long tons	68 thousand	246 thousand	33 thousand
Pineapples	Long tons	70 thousand	45 thousand	Very small
Canned Fruit	Long tons	47 thousand	96 thousand	Very small

Importance of a Sound Agriculture is Recognised.

Food is basic to human existence and few countries like to be too dependent on imported foodstuffs. South Africa—and the Rhodesias—recognise that food imports to them involve long ocean crossings, and ability to feed their people from home production is a vital objective.

Great concern has been felt in South Africa, about soil erosion and about the drying up of natural waters. Ten to 20 years ago it was recognised that much valuable soil was being lost under the farming and grazing practices being followed by black and white people. Water supplies from springs and streams were badly reduced in many places, apparently as a consequence of this faulty land management. Some investigators believe that the drying up of South Africa was partly due to a relatively dry cycle of years from 1905 to about 1940*. Tree plantings to offset South Africa's great deficiency of timber, have also been blamed.

The importance of food and soil and water is reflected in the agricultural services provided from public funds for

education, research and farm advisory services. In addition, direct cash subsidies are provided for a wide range of soil conservation and farm improvement practices.

In 1952-3 South Africa's expenditure from revenue on agricultural services for white farmers was £A5,530,000 (including agricultural education and experiment stations). In addition loan funds totalling £A2,000,000 were allotted for various purposes, but largely for soil conservation loans and subsidies to farmers and for expenditure on State soil conservation works. Some comparative figures for Australia are:—

Expenditure From.	Revenue. £	Loan. £
Western Australia—		
Department of Agriculture, 1953-54	678,000	32,000
New South Wales—		
Department of Agriculture, 1953-54	2,837,000	145,000
Soil Conservation Service, 1953-54	281,000	249,000
C.S.I.R.O., 1953-54	3,615,000*	

The white population of South Africa is similar to that of New South Wales. It has 118,000 rural holdings covering 200,000,000

*See Wicht, C. L., Forestry and Water Supplies in South Africa; Union of South Africa, Department of Forestry, Bulletin, No. 33, 1949.

*This is C.S.I.R.O. expenditure of public funds. It also has funds from various primary and secondary industries. C.S.I.R.O. expenditure is not all on agriculture, though a large part is.



Fig. 3.—Bush veld near Potgietersrus, Transvaal. Cattle are grazed on such land.

acres compared with 73,000 totalling 170,000,000 acres in New South Wales. Western Australia has 20,000 rural holdings.

Organisation of the Union Department of Agriculture.

The South African Department of Agriculture was reorganised a few years ago on a regional basis. After an extensive agro-economic survey of the Union had been made, eight regions were defined as shown on the map of Plate 2. Each region embraces an area whose climatic soil and topographic conditions, as well as its farming systems and pattern, are not repeated outside the region. The research and services of the Department have been co-ordinated with the faculties of Agriculture in the Universities of several regions. Thus at Pretoria, the Director of the Transvaal Region is Professor H. B. Davel of the University of Pretoria; at Stellenbosch, Dr. M. H. Slabber of Stellenbosch University was, at the time of my visit, Acting Director of the Winter Rain-fall region. At Pietermaritzburg, Dr. A. R. Saunders, of University of Natal, is Director of the Natal Region. At Bloemfontein and Potchefstroom the Directors of the Agricultural Colleges are the Directors of the Free State Region and High Veld Region respectively. The regions have Assistant Directors for both Research and Extension. A number of specialist Divisions of the Department also exist with headquarters in the Union Capital at Pretoria. Mr. M. S. du Toit, Director of Agricultural Technical Services has played a major part

in developing the present organisation. I had the pleasure of an hour's discussion with him about the co-ordination of work within and between Regions and Specialist Divisions. The South African set-up may have lessons for Australia, but direct comparisons are not possible, for South Africa has Provinces with far less autonomy than the six Australian States, and it has only one Department of Agriculture for the Union. Though it has a Department of Scientific and Industrial Research, I understand that it is not in the field of agricultural research like the Australian C.S.I.R.O.

Agriculture in the Universities.

The linking of Department of Agriculture and the University Faculties of Agriculture appears likely to improve the facilities for research and for student training. There are over 200 students in Agriculture at each of the three Universities of Pretoria, Stellenbosch and Natal. (South Africa has several more Universities beside these.) At Pietermaritzburg the new Agriculture Building was nearly completed at the time of my visit. It was built by the Government at a cost of about £A400,000.

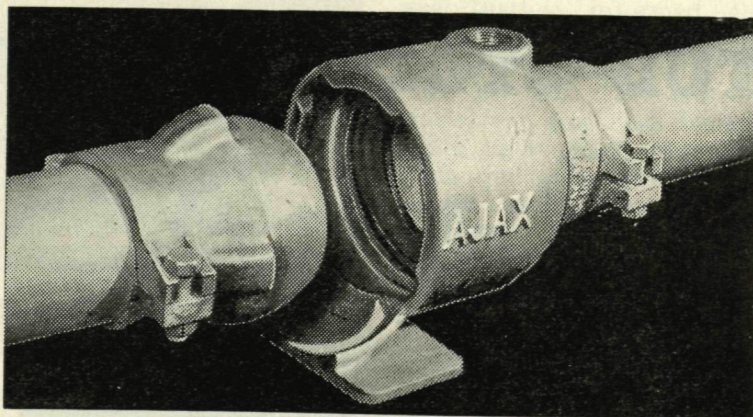
At Stellenbosch, I briefly discussed agricultural degree courses with Dr. Perold. The special course leading to a degree in Soil Conservation was discontinued in 1953. Students are now allowed a wide choice in the final year of the four-year course. Major courses in the fourth year are provided in Agronomy, Animal Husbandry, Dairying, Pomology, Viticulture Field Husbandry, Poultry Science, Agricultural Chemistry, Chemistry, Entomology, Plant Pathology, Microbiology Genetics and Agricultural Economics. A student, by selecting one or two of these and suitable lesser subjects thus completes his Degree course with some specialisation in the field of work he intends to enter.

Soil Conservation and Extension Work.

One of the Divisions of the Department of Agriculture is the Division of Soil Conservation and Extension. Its name might suggest that all agricultural extension officers are members of this Division, but in fact the field extension staff come under the control of the Regional Direc-

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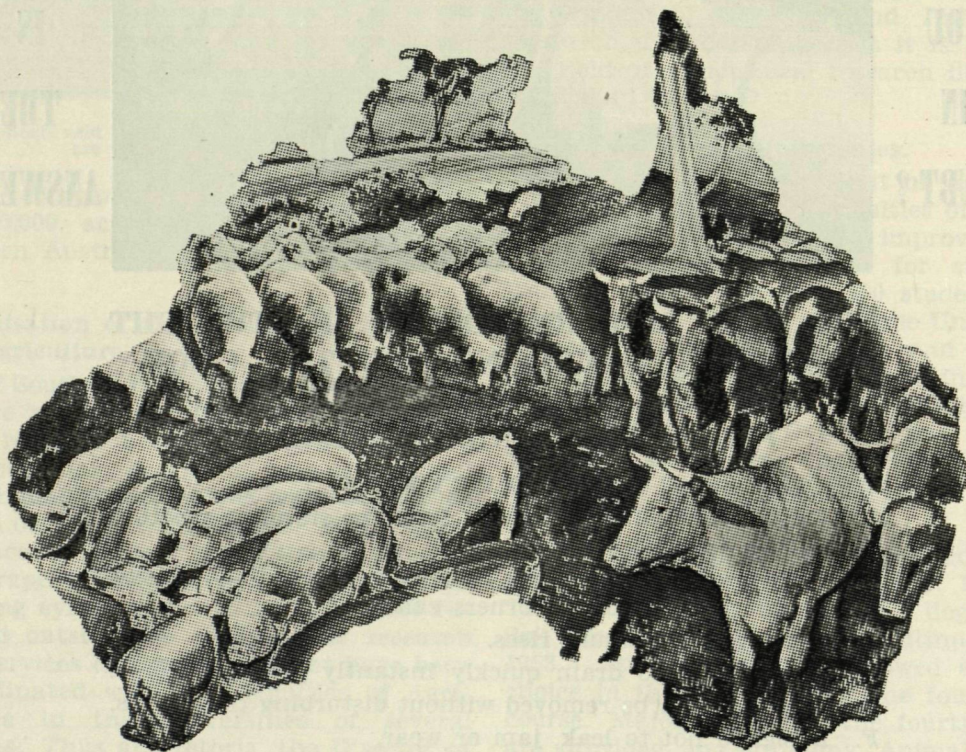
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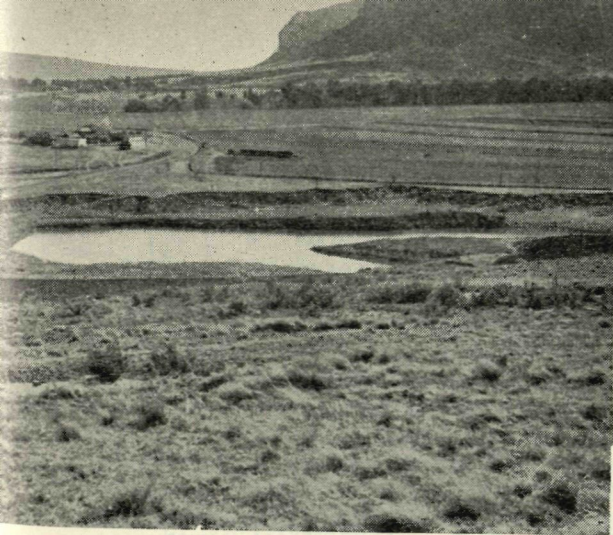


Fig. 4.—Erosion control near Ficksburg, Orange Free State. A dam has been made in one donga (gully), the second donga is the overflow. Contoured farmlands can also be seen.

tors and Assistant Directors (Extension). The Soil Conservation and Extension Division develops and controls through the Regions, the soil conservation and farm planning programme, but at the farmer level, the District Extension Officer advises on soil conservation as well as other farming matters. However the Soil Conservation Division also employs and directs its own specialist staff, including engineers, to design and carry out soil erosion control measures, especially on State works. State works are usually in areas where the severity of soil erosion has required State intervention.

Staff for Soil Conservation and Extension Work.

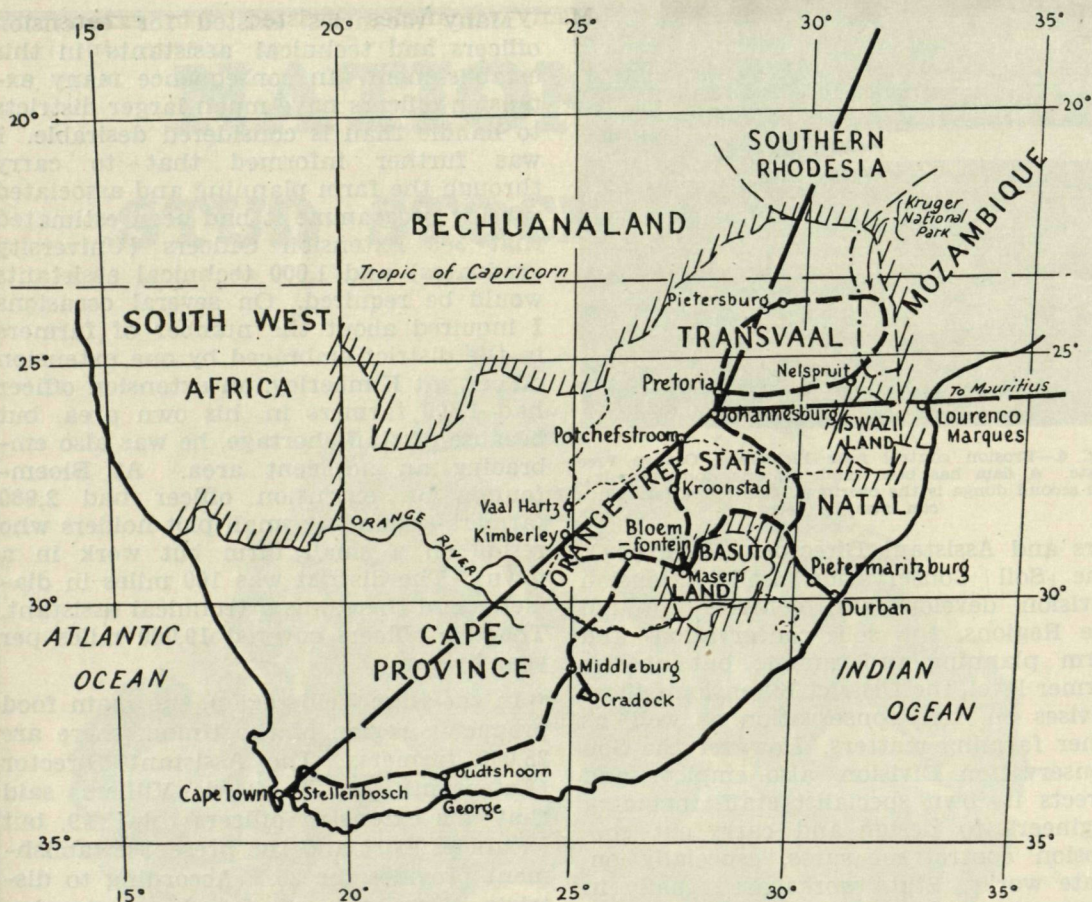
As indicated above, advice and action programmes in soil conservation at the farmer level are carried out by district extension officers as part of their general advisory duties. These officers are officers of the regions. The professional and technical staff establishment specifically associated with soil conservation and extension was given to me as follows:—(The figures include Divisional and Regional officers).

Director	.....	1
Assistant Directors	.....	10
Engineers (4 grades)	.....	42
Professional Officers—		
Extension (4 grades)	.....	202
Home Economics (Women)	.....	37
Technical Assistants (3 grades)	.....	288
Total	.....	580

Many vacancies existed for extension officers and technical assistants in this establishment. In consequence many extension officers have much larger districts to handle than is considered desirable. I was further informed that to carry through the farm planning and associated subsidy programme it had been estimated that 300 Extension Officers (University graduates) and 1,000 technical assistants would be required. On several occasions I inquired about the number of farmers in the district embraced by one extension officer. At Kimberley, an extension officer had 1,500 farmers in his own area, but because of staff shortage, he was also embracing an adjacent area. At Bloemfontein an extension officer had 2,980 farmers (excluding small plot holders who reside on a small farm but work in a town). The district was 100 miles in diameter and there was a technical assistant. The two officers covered 19,000 miles per year by car.

In the High Veld region, the main food producing region of the Union, there are 28,000 farmers. The Assistant Director (Extension), Mr. P. C. de Villiers, said that his extension officers total 19, but vacancies exist and the present establishment provides for 25. According to districts and type of farming extension officers have now 1,000 to 2,500 farmers each. Technical assistants are attached to extension officers, to assist especially in the farm planning programme, with surveys and drafting and checking. Young men who have passed the Matriculation examination are preferred. They are given four months training course and six months practical farm experience. Only after two to three years experience do they undertake farm planning, under the direction of the extension officer.

It is expected, I understand, that approval will be given for the appointment of more extension officers and technical assistants, when they are available. South Africa, like Australia, has been unable to secure sufficient technical personnel for agricultural services, due to the great gap in recruitment and training in the depression, World War II and postwar, period, say 1931-1950.



SOUTH AFRICA

Showing Travel Route and Centres Visited

0 100 400 800 1

SCALE — MILES

PLATE 1.

It is of interest to note at this point that Southern Rhodesia, with only 5,000 European farmers, has 77 district conservation officers and 13 extension officers and vacancies for 12 more. Most of these are University graduates.

Women Advisers in Home Economics.

In 1953 the Union had 22 women employed as Home Economics Officers. The establishment provides for 37. I met two of these: Miss Hattingh at Potchefstroom, and Miss Moira Cilliers at Bethlehem. These officers have the University degree of B.Sc. (Domestic Science) and are paid the same salary as single men on the pro-

fessional staff.* They work with agricultural clubs in the Land Service Movement (like our Junior Farmers), with branches of the Women's Agricultural Union (like our Country Women's Association), and with town groups. Miss Cilliers had a large territory, and travelled 6,000 miles per year by car.

Soil Erosion and its Control in South Africa.

Evidence of soil erosion is common in South Africa's farming and grazing lands,

*South African Government salaries seem to be based on equal pay for women and single men on comparable work. At the time of my visit married men were receiving £234 p.a. (South African) cost of living adjustment, single men about £50.

and in some cases the damage is severe. It is most spectacular on the waterways, and the worst I saw was in the Orange Free State areas north of Basutoland, and the Estcourt area of Natal.

We have often read of the severity of the problem in South Africa, yet I formed the impression after 3,000 miles of travel in the Union that we are too complacent in Australia if we think that erosion is a much smaller problem in this country. Perhaps unsuitable grazing and farming practices, and droughts, plus the defects of native agriculture, have caused South African to realise the need for its great conservation drive. Unlike Australia it has practically no unoccupied areas awaiting development.

Australians are familiar with the term "veld" but many, I think, believe it to be a particular area of open grazing country in South Africa. The term does apply to grazing country, but most of South Africa is natural grazing land, and the term veld is used much as the term "country" is used in Australia, with a preceding descriptive word. Thus in Australia we speak of forest country, scrub country, mulga country, saltbush country. In South Africa sweet veld is land on which the natural grasses are mostly palatable to stock; sour veld has unattractive grasses; mixed veld has some good and some poor grasses; bush veld has small trees with grass understorey rather like Australian mulga country; high veld is at high elevation; low veld is below 1,500 feet, which gives much hotter conditions in the latitudes of Transvaal.

It is convenient to mention here that natural forest is very restricted in South Africa and the growing of Australian Eucalypts for poles and posts, mine props and furniture wood is quite extensive. It is difficult for South Africans to conceive that Eucalypt trees have been destroyed on millions of acres of forests and woodlands in Australia to make farmlands.

In many parts of the Union, lack of suitable grazing control, along with droughts and veld burning, has caused widespread deterioration and accelerated water run-off, with consequent soil erosion in water courses and on slopes. Sloping



Fig. 5.—Basutoland is mountainous. This village is at 6,000ft. Contour ploughed lands can be seen on the right.

lands, ploughed for grain crops like maize and wheat, have water and wind erosion problems as in Australia. A great deal of the conservation efforts go therefore into the treatment of watercourses (dongas) to check soil losses, to conserve stock water, and to promote water absorption to improve water supplies at springs (fountains). The damming of watercourses with earth or concrete structures of various sizes is a major activity. Larger ones are carried out by the Soil Conservation Division as State works, smaller ones are built by farmers or contractors under the subsidy and farm plan arrangements.

Mechanical Works and Land Use Methods in Soil Conservation Programmes.

I formed the impression that South Africa had made originally what may be termed an engineering approach to soil conservation; but is giving much greater emphasis now to a biological approach. Besides approaching erosion control through concrete, masonry and earth structures in watercourses and on slopes, there is now much emphasis on maintaining surface cover to control the rainfall after it reaches the ground. The absorption of rain where it falls is a basic principle in soil conservation and erosion control programmes, and plant cover, either living or dead, plays a major role in achieving this aim. The biological or agronomic approach to soil conservation is now being strongly developed in South Africa, and receives due emphasis in the farm planning programme. The attitude to these matters is revealed by the following quotations from a recent review of soil

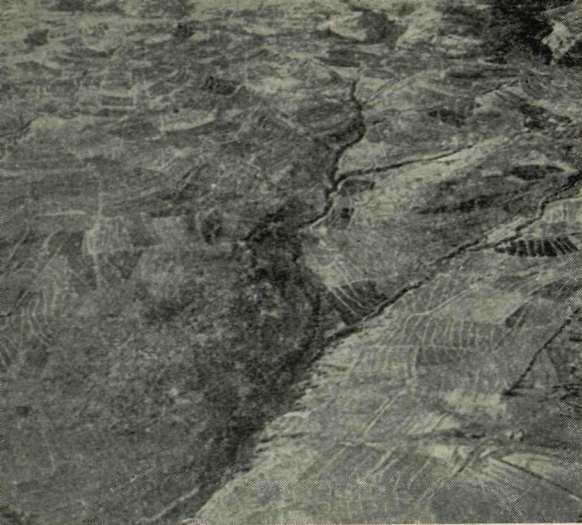


Fig. 6.—The Basuto natives have adopted contour ploughing on over 80 per cent. of their croplands. Contour lines are seen in this aerial view.

conservation in the Union by Dr. P. D. Henning, Director of Soil Conservation and Extension.*

It is freely conceded today that the control of erosion and desiccation, as well as the promotion of better farming, are essentially biological problems, whose only real and final solution lies in the adoption of improved systems and methods of land use. Mechanical works (or **soil conservation works**) alone, can never solve these problems, and may indeed do more harm than good if attention is not given at the same time to the biological or land use aspects (or **soil conservation measures**). In the long run, therefore, far more importance attaches to measures than to works: yet they are mutually complementary and both are necessary facets of almost any soil conservation programme.

The farm plan is the high light of conservation activity in the field. It is the farmer's blueprint for the most efficient conduct of his farm operations in accordance with the principles of conservation farming; it prescribes specifically the most advantageous farming system to be adopted, the methods to be employed relating to veld management, crop rotation and the like, and also the various anti erosion and conservation works to be constructed on the particular farm.

Farm planning has not so far been adopted as the basis for soil conservation and erosion control programmes in Australia. Several States are, however, developing planning methods suited to their particular conditions, because it is well

recognised that works and measures are best considered on the basis of whole farms or whole catchments.

As mentioned previously, some of the worst soil erosion has been in the eastern parts of the Orange Free State north of Basutoland. Here the soil conservation drive has been more intense than in most parts. About 30 per cent. of the crop lands in the eastern Free State are now worked on the contour between contour banks. This does not mean 30 per cent. of the total area of farms, because many farms include grazing areas which are never, or seldom cropped.

Finance for Soil Conservation.

The Division of Soil Conservation and Extension is one of the specialist Divisions of the Union Department of Agriculture. With its own staff and plant it constructs State works where erosion is severe. It also directs the farm planning and subsidy programme, though the detailed farm planning work is done by Extension officers of the eight Regions, in association with farmer-appointed District Committees.

The Soil Conservation Division controls earthmoving and associated plant to the value of £A1,250,000 for use on State works. This is operated by 372 foremen and mechanics besides native labour. For 1954-55 this Division had a Loan Vote of £A1,580,000 and a Revenue Vote of £A200,000.*

The Loan Vote was made up of:—

Soil Conservation Loans to Farmers	£A125,000
Bonuses and subsidies to farmers for Soil Conservation works	£A775,000
Reclamation and Conservation on State works	£A680,000
Total	£A1,580,000

Several points to be noted are:—

- (a) Extension officers are on the regional staffs and are not a charge on the Division of Soil Conservation and Extension.

*Henning, P. D., "Progress of Soil Conservation in the Union of South Africa (excluding native areas) since the Inter-African Conference on Soils held at Goma in 1948", Paper presented to Inter-African Soil Conference, Belgian Congo, 1954.

*After deducting £A312,000 paid from Revenue to Loan Account.

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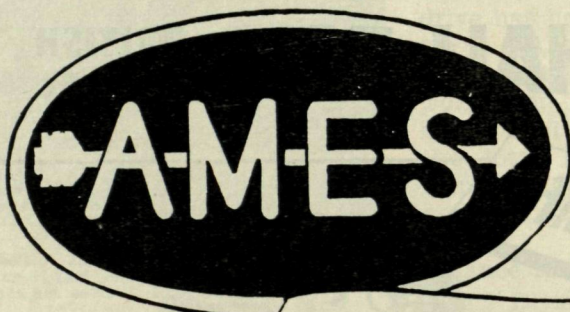
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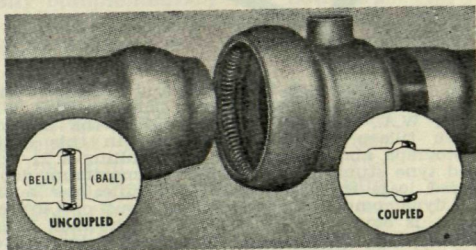
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Fig. 7.—A crop of blue-flowered lupins grown to harvest for seed on a dairying and wheat farm near Cape Town. There is much interest taken in lupins in these areas where they are grown for silage-making with oats and also for the seed as a high protein supplement in summer stock-feeding

- (b) The direction of Agriculture and Soil Conservation on native lands and reserves is handled by separate staff and votes under the Ministry of Native Affairs.
- (c) South Africa has about 118,000 European rural holdings with 200,000,000 acres of farming and grazing land.

Western Australia has 20,000 farmers and pastoralists with 35 million acres in farms and 180 million acres of pastoral leases. New South Wales has 73,000 rural holdings totalling 170,000,000 acres.

Subsidies for Soil Conservation and Water Conservation Works.

Cash subsidies are paid to farmers in South Africa for a wide variety of approved soil and water conservation works and £A775,000 was provided for this in the 1954-55 Budget. Southern and Northern Rhodesia have somewhat similar subsidies and so does the United States of America.* No Australian State uses this system of encouraging soil conservation, but expenditures by farmers on certain soil conservation works are allowable deductions before assessing income tax. In

South Africa, contour earthworks, dams, concrete and masonry structures, fences and silos are subsidised about one third of their cost as assessed in standard tariffs. These works must, however, be part of an approved farm plan drawn up by a district committee and soil conservation officer (usually the district extension officer).

Farm Planning is the Basis for Subsidies.

Seventy two per cent. of South Africa's farmlands, excluding native areas, is now included in 524 proclaimed Soil Conservation Districts. An elected Soil Conservation District Committee manages the affairs of the district and is responsible for seeing that detailed farm plans are prepared for all farms in the district. These farm plans are the basis for subsidy payments. They have considerable detail, including farming and grazing practices, as well as farm design. Once drawn up, approved, accepted, and signed by the farmer, the plan is binding on the farmer.

The preparation of farm plans for most of the Union's farms is obviously a major task, and occupies much of the time of district extension officers. It has been estimated, as stated earlier, that 300 Extension officers (University graduates in Agriculture) and 1,000 technical assistants will be necessary for the farm planning programme, as well as for general advisory duties.

*See Herriot, R. I., "Soil Conservation in the United States" Jour. of Agric., South Australia, Vol. 55, pp. 204 and 246, 1951-52.



Fig. 8.—Contour banked area and waterways, Tygerberg Soil Conservation Area near Capetown. The flowers are capeweed (*Gousblom*). Cape tulip (*Homeria* sp.) and doublegee (*Emex australis*) were also seen in these parts.

The farm planning and subsidy approach to soil conservation with the element of compulsion included in the farm planning documents, was of special interest, because nowhere in Australia is such a system used. Whenever possible I discussed the scheme with district extension officers and a few farmers. Farmers were evidently pleased with it, but I could not help feeling that district extension officers and their technical assistants had a heavy burden in the pressure for plans, and also in checking the sizes of dams or earthworks, lengths and type of fences, nature and volume of concrete and masonry and such like, so that subsidies according to standard tariffs could be recommended.

From a national standpoint the encouragement of soil conservation and soil erosion control is most essential. It should be encouraged by adequate research and advisory services and technical assistance to farmers, and perhaps by limited direct expenditure of public funds in special cases. Farmers must be encouraged to see that they, and their attitudes, are the keys to effective soil conservation. A system of taxation rebates for expenditure on certain soil conservation practices, as applied in Australia, gives of course, the biggest rebates to those with the biggest incomes. In the present state of the Australian agricultural economy, a system of subsidies as used in South Africa—and the Rhodesias—does not appeal as an improvement. The South African system of

districts and subsidies has been patterned on U.S.A. Soil scientists from U.S.A., whom I met in Belgian Congo, told me that a move had been made to halve the large subsidy payments in their country, but political pressures in Congress had prevented any major reduction.

BASUTOLAND

Before discussing other aspects of South African agriculture it is appropriate to describe Basutoland, the native territory administered by the British Colonial Service, and lying between Natal and the Orange Free State (See map Plate 1.)

Basutoland embraces about 12,000 square miles of mountainous country whose streams drain west to form the Orange River and its tributaries.

Elevations range from 4,000 to 11,000 feet, the highest parts being along the eastern border where the ridge of the Drakensberg marks the Basutoland-Natal border. Europeans number about 1,700. The 700,000 natives grow maize (mealies) at the lower elevations, and wheat and beans above 6,000 feet. 1,300,000 sheep return an average of £2 per head for wool and mohair. There are 550,000 goats as well as 400,000 cattle, which are a measure of wealth with native peoples.

The farming and grazing practices of the natives have caused some spectacular gully erosion in the past 100 years, but the British Colonial Service officers have done excellent work in encouraging and assisting the natives (through their chiefs) with erosion control. Contour banks and contour grass strips have been intensively applied. Grazing is controlled even though there are no fences. Burning the grasslands is discouraged. Poplars are planted at the heads of erosion gullies on mountain slopes.

Mr. L. H. Collett, M.B.E., Soil Conservation Officer, has been working on this programme since 1936, but is soon to retire. His influence, and the support of the British Colonial administrators, are reflected in the following figures:—

	Acres,
Area of land suitable for ploughing	1,000,000
Area of land ploughed on the contour	850,000
	Miles.
Contour banks	19,000
Contour grass strips	30,000

Such an intensity of use of contour practices must surely not be exceeded in any other country. The Colonial Development and Welfare Fund has provided about £A500,000 in the past ten years for earthmoving plant to assist the conservation programme.

OTHER ASPECTS OF SOUTH AFRICAN AGRICULTURE

1.—Lupins and Subterranean Clover in the Winter Rainfall Region.

My time in the winter rainfall areas around Cape Town and Stellenbosch was all too brief. The climate here is so similar to the agricultural areas of Western Australia that my interests in similarities and differences of the two areas was naturally very keen.

Cape Town was established in 1653 by Jan van Riebeck, so that farming has been going in for a much longer time around the Cape than in Western Australia. In view of the interest in Western Australia about nitrogen status and soil fertility in wheat growing areas, it was interesting to see, and hear about, the great interest in subterranean clover and lupins in the cereal growing and mixed farming areas of the Cape. It was also of interest in this connection to hear that wheat is usually planted with mixed fertiliser, including nitrogen and phosphate.

The mixed farming of these parts often includes dairying with cereal growing, and silage is much used. Lupins are grown with oats for silage, but also for seed to feed in summer as a protein concentrate. Lupin selection work at Stellenbosch-Elsenburg College of Agriculture has been directed towards sweet, non-shattering varieties with a low percentage of hard seeds. This would serve well to plant as an annual crop for silage or seed stripping. I described how our Western Australian blue lupin is bitter, shatters and scatters its seeds, and has a high percentage of hard seeds; all desirable characteristics as the lupin is usually used in Western Australia, for summer and autumn grazing of sheep on the naturally scattered seeds. Some South African sheep farmers are interested in such characteristics, I was told. I saw blue flowered lupins rather like New



Fig. 9.—Oranges packed for market in orange coloured string pockets, Zebedelia Citrus Estates, Transvaal, the largest citrus estate in the world—5,800 acres of trees, all irrigated.

Zealand blue lupins, and also a shorter yellow-flowered variety (S.E.1).

Subterranean clover, especially the Dwalganup strain, has been planted quite extensively in recent years in 15-20 inch rainfall areas especially around Caledon and Bredarsdorp (which I had to omit owing to minor illness after leaving Belgian Congo.) At Stellenbosch-Elsenburg College, 30 miles from Cape Town, Professor J. T. Sim also showed me Yarloop (white-seeded) sub clover, which the South Africans say is more resistant to sand mite (red legged earth mite, *Halitydaeus destructor*) than Dwalganup and other strains. The ability of the white-seeded strain to grow under waterlogged and surface flooded conditions, was not known to Professor Sim.

Lucerne has been much used in the past, even though heavy applications of lime were necessary for successful growth. I saw a good stand on soil with dense iron-stone gravel in the subsoil; a pit about 4ft. deep for road gravel was adjacent. Arabian lucerne is doing well. Besides work on lupins and sub. clover other promising species at Stellenbosch for winter-rainfall conditions are:—

Kentucky 31 fescue—very palatable.

Cocksfoot—Aberystwyth Hay Strain S/37.

Eragrostis curvula, *Eragrostis chlorome-las*—Natural grasses of South Africa.

Neither *Hyparrhenia hirta* (thatch grass) nor perennial veldt grass (*Ehrharta*

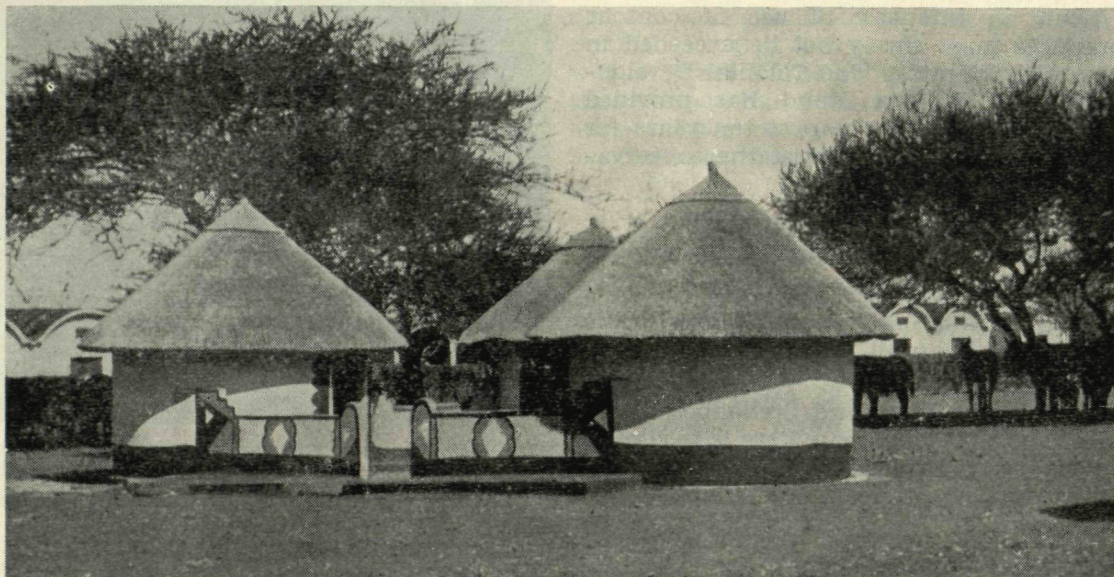


Fig. 10.—The latest three-room living quarters for married native employees, Zebedelia Citrus Estates, Transvaal. They are built of mud and decorated and thatched by natives. Cash outlay about £40.

calycina) has been considered worthy of cultivation. Both are being investigated in Western Australia as perennial species.

The Cape was visited in September, and with Cape weed (gousblom, *Cryptostemma calendulaceum*) Cape tulip (*Homeria* sp.) and doublegee (*Emex australis*) all prominent, our links with this area were all too evident. Perennial veldt grass (*Ehrharta calycina*) was seen by the roadsides. The Cape, like Western Australia, is noted for some attractive wild-flowers, some of which were seen and admired.

2.—Soil Salinity.

Little evidence of salt (brak in South Africa) was seen on farmlands. I was told that at Malmesbury, north of Cape Town, with a rainfall of about 15 inches, winter type, some depressions are salt-affected and become bare. Dams in depressions are avoided because of this, and it seems that it could be a similar problem to that in similar rainfall in Western Australia.

The topography and geology of the areas north and east of Cape Town is quite different from the agricultural areas of Western Australia. The Cape area is hilly and there are mountains 2,000-5,000ft. high 30 to 50 miles inland. The

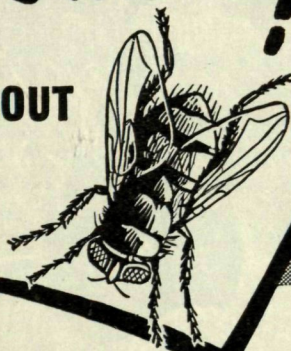
tops still carried snow in mid-September. Sandstones and shales are the principal rocks, though granite occurs in parts, as at Paarl, an important vine growing area, named after the large pearl-shaped granite mountain nearby.

I enquired about *Paspalum vaginatum* (sea shore Paspalum) a summer-growing, salt-tolerant grass used in Western Australia, but those agricultural officers I met did not know it. This grass is said to have been brought to South Australia (and thence to Western Australia) from the Millertown Race Course not far from Cape Town. Here, according to reports, it is watered with sea water.

In some irrigation areas, e.g. Worcester, salt was seen at the roadsides. On irrigation lands, grading, drainage and use of barley as a first crop, evidently gives satisfactory control. East of Bloemfontein, and also south of Senekal in the Orange Free State, I saw brak areas which had been treated with some type of ripper or subsoiler. On a sloping site the work was done on the contour. In both cases examination of the soil showed a dense sealed layer of half to one inch on the surface, with better structure beneath. It seemed the typical surface seal which develops when sodium reaches 15 to 20 per cent. of the exchangeable metal cations in the

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soil. The ripping was intended to give better water penetration and promote grass growth. I could get no clear evidence about the most desirable depth of ripping. Rather it seemed that a ripper or subsoiler had been used to roughen the soil and burst the surface seal, a job not possible with lighter implements.

At Potchefstroom Agricultural College, in the High Veld Region, brak sometimes occurs on the heavy clay "turf" soils. The growth of feed mangels is recommended in such cases.

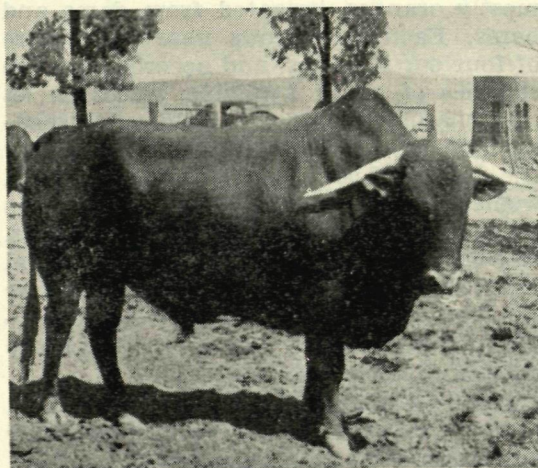


Fig. 11.—Afrikaner bull, Glen Agricultural College, Bloemfontein. This breed tolerates extremes of heat and cold, and may be useful in northern Australia.

3.—Trace Elements for Animals and Plants.

Coast disease, due to deficiencies of copper and cobalt, affects stock grazing on the coastal areas around the Cape. The administration of copper and cobalt through the drinking water will be made much easier by using new compounds developed by Dr. Perold at Stellenbosch. Copper and cobalt in these compounds will remain in solution in strongly alkaline and saline waters. It was hoped by Dr. Perold that the cost of the compounds would be less than £A1 10s. for 1,000 sheep per month.

At George, on the south coast, about 250 miles east of Cape Town is a coastal plain with low scrub, generally similar to the country in the vicinity of Esperance on the south coast of Western Australia. The soils, have grey to grey-brown sandy sur-

face (pH 5.5 to 6.2) there is ironstone gravel below a foot, and yellow and grey brown clay at about two feet. The underlying rock is said to be granite, but some of the surface fine sand may be derived from the adjacent sandstone mountains. The rainfall is 32 inches with peaks in February-March, and September to November. The winter rainfall of the Cape is giving way to the summer rainfall of the country farther east.

On a typical area of this plain the Outeniqua Experiment Station was started a few years ago at the direction of the South African Minister for Agriculture. He had visited Australia and seen the impressive work with fertilisers and trace elements on poor sandy soils. Work is going on with cereals and pastures and various fertilisers. Phosphate deficiency is acute. Superphosphate at 3 cwt. per acre on new land seemed to give little residual effect for ladino clover the following year. Langphos, a South African phosphate rock, gave a good residual effect.

Work with trace elements included manganese and copper, but zinc had not been tried. From my experience in Western Australia I was able to point out during a short visit, that plots of Bacchus Marsh (?) and Yarloop subterranean clover were showing very definite symptoms of zinc deficiency. Oats showed the dark grey to almost black lower leaves which we know as a field symptom of zinc deficiency. A linseed crop a few inches high seemed to be just recovering from dieback, and again zinc deficiency suggested itself. It is interesting to note, however, that ladino clover was doing well. It may have a lower zinc requirement than sub-clover. Dark leaves on growing oats, and dark straw when mature, were said to have been noted by farmers already farming some parts of this coastal plain. The similarity to Esperance was most remarkable.

4.—Fruit Growing.

South Africa produces large quantities of fruit, for home use and export as fresh fruit, wine and canned fruit. (see Table I for comparisons with Australia.) I saw practically nothing of the pineapple and banana areas, but these were visited by



Fig. 12.—Ostriches and "Friesland" cattle on lucerne pasture Oudtshoorn, Little Karoo.

Dr. C. G. Stephens of C.S.I.R.O. Division of Soils, who was in South Africa at the same time.

Near Stellenbosch in the Winter Rain-fall Region, the Western Province Fruit Research Station has an experimental orchard at Bien Donne where climatic conditions are almost identical with those in some of the winter rainfall fruit growing areas of Western Australia.* Here, during a short visit, I saw a variety of work on peaches, pears, apples, olives, guavas, avocados and pecans.

On Elberta peaches 2 per cent. Dytrol spray had been applied on July 22, in experiments to control irregular flowering and foliation. Good results were expected. Similar trials on the same problem are under way in Western Australia. The peach variety Bourland, selected at Stellenbosch, is a high-yielding, white-fleshed, mid-season freestone variety, and shows little tendency to delayed or irregular foliation.

Lupin green manure crops were at full growth and in flower during my mid-September visit to Bien Donne. I was told that unless the cover crop is very heavy, sulphate of ammonia up to 500 lb. per acre is used to ensure sufficient nitrogen for peaches.

The annual field day at Bien Donne now attracts about 1,500 visitors.

*de Villiers, G. D. B.—A Ten Year Summary of the Climatological Data Recorded at the Agro-meteorological Observatory, Groot Drakenstein, 1941-1950. South Africa Department of Agriculture Science Bulletin 349, 1954.

In the Little Karoo, where the rainfall is only 7 to 12 inches, I was surprised to find much fruit-growing using irrigation water from snow-fed streams. Both north and south, mountains rise 3,000 to 5,000 feet. Vines for wine and some for dried vine fruits, and peaches for canning, are the most important fruits. The Kakomas variety of peach is favoured in these areas.

Citrus fruits in South Africa double Australia's production. Near Pietersburg in Transvaal I visited the Zebedelia Citrus Estates, said to be the largest in the world. Here are 5,800 acres of citrus, mostly oranges, irrigated from dams and bores. Each tree grows near the centre of four earth basins, and according to the supplies of water available, water is let into one or more of the basins. All weeding and cultivation are done by hand, by the staff of 3,000 mainly native men and women. The 480,000 trees produce as much as 1,500,000 bushels of fruit a year. Narrow-gauge railways run out several miles from the large packing shed, where the fruit is washed and dried before packing into large string pockets for the home market or into cases for export.

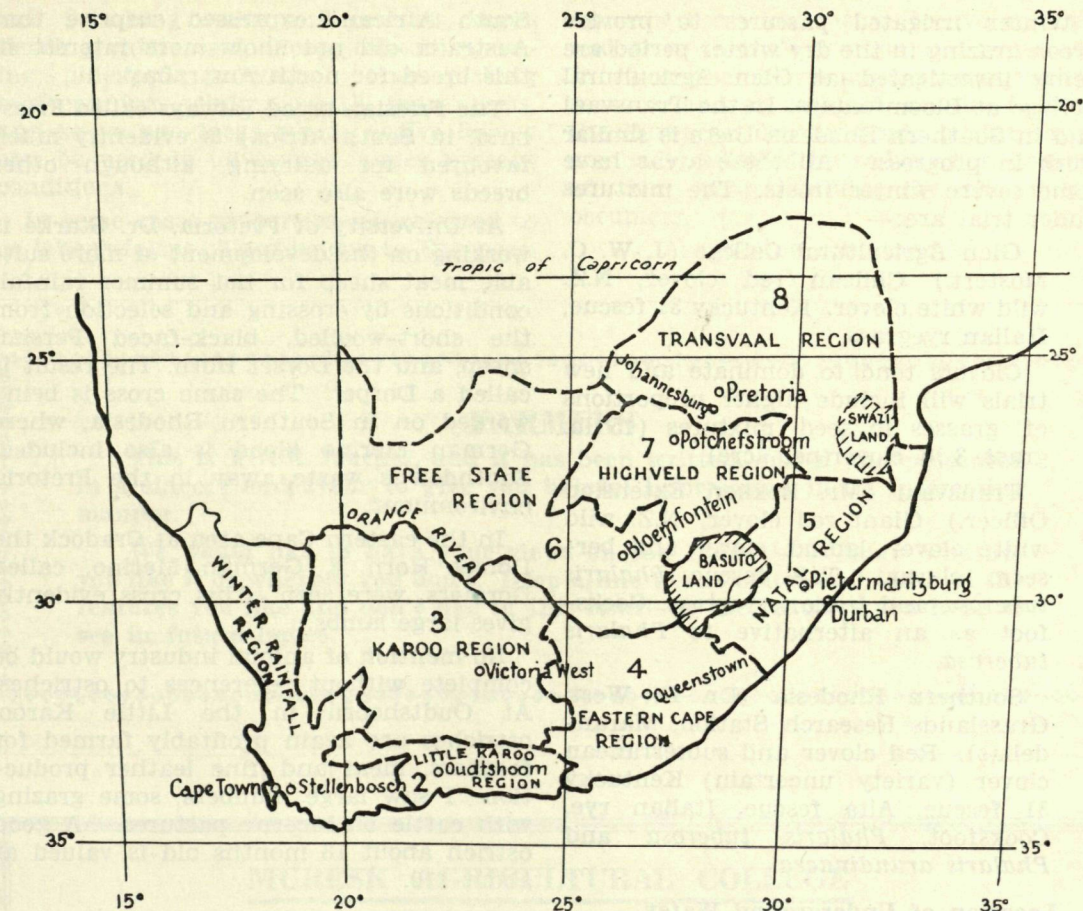
Fruit fly is now controlled at Zebedelia by the use of parathion sprays. Sulphur dusting is done by aeroplane.

The newest three roomed dwellings for married native employees attracted my attention. They are built and decorated by the natives from mud and local thatch grass and timber. The cost to the company is about £40 per house.

5.—Irrigation.

Irrigation to supplement the rainfall and to allow intense production in low rainfall parts is very common on South African farms. Some areas are served from large dams, others depend on individual bores or dams. Irrigation of fruit and lucerne in the Little Karoo has been mentioned. Flying over the Great Karoo green irrigated lucerne patches could be seen near the homesteads of the sheep farms.

South of Kimberley, where there is an 18 inch summer rainfall, I passed through the Riet River Irrigation Area where lucerne and wheat are grown. At the Reit River Research Station, seed potatoes of the variety Up-to-Date are produced, free



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of virus X, a virus which lowers potato yields considerably and yet some strains give no visible evidence of presence in the crop.

North of Kimberley, near Warrenton, is the Vaal Hartz Irrigation Area. Water from the Vaal River is taken into the dry Hartz valley to irrigate about 180,000 acres of red sandy soil. Wheat, lucerne and peanuts are grown. The Vaal Hartz Research Station which I visited, also does work on cattle, poultry, vines and pastures. Here I was told of a proposal to sterilise, flavour and bottle skim milk to sell to natives working on the mines instead of

aerated waters. The net return to the dairy farmers was expected to exceed that paid by cheese factories.

The siltation of reservoirs is a problem intimately related to the problem of soil erosion. In the vicinity of Cradock in the eastern Cape Province the Lake Arthur dam has been reduced in capacity by siltation from 87,000 acre feet to 27,000 acre feet in 25 years. The Grass Ridge Dam on the Fish River is silting up at the rate of 1,100 acre feet a year as the incoming water has $3\frac{1}{2}$ per cent. of silt. Soil conservation work on the catchment is directed to reducing these siltation rates.

Winter irrigated pastures to provide green grazing in the dry winter period are being investigated at Glen Agricultural College at Bloemfontein. In the Transvaal and in Southern Rhodesia there is similar work in progress. All these areas have some severe winter frosts. The mixtures under trial are:—

Glen Agricultural College (J. W. C. Mostert.) Chilean red clover, N.Z. wild white clover. Kentucky 31 fescue, Italian ryegrass.

Clovers tend to dominate and new trials will include higher proportions of grasses in seed mixtures (15 lb. grass, 3 lb. clover per acre).

Transvaal (Mr. Bekker, Extension Officer.) Giant red clover. N.Z. wild white clover, ladino clover and berseem clover. Tall fescue, *Phalaris tuberosa* and Italian ryegrass. Cocksfoot as an alternative to *Phalaris tuberosa*.

Southern Rhodesia (Dr. O. West, Grasslands Research Station, Marandellas). Red clover and subterranean clover (variety uncertain) Kentucky 31 fescue, Alta fescue, Italian rye, Cocksfoot, *Phalaris tuberosa* and *Phalaris arundinacea*.

6.—Location of Underground Water.

Considerable use is made in South Africa of electrical methods to determine likely places where underground water can accumulate in more weathered zones of the underlying rock. The work is performed by officers of the Geological Survey with whose Director I had a short discussion. Since returning to Australia I have been supplied with much more complete data.

Government boring plants operate as far as possible only on sites determined by the geologists. The methods are particularly applied in granite country.

7.—Animal Husbandry—Cattle, Sheep and Ostriches.

Cattle, both beef and dairy, and sheep for wool and meat are of major importance in South Africa's agriculture. Afrikaner cattle were shown to me on several occasions. This breed with its long horns and slight shoulder hump tolerates extremes of heat and cold very well. Some

South Africans expressed surprise that Australia did not show more interest in this breed for north Australia.*

The Friesian breed (always called Friesland, in South Africa) is evidently much favoured for dairying, although other breeds were also seen.

At University of Pretoria, Dr. Starke is working on the development of more suitable meat sheep for hot summer rainfall conditions by crossing and selection from the short-woolled, black-faced Persian sheep, and the Dorset Horn. The result is called a Dorper. The same cross is being worked on in Southern Rhodesia, where German Merino blood is also included. Southdowns waste away in the Pretoria environment.

In the eastern Cape area at Cradock the Dorset Horn X German Merino, called Dormers, were seen. This cross evidently gives large lambs.

No mention of animal industry would be complete without references to ostriches. At Oudtshoorn in the Little Karoo, ostriches are again profitably farmed for feathers, meat and fine leather production. I saw large numbers, some grazing with cattle on lucerne pastures. A good ostrich about 18 months old is valued at about £10.

8.—Farm Labour.

The labour situation on African farms is quite different from Australia. Large numbers of natives live and work on farms and are paid wages and rations which make labour appear very cheap by Australian standards. £4 to £6 per month plus rations seemed a common figure. The natives usually construct their own houses. I was often told, however, that native labour was rather inefficient. With most of the less skilled work in their country done by natives, South Africans find it hard to conceive that all our farm work, coal mining, gold mining, railway maintenance work etc., is carried out by white people at wage rates of £A13 per week and more.

Hand milking, silage making, carting and spreading animal manure, harvesting

*I understand some Afrikaner cattle have been taken to New Guinea as well as Zebu types. Quarantine regulations do not allow imports of cattle from Africa to Australia.

and thrashing maize and peanuts, shepherding cattle and sheep, tobacco growing, pineapple production, fruit picking and canning, tending wattle plantations, and so on are tasks where native labour can be used to advantage under present conditions.

In some cases properties are referred to as labour farms. They belong to European

farmers who allow natives to live on them and grow their food crops and run stock. In return the natives must work at various seasons, and as required, on the farm of the European owner. Some labour farms are badly affected by soil erosion because of their poor handling by the native occupiers.

(To be continued.)

FARMERS

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(Department of Agriculture)

Parents are reminded that applications for 1958 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1958 entrants is made after the Junior results are available in January, 1957.

The successful applicants then continue with Sub-Leaving studies during 1957.

The Entrance qualifications include:—

- (a) Sub-Leaving English, Mathematics A, Physics (including Magnetism and Electricity), and Chemistry.
- (b) Junior Bookkeeping.

Should places still exist after the preliminary selection qualified applicants are enrolled in the order of application.

A few vacancies exist for 1957 admission, for those who will possess the above qualifications before the re-commencement of the College year on Saturday, 16th February, 1957.

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