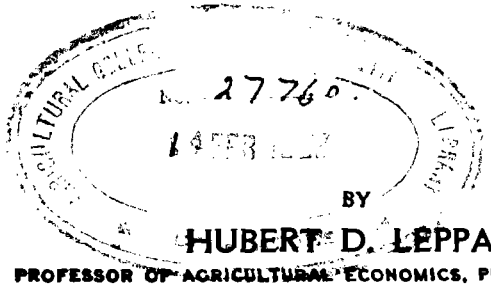
AGRICULTURAL POLICY
IN
SOUTH AFRICA



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AGRICULTURAL POLICY IN SOUTH AFRICA.

To that 'stout fella'
A. M. Bosman,
the best of good friends.

PREFACE.

In the following pages an endeavour is made to give a background to agrarian policy in South Africa. The writer is fully aware of the deficiencies of his survey, but believes that at times something said is to be preferred to silence. Much is advocated tentatively, but it is hoped that even tentative proposals may provoke discussion and so help to clarify the blurred.

The thesis he presents in this short treatise has formed the basis of his teaching and writings during the last ten or twelve years, during which time his experience has gone to fortify him in his convictions.

He has tried not to overburden the discussion with figures, details or references. Some features touched on are more fully dealt with in his "Agricultural Development of Arid and Semi-Arid Regions—*With Special Reference to South Africa*," and in de Kock's excellent book "The Economic History of South Africa." Parts of the discussion have previously appeared in articles by the writer in the columns of the "Cape Times," "The Star," "The Farmers' Weekly," "The Veld" and "The Rand Daily Mail."

In the main reforms can come about only when people are fully aware of their circumstances and of the alternatives to their situation. In consequence no attempt is made to obscure unpleasant facts—they must be faced sooner or later. The changes advocated, it is almost needless to say, should not be brought about too abruptly; and, since reforms are seldom successful unless some of the old machinery is incorporated, where possible, use should be made of existing machinery. It is relevant to point out that even a

small improvement in the way in which a farmer earns his living, if generally adopted, often gives a greater addition to production than something spectacular but which affects only the few.

Experimental work, which is vital to the formulation of policy, should also aim at the solution of problems well ahead of the country's phase of development. On the principle of "to be forewarned is to be forearmed," its aim should be to anticipate trends in order that adjustment can be effected without undue hardship.

It will be held by many that something is at present being done in all the directions advocated. This is not denied, but the writer holds strongly that much effort is to-day misdirected and that some stronger measures which should be taken are comparatively neglected.

Although not dealing specifically with the South African farmer, the essay, "The Lot of the Farmer," is included for various reasons. The farmer struggles on, often unaware of some of the reasons for his struggles; the townsman is often impatient of the farmer's calls for relief. It is hoped that this short survey of the lot of the farmer in the life of a community may assist both the townsman and the countryman in obtaining meaning for some aspects of the latter's situation. It is an attempt to give, simply, some of the major disabilities under which the farming class throughout the world labours.

A certain amount of repetition will be found. In a measure this is unavoidable, because in supporting a thesis a number of approaching avenues are taken and since these converge on the main contention, the final ground to be covered in each must necessarily have much in common.

Pretoria,
30th May, 1931.

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The Lot of the Farmer.

PART I.

The South African Farming Situation.

"It is now recognised that a diversification among human communities is essential for the provision of the incentive of adventures of thought, passionate feeling and aesthetic experience."—*Crew.*

The South African situation in farming cannot be understood without taking into consideration the part played by geographical controls. The development of the country has been modified profoundly by these, and the success of farming in the future will be closely correlated with the way in which farming activities conform with the natural endowments of the Union.

1.

Geographical.—Prominent among the physical controls are those connected with the country's situation on the earth's surface. The Union lies within the parallels of latitude 22° N and 35° S, and parts of continents lying within comparable latitudes must contain humid as well as desert regions. To this generalisation South Africa is no exception. As in the cases of Australia and South America the eastern areas are relatively well-watered, merging gradually into arid conditions in the west.

Even taken alone this explains the importance attached to moisture in the Union's farming. But another control imposed by the country's situation further accentuates the dependence of South African

agriculture on moisture supplies. Owing to the earth's movements in relation to the sun and the resultant seasonal shift of the pressure belts accompanying changes of temperature, the rainfall regime almost everywhere is seasonal. In the north-east and east the rainfall occurs in the summer; in the south-west and west in winter; and a narrow belt in which a small precipitation occurs at all seasons. This marked seasonal rainfall affects the position profoundly, for it means that much the greater part of the country is subjected to a yearly drought.

Unfortunately the Union borders only the northern margin of the Westerlies, and in consequence is denied the benefits of a well-distributed rainfall which New Zealand enjoys and which accounts for the marvellous pastures of that Dominion.

A further aspect with regard to the country's location must be noted, namely temperature. A wide range of temperatures occurs. Some areas are frostless; in others, e.g., the Karroo, frosts are liable to happen during any month of the year; and, in many parts frosts are a common occurrence during the winter months. In a few areas snow is occasionally seen, but the Union possesses no mountains permanently snow-capped.

The situation then governs the temperature and moisture conditions and, of course, influences the marketing of the country's products.

Before dismissing climatic features reference must be made to the reliability of the rainfall. Not only does the rainfall vary widely from year to year, but speaking generally, with the exception of a few districts, the rainfall during the year is erratic in its distribution. A maladjustment of moisture to plant growth within the season is therefore common, and, while the whole country rarely suffers from drought at the same time, nevertheless serious intermittent droughts are common over wide areas.

Two other physical features of the Union remain to be noted, namely topography and soils.

Roughly speaking South Africa is composed of a series of pleateaux bordered usually by rugged mountain ranges and culminating at an altitude of 5000 to 6000 feet in the plateau of the eastern Transvaal and the Orange Free State. In consequence no navigable rivers are found. Further, wide, level plains are absent, the relief of the various plateaus being undulating land broken by ridges and mountains.

Volumes might be written on the soils of the Union, but for the purpose of this survey all that will be noted here is that they are in main infertile; what good soils there are are patchy and restricted in extent; they are generally deficient in phosphates; and, the best arable land lies mainly in the interior.

So much then for a brief sketch of the principal physical features of the country. Our task now is to point out the more salient aspects in which these modify and have influenced the country's agriculture.

2.

Arid, Semi-Arid and Humid Land.—In South Africa, apart from irrigated land, the intensity of agriculture varies directly with the amount of usable rainfall.

With the exception of a few sections, restricted in output by various factors in the south-west Cape, successful cropping is limited in general to the 24-inch isohyet. And when allowance is made for land which must be withheld from the plough, owing to unsuitable soils, rugged and stoney land within this isohyet, the estimation that only 15 per cent. of the country can be regarded as arable is justified—that is with more or less the present standard of living of whites and blacks. In other words the bulk of the country—

85 per cent.—can never be utilised except for pasturage.

At this point an axiom in farming should be noted. It is: that the limitation to animal production, apart from the contribution that may be derived by the purchase of concentrates by means of services or manufactured goods, is eventually determined by the potentialities of a country's cultivation. Although small in extent the relative importance of what arable land the Union possesses is hard to over-estimate, for upon it the future of animal farming will be largely dependent

Varying degrees of aridity within a country give a marked characteristic to its animal farming. As development takes place the drier areas are eventually used for the rearing of animals to be fattened off later in the better-watered districts. The reasons for this practice are not far to seek. Considerations connected with transportation account largely for it. It is cheaper to transport the animals to the feeds rather than vice versa—a statement which is easily understood when it is realised that it takes from six to ten pounds of dry vegetable matter to form a pound of animal tissue. Moreover, a loss occurs in fattening if animals are compelled to utilise much energy in foraging for food over wide ranges sparsely vegetated. In the better-watered parts the concentrates are locally produced, and further the carrying capacity of the vegetation per unit area is high; so that fattening here has the advantage of economies in transportation costs and in obviating a loss of energy by the animal when grazing.

But farming in regions where moisture supplies are meagre has other distinctive features and the chief of these is the manner in which operations are directed to the best utilisation of the available water. In regions, typically oceanic and within the Westerlies a major agricutlural problem is the disposal of the

surplus water by drainage; in the latitudes comparable with those of South Africa the problem often is the conservation of temporary surplusses of moisture. So that in a country like South Africa irrigation assumes importance, and more than that, on land not irrigated, not only are crops having a low water requirement employed, but practices, e.g., a wide escapement of plants, are taken advantage of to make the rainfall as effective as possible.

The natural features connected with the varying average annual rainfall of the different parts have had their repercussions in a great many other directions. Of these mention will be made of one at this juncture. In the 18th century development embraced chiefly the drier areas, loan tenure ruled and the unit of land was very large. As permanent settlement developed the unit remained large and indeed in those drier areas cannot be otherwise. This means not only that the country has been influenced by extensive methods in farming, but that relatively speaking there will always be parts where farming will be extensive and others where it will be of an intensive nature. Unlike a humid country such as Belgium where farming throughout is intensive, a country like South Africa, embracing as it does arid as well as humid regions, will follow contemporaneously extensive and intensive methods in agriculture. In consequence parts of the country in which the unit of land must perforce be large will feel the influence of urbanisation to a much smaller degree than in the humid parts allowing of a relatively small unit. On the whole economic density will be correlated with social density and in consequence a part of the rural population will remain under the influence of a sparsely populated environment, i.e., they will remain relatively backward, not easily amenable to change, but self-reliant—a fraction then that must be taken into consideration when policies are formulated.

3.

Temperatures and a Rainfall Decidedly Seasonal. —Naturally the agriculture in those parts where the rainfall occurs in summer must differ markedly from the parts where it occurs in winter. The thermal requirements as well as the moisture needs of plants must be met. Consequently a good grass growth is found only in those parts enjoying an adequate supply of moisture during the hotter months; where the summers are relatively dry a poor growth of grass is found and the vegetation composes a high proportion of shrubs. The pasturage afforded by the indigenous vegetation is therefore suited to different classes of animals, and so the type of pastoral farming, too, will differ. Cattle thrive best on grasslands, and sheep and goats utilise the grazing on shrub lands better than cattle do.

Moreover the class of animal found is governed to a great extent by the arable production of the region, because the type of crop grown varies directly with the moisture available during the different seasons. While the potency of temperature as a control is almost completely overshadowed by that of rainfall in South Africa, nevertheless when considered in conjunction with the occurrence of the rainy seasons the modifications it causes are material. Temperature conditions in the Union meet the thermal requirements for a wide range of economic plants. In South Africa warm temperate and tropical crops are chiefly cultivated in the summer rainfall areas, while cool temperate crops are found in the parts having a winter rainfall. And certain crops, or their by-products, are better utilised by some types of animals rather than by others. In consequence, for example, the potentialities for dairying in the eastern Transvaal, where hay crops are easily grown, are greater than in the south-west Cape where these crops are grown with

comparative difficulty and where the natural pasturage —typical of a Mediterranean climate—is poor.

Where the rainfall is markedly seasonal, as opposed to other parts of the world where it is evenly distributed throughout the year, definite limitations are imposed on agriculture. The number of different crop plants which can be grown is less, consequently greater difficulty is experienced in following a good system of crop rotation. Diversified farming is therefore more restricted, and the maintenance of permanent fertility becomes less easy. Again, obstacles in the preparation of the soil are increased because of the more limited periods in which the soil is in a proper condition for tillage. Further, since the pasturage must be largely seasonal, too, greater care must be exercised in the provision for supplementary feedstuffs than say in a country like New Zealand where temperatures in winter are not so low as to inhibit plant growth. As a small offset to these disadvantages the advantages of a dry, favourable harvesting period must be remembered. The quality of South African crops is high owing largely to this circumstance; and, the control of weeds during the dry season is comparatively easy.

4.

Distribution Within the Season.—Needless to say, the distribution within the season is also of extreme importance. Where the march of the rainfall follows closely the curve of the moisture requirements of the developing crop, a very much smaller amount during the season will suffice than where the correspondence is not so close. It is conceivable that 12 inches of rainfall well spread may give higher yields than 24 inches badly distributed. Unfortunately a maldistribution of this nature is all too common in most districts of the Union. Naturally where a poor

distribution is accompanied by a low rainfall during a particular season, drought is accentuated.

5.

Reliability of the Rainfall.—For our purpose it must suffice to say that with few exceptions most districts suffer the effects of a very unreliable rainfall. This instability in the chief limiting factor of the agriculture of the country has far-reaching consequences. In fact, repercussions following on this instability affect the country's economic structure in no mean measure. These, however, will be discussed at a later stage.

6.

Effectiveness of the Rainfall.—Although the general mean value of the rainfall for the Union is relatively high, its adequacy for agriculture is disappointing. This is the result of the action of factors which tend to dissipate the rainfall markedly.

(a) **Evaporation.**—One of the vital agencies referred to is the humidity, or rather its comparative absence, in the atmosphere throughout the year. Although the actual humidity of the air throughout most parts of the Union is fairly high, owing to the high temperatures prevailing, the relative humidity is low. The consequence is strong sunlight resulting from the comparative absence of cloud, free radiation, and a high diurnal range of temperature. Under these circumstances it is easy to see why the evaporation is high. At the Union Observatory, Johannesburg, the evaporation from a free water surface is 75 inches, i.e., two to three times that of the rainfall, and in some other parts of the Union it is even higher. In fact in the more arid and hotter parts the evaporation from a free water surface must be four to five times that of the rainfall.

Because of the high summer temperatures, the percentage of the rainfall evaporated is much higher in the summer rainfall area than in the winter rainfall area where the temperatures during the rainy season are, of course, much lower. This partly explains why the winter cereals in the south-west Cape can be successfully grown under an annual rainfall too low for the profitable cultivation of summer crops, within similar isohyets in the Transvaal.

(b) **Run-off, Erosion and Irrigation.**—The intensity of the major part of the precipitation in the summer rainfall area is extremely high, and the result of its pelting, torrential character is to deflocculate the surface soil granules into a comparatively impervious layer. The air is imprisoned in the interstices of the soil, consequently the water is admitted very tardily and the run-off becomes heavy. In the winter rainfall region, because of the penetratable character of the soils of that region, the loss through run-off is probably very much less than in the summer rainfall region.

This loss varies according to the intensity of the rainfall, the topography of the land, and the character of the soil. If these favour run-off serious consequences result, especially in a country experiencing a decidedly seasonal rainfall. Erosion of the soil is almost invariably worst in the countries having continuous dry conditions over a long period of the year. During the dry season the ground surface is apt to become powdered through the tramping of animals and in this condition the surface soil is blown away by winds or swept away with the first rains.

The fact that erosion is rightly considered to be one of the Union's major problems warrants some description of the underlying causes.

Man is no mean geological agent. In countries of marked seasonal rainfall like South Africa, by allowing his animals to over-graze the pasturage, he

upsets the balance set up by Nature between the vegetation and the rainfall, and in doing so he often gives motion to forces which eventually bring about his undoing. Fundamentally the whole problem resolves itself into the maintenance of the annual humus increment to the soils of a region. If the vegetation be denuded by poor range management, veld-burning or other causes, this increment diminishes. As a consequence the physical condition of the soil is impaired, its retentiveness for water decreases, and so conditions for plant growth become uncongenial. The vegetation becomes sparse, the run-off from the rainfall increases, and erosion sets in. Whenever the balance between the vegetable cover and the rainfall is disturbed erosion usually follows. Man's action often involves violent disturbances of this nature, and records of his settlement in various parts of the world show him to be a potent geological agent in the eroding of land into a derelict condition.

It needs little imagination to see that the effects of drought are intensified in those parts where eroded land is common. The water-holding capacity of the soil is lessened; the run-off is increased; because of the lower water content, the decrease in plant nutrients and beneficial soil microorganisms, the productivity of the soil is diminished; plant growth becomes more intermittent, and, in consequence, farming becomes more hazardous.

Eroded land occurs most frequently in those regions of the world where the rainfall is decidedly seasonal in character, i.e., where the year is regularly divided into a wet period followed by a long period of dry weather. During the dry season the surface of the soil is apt to be powdered, chiefly by the tramping of animals, in which condition some of it is easily swept away by wind or water.

Other factors modify the loss of soil through erosion. Naturally the configuration of an area will

have its bearing, for the more mountainous a tract is the more liable it is to loss from erosion. Again, certain soils, especially alkaline soils, are more readily affected than others. The extent to which land, particularly that surrounding the sources of rivers, has been deforested, is also an important factor.

It remains to discuss briefly the effect of run-off on the possibilities for irrigation—a fact to be noted because of the bearing of irrigation on the utilisation of the Union's rainfall. The value of the run-off stored for irrigation purposes lies chiefly in the fact that in the summer rainfall area cropping during the dry winter is made possible, consequently on such land two crops can often be cultivated annually. In the winter rainfall area by means of irrigation crops can be grown during the dry summer, and, in the all-the-year-round rainfall area both summer and winter crops can seldom be grown without the assistance of irrigation. Moreover, irrigation gives stability to the production of some crops grown during the rainy season. Naturally in the more arid districts ordinary field crops could not be grown without its assistance.

The sub-continent has no Nile, and irrigation can never approximate the importance it does in Egypt, the Punjab or eastern Australia. In many of the better-watered areas it will certainly be of importance in supplementing the rainfall, but unfortunately in those parts where irrigation is most necessary, physical conditions are against the possibility of its ever effecting any decided change in the present outturn of the land. Although according to Kanthack and Lewis the Union's potential irrigable land is only in the neighbourhood of 3,000,000 acres, nevertheless its wise exploitation is a question of the first magnitude to the community. Assuming then, that about 3,000,000 acres may be under irrigation in the future, and that half this area is to-day irrigable, it is easy to see why no extraordinary rise in production can be

looked for from this source. A comparison with other countries offers little consolation, for we find that in India over 50,000,000 acres, and in California alone 10,000,000 acres are to be irrigated. The Siddur scheme in Sind itself is to water 8,000,000 acres from the Indus!

(c) **Percolation.**—The loss due to this cause is very much less in the Union than in countries of low mean annual temperatures, and of a smaller annual and diurnal range. Part of the rainfall percolating into the earth is undoubtedly the source of supply for springs and boreholes. However, on arable land of a reasonable depth and texture, percolation seldom carries any of the rainfall to the water-table. From the point of view of cultivation under rainfall alone losses due to percolation are of little moment in South Africa.

(d) **Transpiration.**—Based by analogy on the findings found in other parts of the world and supported by practical experience the transpiration ratio of plants is high. In other words the water required for the elaboration of plant tissue in South Africa is high compared with more temperate regions; in fact it has been computed that whereas a ton of lucerne in North Dakota utilises four to five acre inches of soil moisture, in South Africa the requirement for the same quantity of lucerne is in the neighbourhood of fourteen inches.

Hail.—While the losses from hail are apt to be exaggerated, the individual may at times suffer severely. In some parts it certainly acts as a deterrent to the cultivation of some crops, e.g., wheat grown for grain in the eastern Orange Free State, and, in the inland plateaux it makes for a measure of insecurity in the growing of deciduous fruits. According to Census returns the annual loss to the country occasioned by hail is approximately £500,000.

7.

Absence of Internal Waterways.—Owing to its topography the Union possesses no inland waterways and it is largely due to this fact that the exploitation of the relatively fertile interior was so long delayed, and it need scarcely be said that since the exports of a young country are chiefly raw materials of a bulky nature, the absence of cheap inland water transport is, and must remain, a natural disability of far-reaching consequences.

Connected with the pre-mining period in South Africa, de Kock emphasises the fact that transportation by rendering a larger quantity and variety of commodities accessible to the consumer, in view of the reduction in the cost of obtaining these commodities, raises the standard of living, and that again leads to increased physical and mental vigour.

On the other hand, the lack of transportation facilities tends to promote stagnation, primitive conditions and methods, and a low standard of living. It retards development. "It helped to perpetuate the isolation to which the stock farmer in the interior was exposed, and in that way to render him immune to the civilising influences of social intercourse and education." The absence of inland waterways was particularly onerous at this period because there were no railways, few roads worthy of the name and practically no bridges.

8.

Diseases and Pests.—Intimately related to the physical features so far dealt with are the diseases and pests of the country. In few parts of the world, similarly situated as to latitude, have diseases and pests modified farming to the extent found in South Africa. Indeed it is probable that in the development of no other of the more important younger countries

has the proportion of State expenditure on remedial measures been so high as in the Union. The relatively high winter temperatures have a marked effect on the losses due to diseases and pests, since in these circumstances the multiplication of parasites is not restricted by long hibernation periods. It is largely for this reason that the animal industry in South Africa has been handicapped more than has the husbandry of animals in any of the other younger countries.

The natural flora of any country contains a number of plants toxic to animals; but in South Africa during the dry seasons, and more especially during intermittent drought, animals will often eat these poisonous plants which under more congenial circumstances they would not touch. The total losses from this cause form an appreciable figure.

Among pests other than pathogenic micro-organisms the most important are the prickly pear, jointed cactus, jackal and the locust. These certainly are the causes of enormous direct and indirect losses to the country.

9.

The Resources of Mining.—The role of mining in the past development of the country need not be detailed here. Suffice it to say that mining, through the improved facilities it gave in communication and transportation, and the internal market it created, rejuvenated an otherwise relatively inert population and in turn changed South African agriculture definitely into modern commercial farming.

But in a country so sparsely populated as is the Union the prospects in mining cannot be ignored by the farmer. Fortunately Nature has been liberal in her endowments in this connection. Gold abounds, and its production acts as a stabiliser of the country's economic structure for in times of depression its appreciation in value offsets the decline in value of

the other products of the Union. Added to this, the natural requirements of a metallurgical age are not so well met in any other country of the world of comparable size. The resources in coal, iron, copper, tin, platinum, lime, manganese and others have scarcely been touched. And because of the growth of the internal market consequent upon the development of mining the South African farmer will be wise in doing everything possible to further the interests of the mining industry. The repercussions of mining on farming in South Africa have been of immeasurable value in the past—similarly they will be of incalculable assistance in the future.

Mining of a temporary type may often be of doubtful value to the permanent welfare of the community. But in South Africa with its enormous underground wealth, mining assumes a permanency of type which cannot but redound to the benefit of the nation as a whole, and, of course, to farming as well.

10.

So much then for the natural advantages and disabilities of the country. But before discussing the reaction of South African farmers to their environment, it is necessary to survey briefly one or two aspects of that environment, which, because of their bearing on the general situation and so on agriculture, cannot be neglected.

Changes in the Union's Economic Structure.—The present position of South Africa cannot be adequately visualised without recognising the rapidly changing transitional phase through which the country is passing.

The Union has reached a stage in her national evolution where decided changes in traditional customs are taking place, involving, in many respects, a radical

reorganisation for the future, both politically and economically. Mining is fast losing the dominant position of twenty years ago; manufacture is becoming firmly established; and, instead of being occupied principally with the importation of agricultural produce, to-day, the country's trade in this industry is overwhelmingly that of exportation.

As elsewhere, the fortunes of the Union's farming industries are, of course, inextricably bound to those of mining, manufacturing and commerce. The contributions of any one of these to the national dividend are dependent on the prosperity of the others. The measure of success which South African farming attains will largely be reached by the manner in which it conforms to a changing economic structure of the country as a whole.

Changes from one phase of development to another are usually difficult to negotiate in any country, but this is particularly so in the younger countries, because generally insufficient time has elapsed in which to build up the necessary reserves of capital and experience.

The growth of other industries must promote a more rapid urbanisation. Arguing by analogy with development in other countries this will mean that the standard of living of a large proportion of the population will rise, and to meet the requirements of a larger internal demand and of wants on a higher scale, farming will not only have to become more intensive, but will have to cater for a more specialised demand. And in farming, apart from horticultural enterprises, more specialised production presupposes in the broad, the production of animal products rather than grain growing.

In manufacturing superficially South Africa would appear to be in an advantageous position. Coal, iron, lime and others, she possesses in abundance; labour, demanding low wages, is plentiful; raw

materials, wool, mohair, hides, cotton and so forth, can be produced in wide range; and a protective policy is pursued to cater for manufacture's infancy. But after a certain stage progress seems to be restricted. Apart from the disadvantage of a late start, two reasons may account for this restriction: namely, a small internal demand and inadequate capital.

The wants of less than two million whites are soon catered for, and those of the six million natives, with their present standard of living, are small; and before the manufacturing industries can enter an export trade with confidence, a preliminary canter in a home market of some size is necessary. But to compete successfully with established industries in other countries, the costs of production must be low; large scale production, with its economies, can effect this; but large scale production requires large supplies of cheap capital, and the uncertainty of the South African situation deflects foreign capital to enterprises in other countries of a more stabilised outlook. In spite of these handicaps the Union's manufacturing industries must grow, particularly in processing agricultural products and in the production of less refined products—and in the latter connection the less exacting wants of the local natives and those in more northerly territories should not be lost sight of.

11.

The Population.—So much for the environment in which South Africans are placed. But what of the people themselves?

Between the white races to-day it is generally held that more tolerance is being shown. But it would be folly to blind oneself to the effects of past conflicts and to the dissensions which unfortunately still exist.

The part of the national debt attributable to war and to the quelling of rebellion is an inadequate

criterion of the setbacks caused by the conflicting aspirations of different sections of the community. Far more serious is the apathy to enterprise which follows, the diversion of capital from the country, the discontinuity of directing policy and the subversion of the latter to racial ends. Happily civil armed conflict is a thing of the past but disharmonies still exist, and although to a lesser degree, the effects are the same.

The fact that the majority in the rural areas are Afrikaans-speaking and that the English-speaking people predominate in the towns is apt to promote a certain measure of discord in assessing the claims on the State of the country's industries.

With regard to the coloured races the position is even less satisfactory. The native policy of the past, like that of the present, has been of a vacillating and nebulous character, and has had much to do with the discontent which occasionally shows itself in serious manner. The problem of their future bristles with political, social and economic difficulties. To this difficult and intricate problem has been added the Indian question. Like the native, the Indian tends to accentuate the uncertainty of future development and so affects broader issues which cannot be neglected.

Speaking broadly the white farmers in the Union maintain a standard of living comparable with farmers in Europe or America. Not so the natives. They are limited in land, capital and modern technique and therefore their lot at best can only be a little better than that of the ryot in India. In consequence virtually two standards of farming obtain in the Union: the relatively advanced type followed by the European and that of a comparatively low order practised by the native. The far-reaching effects of this state of affairs should not be overlooked. With few exceptions the quality of farming products in

South Africa leaves much to be desired and the contribution from the native is a decided factor in lowering the general standard.

An example may be cited here. Half the cattle in the country are owned by natives, who regard them as tokens of wealth rather than as sources of production and so the native is concerned with numbers rather than with quality. Obviously the native's attitude here must have a retarding influence on the Union's meat situation.

A significant feature of native agriculture is that by social heritage the native is a pastoralist rather than cultivator—a fact which has some bearing on agrarian policy.

Two remaining aspects of the situation concerning the native are worth comment. During recent years the number of immigrants has not exceeded the emigrants, a condition of affairs attributable to many causes, all of which cannot be detailed here, but one of which is that the unskilled labour of the country is almost entirely native labour. For various reasons the prospects of an influx, of any material magnitude, of white emigrants into South Africa must remain remote, and yet one of the country's most urgent needs is for a larger internal market. Surely the alternative is to regard the six million natives as having some of the potentialities of immigrants? Educated and trained their earning capacity and purchasing power would be raised, and consequently the welfare of the whole population will be enhanced.

Finally, the native, uneducated and untrained, performs his tasks inefficiently, and gradually the white master not only accepts this as inevitable but acquiesces to a low standard in his own work as well. In this way, since efficiency is a basis on which self-respect is based and without self-respect character must suffer, the moral fibre of the white is weakened.

12.

South African Instability.—Before proceeding to survey the way in which the population has reacted to their environment, as sketched above, something must be said on the instability of the Union's production and the uncertainty in its outlook.

The instability in the production of one of the primary industries of the country, and in the general situation permeates, often disastrously, the whole economic structure of South Africa. It has been fostered by various agencies. Political upheavels; the exploitation of more or less ephemeral enterprises such as ostrich and Angora goat farming, and diamond mining; maladministration, such as loan tenure; the protection of wheat and sugar-cane cultivation; these and many others all have added their quota. But most important of all are the violent fluctuations imposed by the climate of the country. This uncertainty is particularly onerous at the present phase of development, because the more efficient section of the population is too limited numerically for the mutual support required by the specialised labour necessary for large-scale manufacture.

Human nature being what it is, a small measure of uncertainty in life's affairs acts as a powerful incentive to progress by the robust, but if too frequently robbed of the rewards of his efforts, man's advances are retarded. Certainly men work most diligently when the returns for their labour are relatively assured. Those farming in areas of precarious production tend to have a lethargic outlook in which a lack of enterprise—for, without hope, indolence or procrastination is fostered—or wild speculation rules. Provision for the future is neglected and advances become spasmodic. In general private enterprise becomes subordinate to State enterprise and the evils of bureaucracy become accentuated.

An attempt to detail fully the consequences of this instability in the situation cannot be undertaken in the compass of this book. But to stress the gravity of this feature of the Union, a few more of the results of marked instability will be noted.

Provision against risk is a cost of production, so that where instability rules the cost of production is increased—a serious aspect especially now that South African farming has entered a definite commercial phase, where her surpluses must be disposed of in the keen competition found in international trade. Because of the risk, capital investment in stock, equipment, manures and so forth, is discouraged. Therefore farming tends to become less thorough and more exploitive rather than constructive. In general, too, because of the insecurity of contracts the charges for money are high.

Instability discourages continuous organisation for specific purposes, e.g., co-operation, credit societies and local social groups of various sorts, thus reacting injuriously on community life. Incidentally, as a result, a poor distribution of produce is found, giving wide fluctuations in price for the same commodities in different localities and at different times.

Conditions of demand for a commodity of steady supply and quality are more certain and reliable; on the other hand instability of supply diverts demand to others sources. Moreover the irregularity of supply causes transportation charges to be high, consequently farmers are placed at a disadvantage when competing with those of more favoured countries.

A common result is that the poorer farmers tend to drift to the more unstable areas, and the better to the more stable—excepting those highly efficient farmers having abundant capital to tide them over bad periods. Land charges hands too frequently, or is often left in the possession of those willing to live

under poor standards. Closer settlement is restricted since the minimum area of the farming unit tends to be such as will provide a good average income, i.e., the size of farms will tend to be larger under conditions of uncertainty. Immigration is retarded or diverted to parts of the world where more security is found.

Obviously, too, the instability in primary production retards manufacturing and, in turn, commerce.

The general instability in the South African outlook tends to handicap development. Immigrants prefer to settle in countries where future progress seems more certain. Foreign investment, on which young countries are largely dependent for their development, is diverted to regions of more economic and political security.

Palpably an agrarian policy which may be formulated for the Union cannot ignore measures designed to stabilise the situation.

13.

REACTION TO THE ENVIRONMENT.—The present situation shows many trends where the controls set by the environment have been fairly clearly recognised, but the full force of others has been very inadequately visualised. Our purpose now is to depict some of the main features of these trends in order to understand their bearing on agrarian policy. But before proceeding to aspects specifically of an agricultural nature some broader considerations must be discussed in survey.

Fiscal Policy.—The Union has definitely taken up a strong protectionist attitude. The merits or demerits of the case in general will not be argued. Fundamentally it is a natural outcome of the nationality complex, strong in South Africa, and curiously enough, accentuated the world over by the

War—history's biggest lesson in the futility of a restricted outlook in the grouping of peoples!

Be that as it may, the fact remains that behind the tariff walls of the country the increases in manufacturing are measured in terms of fold—percentages are somewhat inadequate! To hasten the pace, as witness the South African Iron and Steel Corporation, the State now virtually enters as an entrepreneur. As a result of this development urbanisation will set a new pace; the higher wages of the town will have their repercussions in the countryside, and the farm labourer will demand more. In turn this will stimulate the use of labour-saving machinery and more efficient farm management in order to keep down costs. Incidentally this means that farming as a mode of living will become subordinated to the business role. No doubt the farmer will employ more and more the services of urban people to assist him in processing his products and in other marketing functions. In consequence he will be able to concentrate more on primary production in the way of farm utilities and so specialisation in farming will be ushered in more rapidly.

If dreams come true—and much depends on increasing the wants of the blacks in the Union and to the North—and an expanding outlet is found for manufactures, the internal demand for the products of farming will increase, owing to the increase in the use of raw materials from the farm and to the additions required in foodstuffs by increased town populations.

To counterbalance the increased cost of farm requisities and of labour the farmer will have to strain every effort to make himself efficient as a producer at lower costs. The effect of the country's protectionist policy in manufacturing will be salutary in the sense that it will spur the farmer to more efficient methods in his operations and in his organisation.

If manufacturing continues in its present stride the standard of living of many urbanites will be raised, which will entail a more specialised demand in general for farm products, and in sympathy the supply from the farms will become more specialised.

The reflex of extensions in mining on agriculture will have much the same results: the standard of living of more will be raised, wages on farms will increase and again an added call will be made on the farmer to specialise in quality and to diversify his production.

Development in commerce too will accentuate this trend. In transportation the Union's commerce is at an advantage over overseas competitors in local markets, of course, and in any trade which may spring up with her northern neighbours; on the other hand the Union is handicapped by the absence of internal waterways and by long hauls over steep gradients. These two disabilities bear heavily on commerce dealing with agricultural products because these products are naturally of low value in relation to bulk.

But import duties and embargoes, designed to protect the farmer, are in force. Heavy duties are imposed on wheat, sugar-cane and peanuts, and certain grades of Rhodesian cattle are debarred entry into the Union. In the sequel the peculiar necessity for State aid in agriculture will be discussed. Undoubtedly the farmer must be helped. The merits of the present protective steps taken in this direction will be dealt with later. At the moment it should be noted that the farmer has been unable to adjust himself to his environment without their assistance. In general economists are practically unanimous in the opinion that the farmer, relative to the townsman, is not commensurately rewarded for his services to the community; and, in view of the fact that because the protection of secondary industries raises the cost of

of his requisites some argument may be advanced
isting the farmer by protective legislation. But
of this presently.
t this stage our concern is to appraise and to
s the ways in which chiefly the farmer has
l to his environment. The aside, that happinss
nd when the adjustment of people to their
nment is harmonious—environment being the
y of their experience—is not without its
ice. For the corollary, that tragedy is the
of a failure in adaption to change, is also true.
ith Africa the tragic circumstances of the poor
is largely due to their failure to adjust them-
to the rapid whirl of development initiated by
s.
oadly speaking, until mining gave the country
equired transportation facilities for arable
g, pastoral enterprises were the chief features of
Afrcan agriculture. The arid nature of much
country settled at that date largely ruled out
tion also. Mining not only provided railways
gave an internal market for the products of
tivator. Grain production came into its own,
n the case of maize, importation ceased and
ally exports began. Improvements in refrigera-
pened up the European meat markets to New
d, America and Argentine, countries superior in
atural endowments as regards pastures to South

Moreover this country's animal population
dly depleted in numbers during the Boer War.
sy to see, therefore, why she could not compete
ly in the meat trade and why so much effort
be focussed on grain production. Waiting for
mals to multiply, the farmer, compelled to earn
hood, was forced to exploit his possibilities in
farming.
rmers are often rightly conservative—Nature so
obs those too veturesome of their rewards—

and they are prone to adjust themselves slowly to changed circumstances. In consequence it is not surprising to find South Africa, a pastoral country, laying undue emphasis in its production on the products of cultivation. But it is a matter of surprise that those responsible for the direction of policy should not have anticipated world trends earlier. However, further discussion on this point must be deferred to a later stage.

In the main, farming has adjusted itself to the distinctive requirements of the different hyetal regions. In fact the terms, "summer" and "winter rainfall" parts, are common currency nowadays in the speech of the farmer. But conformity with this natural demarcation of the rainfall zones came about only after much misdirected effort had been expended. For example, the cultivation of wheat in unsuitable areas of Natal, the Transvaal and the Eastern Cape persisted almost to the present day. Determined efforts initiated by the claptrap preaching concerning "dryland" farming were made to grow grain in areas too arid for its cultivation. However, the farming to-day is fairly closely correlated with the natural features of the country in so far as the warm temperate crops are now chiefly grown in the summer rainfall region and the cool temperate crops mainly in the winter rainfall region. Moreover, the relation between the natural vegetation and the livestock farmed is to-day a closer one, and so we find cattle confined chiefly to the grasslands, certainly few in the areas of desert shrub.

The shortcomings of the indigenous vegetation for pasturage were early recognised and numerous attempts were made to introduce the pasture grasses and clovers of America and Europe into South African agriculture. In general these attempts were abortive. Eventually plants from new sources were tried and some of these now give promise of rejuvenating South African farming. Incidentally the ox has

ıed the chief agent in farm traction largely
ıe of its superior ability over the horse to main-
tself on relatively uncongenial pasturage of a
ıutritive value. Moreover the equines are not
to supersede the ox in South Africa; in many
motor traction is likely to do so, but where
ls are resorted to, the superior rustling capability
ox over the horse will ensure the retention of
rmer.

ı meeting his situation with regard to diseases
sts the South African farmer has made admirable
ces. He has consistently urged the necessity for
ıtive and remedial measures, and his strong
ɛntation in the legislative bodies of the country
ısured compliance with his demands. In conse-
ɛ, tracts, which, because of disease and pests,
not be farmed formerly, are now being farmed
a fair degree of safety and preventable losses
ghout the country have diminished enormously.

14.

ut disabilities connected with moisture are the
imitations to South African farming. How has
rmer adjusted himself to this situation?

ccording to Official Year-books the average
from drought, disease and exposure have been
ows:—

	1925-26.	1926-27.	1927-28	Average.
...	471,513	686,771	700,811	619,698
... ...	2,367,333	4,209,287	4,898,866	3,852,162

eaths themselves cannot be taken as indicating
tal loss, for to obtain the latter the decrease in
ction from emaciated animals must also be
This total loss is on the whole due to a lack

of feed—a situation which must appal those farming within the influence of the generous climate of the Westerlies! Those conversant with conditions in South Africa realise that these losses cannot be avoided altogether, but it would be a sorry state of affairs were this drain to continue on the same scale—especially in a country to-day exporting maize and where farmers are often compelled to sell their lucerne hay far below the cost of production.

Certainly then the farming community has not adjusted itself properly to the possibilities, or rather, probabilities, of droughts occurring. Fortunately provision for these periods of shortage in the pastures is becoming more common and a fair number of farmers meet the situation by establishing reserves in the way of hay, silage, grain, spineless cactus and so on—but much remains to be done in this direction.

15.

Naturally to meet the stiuation recourse is taken to irrigation, and rightly so. In South Africa a lack of sunshine is practically never a limitation to plant growth—given moisture and all is well, a fact appreciated by everybody. Incidentally, the resiliency in recovery which the Union's production so often shows must be attributed in large measure to the reliability of the sun's unrestricted contribution to growth. Irrigation gives, then, an assured production which can be relied upon to furnish animals with feedstuffs during period of deficiency in the natural pasturage, and so it is not surprising to find a high valuation placed on irrigated land. The farmer with some irrigated land feels he can face drought with equanimity. Nationally, too, the role of irrigation should be regarded as a stabiliser in the Union's farming—namely, to supplement by means of feedstuffs the poor pasturage in

those areas having a precarious and low rainfall. So that while the potentialities of the country with regard to irrigation are meagre—experts agree on a possible acreage of three millions — they are extremely important.

But development in irrigation may easily outstrip the economic situation in farming, and, there is ample evidence to show that this has already been the case not only in South Africa, but in America and Australia as well. At the moment irrigators on land in the Union subject to frost, are prone to grow crops for sale, chiefly grain crops, a practice basically wrong, for grain crops grown under irrigation cannot compete with the grain produced in other parts of the world on rainfall alone. The yields under irrigation are somewhat higher but this is more than offset by the higher overhead charges and other costs involved in irrigated farming. With an unorganised animal industry to absorb his products, added to a small internal demand for many crops other than the grains, the South African irrigator is in a quandary as to what to cultivate. Reference is not made here to those frost-free areas, where crops like citrus, of high monetary value per acre can be grown, but it must be remembered that the bulk of the land at present irrigated is subject to frost.

In the Union the cheapest schemes have already been constructed, and these chiefly in those tracts most in need of irrigation. The remaining projects will be infinitely more costly per acre, and, in general, lie within parts of South Africa where the rainfall alone permits of a tolerable standard of farming, i.e., below the eastern escarpments.

But, as often elsewhere, in South Africa the politician overrules the statesman and is apt to throw things out of gear; and so, not unexpectedly the hoary shibboleth of "back-to-land" holds sway.

Man is easily impressed by his conquests o Nature. The elemental in him modifies his vie deeply. To bend Nature to furnish his wants i spectacular manner is to him a wonderful achievem —and to force Nature to grow marvellous cr instead of desert shrubs must surely be Olympi How the politician glories in his magic! How s satisfied in his ignorance, and how ephemeral memory when the polling-booth looms ahead!

Acquisitiveness is often lured from its goal the glittering. The geographer, Dr. Bowman, sa "The wealth of the irrigated lands of the worl India, Mesopotamia, Egypt, Spain and even of own country (U.S.A.)—has been borne in upon with such insistence that we attribute to engineer skill the ability to transform the deserts of the wo into productive gardens. If this were true we sho pursue an easier course if we left the mid-zone of pioneer lands where normal agriculture and grazi may be prosecuted and go at full stride into desert."

Results in America.—Again, the politician, wi ing to preserve a mythical optimum urban-ru ratio of the population, pours vast sums of mor into irrigation in trying to force the failures from land back to the land. What has been the experie of the United States in this direction? Dr. Bowm writes: "The reclamation service has been in existe for twenty-five years. It has done constructive wo in providing water for valley floors and bench lands selected places in the arid west. It has develop irrigation projects where water has been stored a where the settler has been invited to come in un terms regarded as generous. The Government h thus tackled directly the problem of the populati capacity of the land. Yet what has been the resu In twenty-five years how many people have actually taken care of? The total farming populati

upon the twenty-four national irrigation projects of the West after twenty-five years of Government aid and generosity is but 137,000. (The population of the United States is 120,000,000!). Irrigation alone will not solve questions in general over-population or the much deplored cityward movement. It is easy to see that the most trifling improvement of agricultural practice in settled communities will accomplish much more in the production of agricultural products and the growth of population than all the millions that have been poured out upon the irrigation projects of the West in a quarter of a century." That is the finding of an observant man on the position of irrigation in the United States—a country capable of irrigating nearly 60,000,000 acres. South Africa at tremendous expense may be able to irrigate 3,000,000 acres in the dim future!

Patriotism cannot ignore the natural endowments of a country. Moreover, the politician should remember that the social destiny is not necessarily correlated with economic density. He may crowd a number of people under an irrigation ditch, but can he maintain them there with a decent standard of living? And to try to force back on the land those who have failed there through incompetence is peurile in its naivety.

Much premature expansion in irrigation has been due to the desire to use irrigated land as a means of absorbing the indigent whites of the country.

But other factors, too, have had their bearing here. Vested interests, realising the appreciation in the values of their land following on irrigation, have, no doubt, exerted an undue influence on State coffers. Again, the value of irrigated land in the Karroo areas and in frost-free areas has been confused with that in other tracts where frost is liable to occur. In the Karroo irrigated land is rightly highly valued because

the lucerne grown on this land is all important to the sheep farmer during droughts.

That frost is a potent control in irrigrated farming may be seen in the following table[1] which shows that the value of production from this land varies directly with the frost free period:—

3	....	296	....	56.71
2	....	229	....	44.62
4	....	186	....	38.30
6	....	137	....	26.73
5	....	125	....	29.74
1	....	113	....	14.89

More than this the time required to use the land fully under a newly constructed scheme has been under-estimated. How protracted this period is may been seen from the following data furnished by Teele[2] in the United States:—

5	years	....	....	....	....	36
10	,,	....	....	....	....	45
15	,,	....	....	....	....	52
20	,,	....	....	....	....	56
25	,,	....	....	....	....	60
30	,,	....	....	....	....	62
35	,,	....	....	....	....	63
40	,,	....	....	....	....	65

Commenting on this Table, Teele says "The real problem in reclamation work is bringing the land into use promptly enough to prevent financial failure caused by heavy carrying costs chargeable to land that is not producing."

So far then as irrigation is concerned South Africa has dashed ahead of economic requirements in her State schemes.

Before dismissing the subject a warning note should be sounded, and is discussed in the following section.

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(1) *Widstoe*—Success on Irrigation Projects.

16.

Alkaline Soils.—The two great factors withholding from cultivation millions of acres of land in arid and semi-arid parts of the globe are drought and alkali; and even if the drought factor is eliminated by irrigation, the presence of brak may still prevent successful crop production. In fact practical experience has demonstrated time and again that the brak evil may be greatly aggravated by irrigation, and in many cases brak salts appear in the surface soil in harmful quantities only after the land has been brought under irrigation.

Brak is commonly known as "alkali" in America and other countries. It refers to the presence of soluble salts in the soil in sufficient concentration to injure plants, and may include salts which in smaller concentration are decidedly beneficial to plant growth, e.g., nitrate of soda.

All arid soils are, of course, not necessarily affected with brak, but arid conditions in general are favourable to the accumulation of brak salts, whereas humid conditions are not. In the latter case abundant rainfall, coupled with natural drainage, will effectively prevent any harmful accumulation of soluble salts.

Frequently the concentration of brak salts in the surface soil is not as yet sufficient to injure crops, but unless proper precautions are observed, almost invariably the natural tendency is for the concentration to increase under irrigation.

Crops vary greatly in their tolerance for brak soils, so that concentrations which are decidedly injurious to certain crops may have no harmful effect upon others. There is, however, a limit to the amount of brak which can be tolerated by any crop, and occasionally the concentration is so high that the growth of ordinary farm crops is impossible. The natural vegetation of such lands is generally confined

to plants useless to man. Notable exceptions occur, however, as instanced by much of the Karroo vegetation which forms pasture, and by Australian salt bushes, which are readily eaten by all kinds of stock. In extreme cases brak lands are wholly destitute of vegetation or bear only such saline growth as is rejected by all domestic animals. The reclamation of land badly affected with brak is costly, and frequently not worth attempting, save in the case of exceptionally valuable land; but if the brak tendency is recognised while the concentration is still small and comparatively innocuous, the adoption of simple precautionary measures may prevent the rapidity of accumulation and even maintain the crop-producing power of the land almost indefinitely.

A noteworthy feature of brak soils is the fact that high cencentration of soluble salts generally coincides with richness in plant food, so that these soils are characterised by high potential fertility.

In dry-land arable farming, lands badly affected by brak gives returns so uncertain, largely because of their poor mechanical condition, and the difficulty of finding crops to withstand the high salt concentration, that their cultivation is seldom undertaken. Where the concentration is slight, some of the more tolerant crops, e.g., sorghums, cotton and salt bushes may be grown. In the extensive farming ruling in these parts, sufficient land for cultivation is usually easily obtainable and the necessity to utilise this land seldom arises, unless, as in India, the pressure of population is very great. The presence of alkali or the possibility of land becoming alkaline, are questions of vital importance to the irrigator in these regions. Even in parts of California where the water used is remarkable for its low salt content, some of the most valuable land is becoming useless for odinary cropping. In South Africa, too, instances abound where land is becoming useless. Indeed, although evidence is difficult

to obtain, it is conceivable that ancient civilisations based on irrigation, e.g., Mesopotamia, have disappeared because of the gradual accumulation of salts in the soil.* The damage is slowest to show itself on coarse textured soils supplied with water having a low content of salts, e.g., from snow-covered mountains. It is quickest where the soils are of a heavy nature, the evaporation high and the water highly charged with salts., e.g., flood water from areas like the Karroo. In the latter case the run-off carries with it large quantities of salt in solution; this water is held in reservoirs until required, but is subject to a high rate of evaporation while there, so that by the time it is used for irrigation the concentration has increased to a high point indeed. The heavy textured soils found there, initially fairly highly charged with salts, are very retentive of salts like sodium, carbonate, and in consequence deleterious effects soon become apparent.

Remedial measures are given in books on the subject. In a few cases these may be profitably followed; but in a good many cases it is questionable whether the profitable reclamation of brak land is possible. Unquestionably, judicious irrigation will lower the rate of salt increase, and at times may postpone almost indefinitely a harmful accumulation. The writer was informed by Hilgard's successors in California that no permanently effective means had been discovered to prevent the heavier types of irrigated land from becoming saline to an extent injurious to ordinary crop plants. Under-drainage

* (1) Whitney—Soil and Civilization (p. 191), does not subscribe to this statement concerning Mesopotamia. He writes: "Their works were destroyed and their agriculture killed—not by the exhaustion of their soils, but by the complete change of the inhabitants of a sedentary nature to a race of nomads who despised a farming life." Discussing the subject of alkali in general, he says: "Great irrigation systems have been developed with apparent success when this hidden menace (alkali deposits beneath the surface) has arisen to devastate entire districts."

and other measures may delay the rapidity with which land deteriorates, but have not proved an infallible remedy.

Taken in conjunction with the high cost of making provision for water supplies, the problems connected with alkaline soils give a certain measure of uncertainty to the ventures of a State investing heavily in the development of its irrigation resources.

17.

Immigration.—The question as to whether in population South African land is saturated involves the problem of immigation.

In certain areas, owing, it is attributed to faulty range management and the poor growth of the natural vegetation on eroded land—a consequence of faulty rangemanagement — the farming population has decreased. In other parts, e.g., the Highveld of the Transvaal and Orange Free State, the farm unit is rapidly decreasing in area;and this, unless checked by a greater development in mechanised farming which requires a relatively large unit, will largely offset the decrease taking place in the Midland districts. In addition it is likely to cater for some time to come for the present farmers' sons. But judging by the fact that the immigration into the country is balanced by the emigration it would appear that any rapid increase of the rural population is unlikely to take place, and moreover that the opportunities in South African farming as viewed abroad as being inferior to those found in Canada, Argentine, Brazil and elsewhere.

Several reasons may be advanced to explain the almost complete absence of additions by immigration to the rural population of the country, notwithstanding the generous terms on which land can be procured through the assistance of the Land and Agricultural Bank and the Lands Department. In

the first place it must be remembered that the unskilled labour of the country is almost entirely native labour. It is easy to see then that the magnet, high wages for this class of work, which has attracted so many of the immigrants in the cases of North America, Australia and New Zealand is absent in that of the Union. Secondly, what Crown land remains is restricted in extent and poor in quality. Thirdly, methods of production are very different from those found in Europe; whereas the settler in Canada or the United States can be largely guided by his European experience, in South Africa this is relatively not the case. Fourthly, because of the uncertain production and the necessarily large unit of land employed in farming, the settler requires a capital of between £2,000 and £4,000, which is several times as large as that considered adequate in many other parts of the world. Moreover the uncertainty in farming production in the Union is now well known and in itself acts as a deterrent to settlement by immigrants. Fifthly, the settler must possess the somewhat rare ability to manage native labour well. And finally, he must be temperamentally suited to a comparatively lone existence because of the large unit of land necessary in South African farming.

18.

Native Agriculture.—The most urgent problem requiring solution in native farming areas is to reclaim the land already badly eroded and to prevent a further spread of the evil results of soil erosion.

In the native areas there are, on a small stock basis, 2.42 animals per morgen, about four times as high as the average carried on European land—and European areas, despite boundary fencing, paddocking and some supplementary feeding, are commonly overstocked!

On the whole the native land is often of the best in the Union; and, until comparatively recently the pastures were luxuriant, water was abundant and the animals were maintained in good condition. To-day the pastures are badly denuded, what plants remain are in the main little edible, sheet and donga erosion are rampant, springs are disappearing and the watering of animals is becoming increasingly difficult, the condition of the degenerate animals is deplorable, little milk is available and the chief products sold are bones and hides—a state of affairs almost entirely attributable to overgrazing. The land is overstocked with scrub cattle which lower the average quality for the Union. Formerly a cow gave eight to twelve calves during her lifetime; to-day the average is only four to five—an index of the degeneracy which has taken place in herds. More than this the land is overstocked with sheep, which because of their close grazing makes the situation worse for cattle; worse still, it is overstocked with goats which are notoriously destructive of vegetation. Finally, the enfeebled cattle are of poor assistance to cultivation and in consequence crop yields, already low on the exhausted soils, are diminished. Already much of the land is beyond redemption and much of that remaining must inevitably become derelict unless effective measures are quickly taken.

The extent to which the productivity of this native land is deteriorating may be gauged by the fact that the Glen Gray district, to-day larger than before, is supporting 17,000 less natives than formerly when the population was 60,000.

A contributing factor to this states of affairs is the prevailing form of holding land, i.e., communally.

According to census returns native parts are deficiency areas in grain to the extent of eight million bags—a fact attributable to soil exhaustion, poor work cattle and ignorance.

In the Ciskei a poor black problem has arisen and already relief measures have forced themselves on the authorities.

Among the results of this state of affairs is a fluctuating labour supply for Europeans. An improved native agriculture would give steady returns to the native, a stable revenue to the state, an uniform labour force for the whites, and an increased internal demand for the manufactured products of the country.

Obviously this situation cannot be allowed to continue.

To remedy the position active steps must be taken quickly. The principal ones being: to induce the natives to keep fewer animals in better proportions of each class, and of improved types; to educate the native to relinquish some of his traditions—at present he regards his animals as a token of wealth and in consequence is unduly impressed by numbers rather than quality; to change the system of land tenure to forms more conducive to constructive farming; and to expend more on a rational system of education suited to the needs of the native. At the moment the money for education is totally inadequate, compulsory attendance is absent and little continuity is shown in receiving instruction.

Palpably it is useless to supply the natives with more land until they are taught how not to abuse the land at present in their hands.

The native is by social heritage a pastoralist rather than a cultivator and a wise direction of his agriculture must take cognisance of this fact.

Fortunately the recently established Office of Agriculture for Native Affairs is under the direction of one of the Union's most competent technical agriculturists, and if adequately supported in his proposals his tact and insight will do much to ameliorate matters.

19.

Technical Agriculture.—Previous to 1899 Cape Colony and Natal possessed moderately well established Departments of Agriculture, and the Transvaal already had Dr. Arnold Theiler at work. It is true that veterinary problems of the country were being earnestly attacked; in Cape Colony, Elsenburg Experimental Station had been started and elementary courses in technical agriculture were being given at one or two centres. But on the whole the activities undertaken were quite inadequate to meet the growing needs of the country, a fact quickly grasped by Lord Milner when considering reconstruction after the Boer War.

A larger number of experimental and demonstration stations, situated so as to solve the pressing problems of representative areas, and supervised by technical men, were started throughout the country. The officers of these stations and those of the various departmental divisions lectured, inaugurated co-operative experiments with farmers, advised, and in a great many ways assisted the farmers with their difficulties. New varieties of crops and one or two new crops such as teff grass, destined to play an important role in farming, were introduced. Stud animals selected by qualified men were purchased from abroad, both for the Governments—who allowed the services of the sires for nominal fees—and for private individuals. Land Banks assisted settlers and others, and co-operative movements and agricultural societies were formed.

Production improved in quality and quantity by leaps and bounds; the importation of many agricultural and pastoral products quickly dwindled, and, in 1907, with the reduction of the railway rates to the coast, the first shipments of maize for export were made possible. From now onwards production not only rapidly met the increased internal demand, but provided for a large increase in the number and

quantity of the farmer's products. Indeed, while the exportation of certain products such as wool and mohair had long taken place, it may be said that, dating from the first shipment of maize for export in 1907 South African farming definitely started on a career in world commerce as opposed to the comparatively petty local trade which it had previously engaged in.

Further alterations in administration, when the Act of Union came into force, resulted in far-reaching and important developments—particularly with regard to technical instruction and research work. Agricultural schools, where practical and technical instruction were given to prospective farmers, were opened; and, the influence of the demonstrations given at these institutions and of the young men trained therein, was invaluable in the general uplift of the industry throughout the Union. By the pooling of resources and men, and the increase in the staff of technical men, largely comprised of returning Government-scholarship holders, bold research was rendered possible in many directions, and was attended with the most conspicuous success on the part of the veterinarians under the immediate direction of Sir Arnold Theiler. Large tracts of country previously disease-stricken, could now be profitably farmed; locusts were largely controlled; new breeds of crops specially suited to local conditions appeared; and in every direction pressing problems were being solved and fallacies exposed. The year 1916 gave birth to two faculties of agriculture; these were soon well equipped and a few years later the first agricultural graduates, educated in these institutions appeared.

In the passage of time more data are accumulated, light is thrown on much which was obscure, mistakes of the past will be laid bare, and policies will have to be revised; but before

adversely criticising the work of their predecessors, those who have been called upon to take over the responsibility of direction will do well to bear in mind the debt of gratitude the Union's farming community owes to its technical pioneers.

In recognising the disabilities confronting an industry, composed of disorganised and isolated producing units, to adjust itself to its environment the country showed a keen appreciation of the value of technical men and of the necessity for generous State aid. In fact, to a great extent, the environment was adjusted to the activities of the people.

Certainly much has been done, but much remains to be done. Changing circumstances often require a changed mental orientation and it is held by some that in recent years bureaucratic control in the Union has been apt to follow the stereotype and tradition rather blindly. Two examples will be given to uphold this opinion, namely, the over-emphasis shown by the official mind in fostering grain production and the attitude displayed towards agricultural research.

The official attitude towards grain production has been to foster the sale of grain rather than the feeding of grain as is evidenced by the facts that duties are imposed on imported wheat and maize, by the construction of an expensive elevator system* to facilitate the export of grain, by low rates charged for transporting grain, and by the effort spent on technical work on the cereals—an effort totally disportionate to the inadequate effort spent on fodders, grasses, pastures and range management. This attitude has exhibited a lamentable lack of foresight, for little thought would have been necessary to realise that

* (1) It is not intended to imply that the construction of the elevator system is not warranted. On the contrary the indirect advantages of this system outweigh the loss incurred in operating it. But it is contended that the elevators were primarily constructed to foster the sale of grain abroad and locally.

South Africa must remain a pastoral country, and that grain could be produced more cheaply in other countries better suited over vast areas to the production of grain. What surplus grain South African can produce should be used, of course, to cater for the needs of the animal industry—at present notoriously badly maintained. Of what use the heavy expenditure on excellent veterinary work and other services for the animal industry if eventually the final product can scarcely be sold?—and it is sold with difficulty because the quality from inadequately fed animals is poor.

With regard to research the indictment is even more serious. Farming is a science, a business and a craft. Essentially it is composed of innumerable enterprises by which a large proportion of the people of any country derive their livelihood, consequently general interest is usually focussed on matters relating to aspects connected with management and craftsmanship. It is, of course, the oldest of professions and it is not surprising, therefore, to find that modern technology has contributed less to agriculture than it has to many other industries. Compared with mining and manufacturing social heritage, through the ages, has amassed a wealth of knowledge in farming, which although empirically gained, nevertheless leaves, relatively speaking, less for science to improve upon.

However, the work of Biffen, Theiler and others illustrates the advantages which can be made through science. Economists are agreed that the remuneration for the services of the farmers are disproportionately low when compared with those professions whose livelihood is governed by the law of increasing returns. Obviously then, whatever can be done to alleviate the lot of the farmer should be done, and unquestionably science can do much in this direction.

Agricultural research is characterised firstly by the high expenditure involved and secondly by the long

periods usually required before significant results can be obtained.

Farming is dependent upon area; supervision, therefore, is difficult, and so large-scale production is rarely seen. The businesses are carried on by numerous small-scale independent units, none of which can afford the necessary cost of fundamental research. But the role of agriculture is so important that its welfare must be catered for, and therefore the need for State aid in the researches attempting to solve the problems of the industry is obvious. Relative to the question of State assistance, O'Brien says: "Insofar as particular industries are unable to increase their efficiency to the maximum by their own unaided efforts, it is the right and the duty of the State to come to their assistance in the national interest. The measure of State aid, therefore, depends upon the degree of self-help of which an industry is capable; if any branch of national production can be shown to be in a position where it is peculiarly helpless to improve by its own efforts, its claim for public assistance is unanswerable. An example of such an industry is to be found in agriculture."

The dependence of agricultural research on State aid is recognised by all leading countries, and in the budgets of each not only is the sum set aside substantial but the trend is for the amount to increase A knowledge of this fact is common, but the manner in which this money is expended is not known to many and indeed comparatively few have given the matter much thought. And yet the way in which this money is spent is vital to the efficiency of the research conducted.

In a few of the younger countries expediency has demanded that this work should come directly under State control, i.e., that the money expended by civil servants who themselves supervise the work of other technical civil servants. Unquestionably at times some

excellent results have accrued in this way, but in the main it is a method wasteful of money—a fact long recognised in the older countries and by the thoughtful in younger countries. In consequence the tendency is for enlightened administrations to follow the procedure of allocating these funds to institutions independent of direct control by civil servants.

The reasons for following this method are understood when the nature of agricultural investigations are understood and when the limitations of the civil service for this type of work are appreciated.

Agricultural problems are concerned with living things, themselves capable of infinite variations subjected to an environment composed of an enormous number of variables usually requiring long periods for their full expression. Obviously then the time factor is of extreme importance, and consequently research in this field must be continuously conducted over a long periods. Work of this nature is commonly alluded to as long-time research, and continuity of effort is vital to the success of this type of research.

The high cost of agricultural investigations is often due to the conditions which govern long-time research. Plant growth under a given environment may give entirely different results to those obtained in another environment—consequently experimental stations, often engaged on relatively similar work, must be placed in several localities, e.g., a citrus experiment station in one area is unlikely to meet the most urgent needs of another area.

Some problems, including those of an exploratory nature, can be solved in short periods, and are spoken of as being of a short-time nature.

How does the civil servant fulfil the requirements for that work under the demands made upon him? In the main, of course, his duties are largely concerned with regulatory services—or should be—which at the outset tends to cramp the attitude of mind of the

research worker. However able the officers concerned may be, the best research work cannot be done when hampered by the inevitable restrictions and routine common to all State services. Added to this the continuity of investigational work too often suffers because of changes brought about by political pressure, administrative demands, and other causes.

The civil servant, too, who must show early and successful results in order to support his Minister at polling time, is often apt to undertake only that which he knows will be thought successful, for at all costs he must succeed. Work, problematic in its outcome, is frequently not attempted, and, in consequence, progress bearing on a considered long view of the industry is often neglected.

Good cretative work certainly requires industry on the part of the worker, but it is too closely allied to the subtile to flourish under regulation or routine, and so the best work is usually done by those untrammelled by the irksome observance of red-tape conventions.

Under the circumstances it is only to be expected that the major portion of scientific research hitherto turned out in South Africa should be done by public servants. In his far-sighted way, Lord Milner saw that one of the most important steps towards the reconstruction of South Africa after the Boer War would be the technical guidance of farming. In consequence he introduced a number of technical agriculturists who in turn introduced other investigators. Obviously much of the first research work in agriculture was done by public servants, and it is difficult to see how this work could have been otherwise accomplished. But the tradition continues to hold sway and so to-day few research workers outside the public service are found—in fact a mere handful compared with several hundreds in the Department of Agriculture.

Without the criticisms and independent work of privately controlled bodies bureaucratic Government has no check, and without them loses a powerful ally in furthering the interests of the country.

Undoubtedly short-time research, sometimes that of an exploratory nature can often be investigated by the technical civil servant. But there can be no question that problems requiring long-time research are generally best left to bodies outside of direct State control, e.g., universities and other technical institutions. These bodies may or may not have State nominees on their boards and of course they should be empowered to collect funds from private sources to assist in the maintenance of the institutions.

Knowing the inefficacy of public money spent on research by civil servants, private interests will often willingly endow private institutions where they would be unwilling to submit to further taxation. These subscribers, too, are usually vitally interested in the problems under taken and often supply useful criticism and suggestions.

PART II.

AGRARIAN POLICY IN SOUTH AFRICA.

Introductory.—As the present depression (1931) throws into relief the country's position some comment on it may not be out of place.

The Union's farming has now definitely entered the commercial stage. Moreover, because of the small internal demand an outlet for its farming products must perforce find its way into international trade. Obviously then the South African outlook in farming cannot be divorced from the situation abroad.

Tritely stated, a world's depression exists, or, as some would say, a recession to lower price levels is in process. The farmers often hear this, but some are apt to overlook its bearing on their present position. The farming industry is not peculiar in the hardship it is enduring at the moment, although the opinion that it is suffering more than most industries is almost unanimous.

The world depression is due to many causes. Gold production is not increasing fast enough to meet the demands of increased exchange; the world's purchasing power was badly overestimated, particularly in America, and in consequence production outstripped consumption on a colossal scale; disorganised Russia, disturbed India, and chaotic China have all accentuated the world's low purchasing powers; people obsessed with a nationality complex have raised tariff barriers which obstruct trade channels; the Hatry crash increased the feeling of uncertainty and pessimism engendered by the Wall Street panics and

a drastic curtailment of credit followed; manufacturers restricted their outputs, trade diminished, and unemployment increased; and so on.

In a period of low prices, to meet his obligations the farmer is almost inevitably compelled to increase his production—and the farmers the world over have resorted to the same expedient. Added to this, mechanised agriculture on the wide plains of America, Argentine and Russia has increased production very markedly during the last decade. After all the stomach capacity of the world is limited and consequently surpluses in foodstuffs cause inordinate drops in prices. This is exactly what has happened. And from what has been said above it is easy to see why the farmer's production of raw materials for manufacture are not easily sold.

Will the world depression lift soon? Too many variables enter the situation to encourage prognostication. What indications there are seem to point to a slow recovery. Certain things will help. A return to optimism; international agreements on the lowest gold reserves concomitant with safety required by banks; a reduction in tariffs all round; a return to stability and constructive development on the part of Russia, India and China; all these will help, but how soon these changes can be brought about can only be a matter of conjecture. The safest course would appear to lie in an adjustment anticipating a continued low level of prices and a slow recovery in the world's purchasing power.

Such then are the world's conditions which in their effects bear intimately on the South African outlook, and, of course, on the Union's farming.

1.

In the portrayal given of the situation several features, with which the policy of farming should be concerned, stand out prominently.

In the first place the general situation of the Union is characteristised by rapid changes politically and in the economic structure, so that, under these circumstances an intelligent anticipation of the direction in which trends are moving is all important if unnecessary hardship is to be avoided.

Imposed on this position is the instability ruling, in outlook and in the country's production, which acts as a deterrent to constructive effort. Any measures which modify the violence of the fluctuations in the situation must react to the general welfare.

The best utilisation of the natural farming resources will be brought about by following a policy which stresses the roles which should be played by the animal and fruit industries.

In the main the arable land available is limited in extent and fairly poor in quality—vital facts because of their basic importance in the agricultural economy of the Union and to the necessity for the soil's constructive husbandry.

The high preventable losses from drought must be taken as an index of the maladjustment of the rural community to farming in regions of uncertain rainfall.

Erosion seriously threatens the natural endowments of the country, and to ward off this danger, among others, steps must be taken to improve native farming and range management in general.

Much of the enterprise under irrigation has been premature and in consequence the irrigator is in a precarious position. Measures must be taken to improve the lot of the present irrigator in areas subject to frost and to foster sound policy on this land.

What agrarian policy exists is nebulous in outline often misdirected, and in regard to agricultural research frequently lamentably shortsighted.

A survey of the steps which should be taken to introduce a healthier general political atmosphere and a saner co-ordination of all the country's major activities lie beyond the scope of our discussion, which must be confined directly to the farming industry or to immediately related aspects.

2.

Stability.—The major problem to be solved in connection with rural enterprises is to ascertain how a greater measure of stability can be obtained in a production giving surpluses to be marked abroad.

Sufficient has been said to indicate why emphasis must be laid on fostering the production from animals and horticulture. Fortunately such a policy will tend to stabilise farming; added to this, the South African farmer's comparative advantage lies in these, and it is in conformity with the trend in world markets.

3.

Fruit.—The cultivation of fruit is, or should be, only undertaken where moisture supplies are assured—a fact in itself promoting stability in supplies. Further, the high quality of South African fruit, allied to the Union's advantage in an opposition of seasons to the industrialised regions of the world, gives a measure of security in profitable marketing. The cultivation of fruit in suitable localities should be encouraged and the importance of carefully studying the wants of the consumer abroad should be stressed.

4.

Animal Farming.—But of far greater importance than fruit is the animal industry.

Any advance in pastoral farming must tend to stablise general production in a country where the

natural controls give their influences erratically. Basically this is so for the reason that in lean periods animals can be moved or feedstuffs can be transported to them; plants, of course, are stationary—after all has been done for them by the farmer, their full fruition is uncontrollable, since this is determined by the weather and not by man. Moreover, many areas, in which grain-growing is a hazardous undertaking, are suitable for fodder production, which if used to supplement the poor pasturage afforded by the indigenous vegetation will tend to mitigate losses in animals and so stabilise pastoral enterprises. Further, a properly maintained and well organised animal industry will absorb the feedstuffs which should be the main aim of irrigated farming, in areas subject to frost, to produce. Again, the surpluses in maize, peanuts, cotton-seed meal and other crop products, which are finding an outlet abroad increasingly difficult, would be utilised locally. Obviously then, a properly conducted animal industry must form the keystone to the country's farming arch, and so must add to the security of the Union's economic structure. If production, apart from fruits, is focussed on catering for the needs of a well-maintained animal industry, an interlocking of rural enterprises is brought about which must result in securing a more stabilised outlook.

At this juncture it is germane to ask how animal farming can be advanced. This immediately brings us to the role played by pastures in agriculture in general and to South Africa in particular.

5.

The Role of Pastures.—Good pastures, in countries farmed by whites, are basic to a balanced and advanced agriculture. Countries of a Mediterranean climate, (e.g., California and the South-west Cape, may reach prominence through the cultivation of the

various fruits, but, because of the poor grass growth in the dry hot summers, these regions suffer a natural disability in their animal industries—and history points the lesson of the value of manure in the profitable maintenance of soil productivity.

The greatest advances in animal husbandary have taken place in countries lying within the Westerlies, e.g., England, Holland, Denmark and New Zealand. And the reason is not far to seek. Within the Westerlies the rainfall is evenly distributed throughout the year and the intensity is such that a drizzling type of precipitation, giving a low run-off, is the rule. These damp conditions favour a substantial growth of succulent and nutritious grasses and clovers, suitable in pastures to all classes of farm animals.

In the farming industry, specialisation, apart from horticultural enterprises, takes place when grain production as the chief feature of agriculture gives way to the production of animal products. Obviously diversity in this specialisation can only take place where the pastures are suitable to a wide range in the classes of animals. The quandary of the Karroo sheep farmer in this connection is apparent; woolled sheep utilise to best advantage the desert shrub of the Karroo —in fact as pasturage for cattle, horses, pigs and mutton sheep the indigenous vegetation of this part is comparatively poor; in consequence when wool reaches low price levels, the sheep farmer is unable to relieve his position by substitution—he is compelled to continue with his woolled sheep. In others words, his prospects are definitely restricted by his pasturage.

When the grain growers of the Eastern States of America were faced with a crisis, because grain could not be produced by them in competition with the Middle West, they resorted to specialisation in farming, i.e., they went in for animal production. When the German market closed its doors on Danish wheat the Dane specialised in a like way. In England

events followed a somewhat similar course. In all three countries their excellent conditions for pastures enabled them to take full advantage of specialisation and of the principle of substitution.

So much for generalities on pastures. What of the situation in South Africa?

At the outset it must be admitted that the indigenous vegetation as commonly used has a low carrying capacity per unit area, a fact to be attributed to the nature of the rainfall and to the poor range management prevailing.

In the main the Union's rainfall is unreliable and the growth of plants in consequence is also erratic. Not only do intermittent droughts occur, but because the rainfall is markedly seasonal almost the whole country suffers from yearly droughts. In the Transvaal, Orange Free State and Natal the winters are dry and in the South-west Cape a summer drought is unfailing. In South Africa moisture supplies, more than temperatures, cause a cessation in plant growth. Moreover, over large areas arid conditions impose a restriction on the annual production of the vegetation.

The result of these circumstances on pastures is that in the summer rainfall region a strong flush of grass growth takes place in summer affording only a comparatively short good grazing season, because the rank growth soon falls away in palatability and in nutritive qualities; in the winter rainfall region the relatively low temperatures of winter do not encourage the growth of grasses nor do the dry summers. Obviously then the natural features of the South-west Cape do not favour good pastures and in consequence they offer no mean handicap to the animal industries of that region.

Unquestionably the largest hyetal region of the Union, i.e., the summer rainfall region, possesses the greatest potentialities for pastures, for cropping and for the development of the animal industry. The

chief problem in the pasture question in this region is to utilise the available soil moisture more advantageously. At present the soil moisture is commonly quickly depleted by the heavy growth of the plants. If this rapid growth could be kept down by proper range management or by the use of artificial pastures employing species which spread their active growth over a longer period, the available soil moisture would give a longer grazing season and pastures of a higher nutritive value—if grass is kept low the feeding value, especially in protein, is very much higher than when it is allowed to reached an advanced stage in maturity, added to this the moisture transpired is less.

Rational range management involving the proper use of supplementary feedstuffs will assist undoubtedly. By proper management the botanical composition of the veld can be changed to more desirable types in many areas. Mr. Melle, near Pretoria, has demontrated the value and practicability of doing this.

But possibly the greatest advance will come from the establishment of artificial pastures. The demonstration, initiated also by Mr. Melle, in which a cow was maintained for several years on an acre of Woolley Finger grass at Groenkloof cannot be dismissed as being of no guidance, for similar work at the Pretoria University farm and at Cedara give weight to the findings at Groenkloof. The high value of Rhodes, Woolley Finger, Kikuyu and Paspalum grasses when intensively grazed is unquestionable. But a great deal of research regarding the suitability of different areas for the various species, the best strains, the best use of fertilisers, best methods of grazing and so on, remains to be done. More than this, while past experiments have shown decided possibilities, practically none has been carried out to give reliable quantitative data—and the farmer is usually only convinced when he sees things done on a fairly large scale.

The methods by which improvements may come about cannot be detailed here. The salient fact is obvious: our pastures can be improved tremendously —in many parts land under indigenous vegetation, as usually managed, has a carrying capacity of a beast to several morgen; the indications are that the carrying capacity can be more than doubled by judicious range management and the establishment of artificial pastures. The importance of this promise cannot be over-emphasised.

With a foundation based on poor pasture, no matter how much care is taken in breeding, cattle will not give the most profitable response from the concentrates fed them. South African meat will not find ready acceptance on the European markets requiring a high standard, until quality can be obtained in quantity. And while the pasture situation remains as it is to-day it is futile to look for any rapid growth in the meat trade. The necessity for good pastures as a basis in dairying and other animal enterprises needs no further comment.

Any decided advance in the prospects of South African farming depends on improved pastures more than any other single factor. Compared with other parts of the world, the Union's natural endowments do not favour grain production. More than 80 per cent. of the country can never be used except for grazing; the trend of the international grain trade is against South Africa—other countries having wide fertile plains and employing a more advanced mechanised technique are too strong as competitors; and animal products of good quality will always find a market in the industrialised areas of the world. Obviously, apart from fruits, the South African farmer's comparative advantage lies in the production of foodstuffs from animals, a production dependent for its success upon the country's pastures.

6

Aspects Connected with the Animal Industry.—All possible being done to improve pastures, it would remain to urge the necessity for growing fodders where grain cultivation is uncertain, for a more general use of silage and for establishing feeding reserves in the way of hay stacks and paddocks of fodder trees and shrubs.

In a survey of this nature an outline sufficient to guide policy is all that can be attempted. Specific details must be left to the respective specialists and authorities; but before dismissing the animal industry a few more features of a general nature must be discussed.

In the main the policy to be advocated is to produce good quality in quantity. Figuratively speaking if this can be achieved marketing problems will largely solve themselves—modern competition for profits will ensure that—and while the importance of good feeding cannot be over-emphasised as a primary requisite, nevertheless breeding cannot be neglected as apparently it is. Professor Bosman says that in the three most important cattle breeding areas only eleven per cent. of the bulls are pure bred; a fact pointing to the necessity for strong measures being taken in the control of sires.

Hitherto the trend has been to stress protective measures, veterinary and otherwise, but the means by which good quality can be obtained have been seriously neglected. More than this, far too little consideration has been given to the disposal of the final product. Storage and transportation problems have been largely left to themselves. The best means of processing and disposing of old cows, unproductive old hamels and ewes have not been investigated—and that in a country producing a surplus of inferior quality! For these reasons alone the present policy of the Government in placing the Animal Husbandry Division under the administration of Veterinary Research and Services can only be viewed with misgiving. It will divert

the veterinarians from their legitimate activities and will tend to accentuate a bias at present wrong, namely to subordinate the other functions of a properly directed animal husbandry to that of animal protection—in other words the business side of these enterprises must tend to be neglected or the veterinary work of the country will suffer.

In urging the necessity for a further exploitation of the country's animal industry a further point should be noted. Statistical evidence goes to show a decided change in the diet of Western peoples. The consumption of the bulky foods, bread and potatoes, is decreasing, while the consumption of foods high in proteins, fats and vitamins is increasing—obviously a trend favouring a policy advocating the production of foodstuffs from animals. Moreover, since the cereals are being sold more cheaply—and they form an important item in the workman's food budget—more people will be able to afford a diet more generous in animal products.

Finally, as previously indicated, the soils of the Union being comparatively infertile and already often showing signs of exhaustion, are urgently in need of animal manures; and therefore an animal industry more intensively conducted will tend to rectify this state of affairs.

7.

Arable Farming.—The animal industry of the Union owes its unsatisfactory position largely to sins of omission; but the difficult situation of the cultivator is due to sins of omission as well as to those of commission.

As a background to the Union's cropping an attempt has been made to show that the arable land is restricted in area, poor in quality and that signs of soil exhaustion are often evident—factors which cannot be ignored in any serious consideration of agrarian policy.

In conformity with the protectionist policy being followed in the Union, substantial increases in the import duties on wheat and flour have taken place within the last decade. In fact the import duties of 1930 are more than twice as high as those ruling in 1920. Added to this, maize, peanuts, sugar cane and other products of cultivation are protected.

Now wheat grown in monoculture—virtually the case in South Africa—is a robber crop, for it then reduces the productivity of the soil. Much the same may be said of maize. Certainly where the export of this cereal is encouraged—the case in the Union—the soils again must suffer; the plant nutrients in the grain exported go to build up the soils of importing countries. Palpably then, the present policy in the Union in fostering the production of grain for sale is basically wrong. The soils are urgently in need of restorative crops and of manure and these requirements would be met were the policy of focussing cropping on catering for the demands of the animal industry followed. Figuratively speaking emphasis should not be laid on helping the wheat and maize farmers with their grain; State aid should be directed towards the improvement of their animal husbandry—and the directions in which improvements can be effected in this branch of farming are legion.

8.

Soil Exhaustion.—The portents with regard to the deterioration taking place in the country's soil cannot be thrust aside and they warrant discussion because of their bearing on national welfare.

Simkhovitch in his powerful essay, "Rome's Downfall Reconsidered," gives irrefutable evidence to show that one of the main factors in the decadence of Rome was soil exhaustion. Bradley in "The Enclosures of England" furnishes conclusive data to

prove that the poverty reigning in England during the fourteenth century and culminating in the enclosure of land in England after the rural revolts of the sixteenth and seventeenth centuries, was chiefly due to the same cause. It need hardly be pointed out that modern rotative farming with a free use of artificial fertilisers was not practised by the Romans and early English farmers. These two instances are cited in order to emphasise lessons of the past and to note the natural scope of the question of maintaining soil fertility.

Sir John Russell says, "the reduction of fertility brought about by cropping is called 'exhaustion' of the soil. It results from the circumstances that the nutrients and bases absorbed from the soil by plants are not returned to the surface but carried away more or less completely so that the restorative part of the cycle (of maintaining fertility) is broken. It must be understood, of course, that even badly 'exhausted' soils will still produce crops but of very low yields.

What is the situation in South Africa? It is our opinion that maize, our major crop, can be used as an index.

The Union's production of maize grain has been as follows, viz.:—

1921-22	....	13,480,000 bags.
1922-23	....	19,760,000 ,,
1923-24	....	11,230,000 ,,
1924-25	....	24,290,000 ,,
1925-26	....	10,092,000 ,,
1926-27	....	18,260,000 ,,
1927-28	....	19,170,000 ,,
1928-29	....	19,025,000 ,,
1929-30	....	23,200,000 ,,
1930-31	....	15,900,000 ,,

(Official estimate).

Allowing for fluctuations connected with seasonal vagaries of the weather, the tendency has been for the country's production to remain more or less stationary. No one conversant with farming in South Africa can doubt the fact that, although an enormous improvement can still be effected, farmers are to-day conducting their operations much more efficiently than in the past. The maize used as seed to-day is more acclimatised than in the past and is therefore inherently better suited to the various localities than has been the case hitherto; more care is exercised in cultural methods, and fertilisers are much more commonly used. But the country's production, on much the same acreage, does not show the upward trend one would expect. Is it that while the productivity of some soils has been maintained, in some cases even improved, and in many the poorest have been abandoned, that the general tendency is towards soil exhaustion?

In Germany and in England the yields per acre of crops have gradually risen during the last fifty years. An inquiry as to why this should be the case in those countries may, by comparison, shed light on the subject. The high yields there are largely due to a more advantageous climate for cropping than is the case in South Africa, and the increased production per acre can be attributed to a number of causes.

Firstly, improved varieties have been obtained; secondly, better cultural methods, including a very liberal use of fertilisers, are general; thirdly, rotative farming based largely on restorative crops, is almost the invariable rule; and, lastly, both these countries are deficiency countries with regard to concentrates, so that to meet the needs of the intensive feeding of animals large quantities of concentrates are annually imported, a large portion of which eventually finds its way to the soil in the form of animal manures.

Practice in South African farming differs from the above radically. A relatively small amount of the grain produced is fed to animals and an exceedingly small quantity of concentrates is imported; rotative cropping is the exception rather than the rule; and, the average fertiliser dressing is far below the requirements of comparatively low yields per acre.

Experiments conducted at the Pretoria University Farm are relevant to our discussion. In 1921 a number of experiments employing different rotations were started. Some details concerning one will suffice to illustrate our point. This three-year rotation, maize fertilised with 300 pounds of superphosphate followed by maize without fertiliser, followed by cow peas ploughed under is compared with check plots on which maize is grown continuously with and without superphosphate. The average yields of these plots for 1926-7 and 1927-8 were as follows:—

Maize continuously without fertiliser—5.01 bags per acre.

Maize continuously with 100 lbs. super. per annum—8.47 bags per acre.

Maize in the rotation—9.31 bags per acre.

The yields on the differently treated plots vary from year to year, but after looking through the results over the full period in which the experiments have been conducted, there is no question that on this soil an average one of the Transvaal, the productivity of the plots on which maize is grown continuously without fertiliser is rapidly declining, while that of those receiving fertiliser is practically stationary, and of those in the rotation slowly increasing. In scrutinising the results it is significant too that during years of drought, i.e., 1925-26, the yield on the plots cultivated continuously to maize without fertiliser give almost no grain, while the others in the same

years still give fair crops. In time as the cumulative effects show their influence no doubt the yields on the plots continuously cultivated to maize without fertiliser will be reduced to an extremely low level, while those rotated and fertilised will give substantial increases over their present good yields.

In his survey of the costs of maize production Parish has shown definitely that the use of fertilisers pays handsomely in increasing yields.

According to the Agricultural Census (No. 8) in 1924-25 the cultivated land in the Transvaal received 27 lbs. of fertiliser per acre and in the Orange Free State an average per acre of only 6 lbs.! A fair maize crop takes about 12 lbs. of P_2O_5 per acre from the soil. Assuming the fertiliser used to be entirely superphosphate of ordinary grade, then about one-sixth of these amounts would be P_2O_5; so that during 1924-25 in the Transvaal approximately 3 lbs., and in the Orange Free State less than 1 lb. of P_2O_5 was returned to the land to meet this drain. Since then the use of fertilisers has increased markedly but is still totally inadequate to meet the needs of good crops on soils initially not high in productivity.

From what has been said above justification would seem to exist for the statement that our low yields per acre and almost stationary total production point to a situation in which the trend is towards soil exhaustion.

The Union's wheat is grown mainly in the South-West Cape on soils now generally admitted to be badly impaired both chemically and physically, and animal farming under a Mediterranean climate is always attended with difficulty because of the poor growth of summer pasturage. But Victoria has shown us what can be done with animals under physical controls very similar to those of the Cape. In the Cape the wheat farmer could employ more of

his crops for grazing and for hay, and, rotations including wheat, oats, field peas or vetches could surely be devised. Lucerne grown on rainfall alone is an outlet too which might be further explored. Even in wheat itself have we not been rather myopic in breeding for grain alone? In Australia the chief utility of some varieties is to furnish pasture, while others are looked upon definitely as hay types—certainly a recognition by the Australian of the importance of animals in his farming. These local problems concerning the South-West Cape are surely not beyond the ingenuity of the technical men and farmers of that part of the Union. To-day the position of the farmer centreing his production chiefly on grain for sale, is serious, but his plight will become worse if the present policy becomes permanent.

The world's known phosphatic resources are quickly dwindling and modern agriculture is so dependent on phosphates that some leading students of the position maintain that future wars may possibly be waged over supplies of these. How near the truth this view may be is a matter for speculation. However, it does stress the importance of phosphatic fertilisers, and one wonders whether the Union's phosphate deposits are receiving the attention warranted.

9.

Necessity for Stabilising Acre Yields.— Enough has been said previously to indicate the general role that should be played by cropping in the agricultural economy of the country. Properly played this role will assist in stabilising the Union's production from farming. But the unfortunate results of an uncertainty in crop yields after often overlooked.

An example to show these may be of assistance. Suppose that in eight consecutive years two farmers

each in separate districts, A and B, obtain the following yields from maize:—

Year.	A. Bags per Acre.	B. Bags per Acre.
1	15	11
2	8	8
3	0	5
4	12	9
5	15	11
6	0	5
7	3	6
8	11	9
Total	64	64

Each obtains the same average, i.e., eight bags per acre per annum, but B farms at a distinct advantage. His relative loss in the good season is small because prices are low, but his returns in the bad seasons are relatively high because prices in those years are usually high. Moreover his farming operations are unhampered by having to purchase feeds during times when prices are high. Obviously he can undertake constructive enterprises, requiring continuity of effort, with greater assurance than is the case with A. In the absence of compensating factors it is wrong then to suppose that the average yield is all important and to assume that what A loses in the swings he gains in the roundabouts—certainly over the whole period he does not gain to the extent that B does. (These examples are not far-fetched. If B farmed in an area of assured rainfall but of poor soils his yields might well be those given; and, if A farmed in a district of good soils but erratic rainfall the yields given could easily be representative).

The purpose of giving this example is to stress the necessity for modifying fluctuations in yields. Nationally, too, the bearing of so doing must be

obvious; and in the country's cropping much can be done by the farmer to stabilise his output. A wider escapement of plants than is the rule would be of assistance, the object being to have only sufficient plants to mature on the available moisture; a more general use of fertilisers in those areas warranting their use would help, since the richer the soil the lower is the ratio of dry matter to the water used; the control of weeds and improved cultural practices would lend their quota.

10.

Wider Range of Crops Required.—Two remaining aspects of the Union's cropping remain to be discussed in their relation to this thesis: the range of crops cultivated and the problems requiring investigation.

The range of crops extensively grown is very small, due no doubt to the extensive bias hitherto given to South African agriculture. Palpably to exploit the country's resources a greater diversity in crops is desirable. Unfortunately proper machinery for the systematic introduction of new economic plants is wanting. No regularly employed explorer for new plants is employed by the Department of Agriculture —the number in the service of the United States Department of Agriculture would surprise the layman. And in view of the facts that the country's farming must rapidly enter a more intensive phase employing a wide range of plants, and that in many areas the irrigator is in a quandary as to what to grow, it would seem that those responsible have been neglectful in this direction.

11.

Investigation.—Speaking generally the agronomic problems of the Union have received a great deal of attention by investigators. Among the main adverse criticisms which are tenable is that work of a basic scientific nature has been neglected and that of a more

superficial sort undertaken instead. So that we find fundamental physiological and biological problems in grasses and drought resistance in plants have received scant attention. The next criticism is more trenchant, i.e., that insufficient co-operation has existed between the experimentalist engaged in solving questions concerning the animal industry and the technologist in plants. Obviously in South Africa the closest co-ordination in research should exist between the agronomist and the investigator of many problems confronting animal husbandry—particularly those of a nutritional nature.

The policy outlined for the animal and cropping industries will solve the main problems connected with droughts. However, one or two further relevant observations may be noted.

The intermittent flow of the rivers and springs in the country has far-reaching effects on irrigation—on supplies and on the silting up of reservoirs—and an afforestation policy designed to protect the more mountainous regions in areas of sufficient rainfall would do much to help matters. The long gestation period in forestry precludes private enterprise undertaking such schemes on an adequate scale; but it would seem to lie within the province of the State, and projects eventually self-supporting could surely be devised.

12.

Erosion.—Two outstanding characteristics of erosion must not be overlooked—it is cumulative and insidious. The longer erosion is allowed to go unchecked the more destructive are its effects. Once dongas are allowed to form run-off is facilitated and eventually floods accentuate the process. Wind and sheet erosion are especially insidious in character, as years may elapse before their evil effects are sufficiently apparent to constitute a warning.

Apart from that of cultivated land, obviously the problem is mainly concerned with range management.

Range Management.—As indicated above, erosion is closely related to the annual addition of organic matter to the soil. Any decrease in the humus content of the soil brings about a decrease in its water-holding capacity and cohesiveness. This changed condition immediately reacts on the type of flora it will maintain and the quantity produced. As the vegetable cover decreases the run-off of the rainfall increases, erosion is encouraged, and the remaining soil becomes less suitable for plant growth. Palpably then, the problem confronting the farmer is to maintain the vegetal cover as near the maximum as possible, while at the same time supplying adequate pasturage for as many animals as he can.

Notwithstanding its importance in maintaining the carrying capacity of the vegetation and its incalculable value in checking erosion, good range management is still in its infancy. It is usually absent even on State experimental farms.

Primary Evils.—For our purpose here, only the principal effects of over-grazing and destructive grazing will be noted. The changes from a useful to a comparatively useless type of vegetation, or to its partial destruction, and of the soil from a non-eroded to an eroded condition are gradual, and over short periods, i.e., two to five years are not easily recognised.

The grazier bases his judgment on general observations and is content so long as his animals are maintained in good condition. Too often he misses the gradual change of a desirable plant association to an undesirable one, and unless the erosion is of a gullying type, he may not notice his loss of soil. As previously stated the process is insidious and therefore the more dangerous.

Technical agriculturists, through their ecological studies, have given indicators whereby the decline in grazing capacity, and therefore of the increase of erosion as well, may be early noted. In a few regions experts have evolved grazing systems by which the growth requirements of the plants are met, and by which a high grazing efficiency is assured. The basis of the system, whether it be deferred, rotative or otherwise, is to give vegetation periodically an opportunity to become fully established again. So far as the longevity of plants is concerned it must be remembered that vegetation may be pastured by the wrong class of stock, and that certain types of animal are more destructive than others—the goat being notorious in this latter respect.

The Factor of Watering.—The subject of range management and its relation to erosion cannot be discussed without taking into account questions relating to water supplies for stock, the role of vermin, and the possibilities of supplementing the natural vegetation by the cultivation of fodder trees and shrubs or by other means.

Obviously the better the drinking facilities for stock the greater the grazing efficiency of the pasturage, a point fully recognised by farmers. But the destruction of the vegetation and the effects of erosion caused by animals going to and from watering places, particularly in those areas where facilities are meagre, are often ignored or overlooked.

The effect of the presence of predatory animals is much the same. For protection, the practice in many cases is still to drive sheep and goats into enclosures at night. The tramping by animals in the proximity of these kraals, together with over-grazing, causes a partial or complete destruction of the vegetation; an increased run-off is found and erosion follows.

During protracted droughts the enfeebled plants are readily destroyed when severely grazed. To avoid

the pasturage becoming impaired in this way it would seem obvious that the farmer should provide for supplementary feeding, either in the form of paddocks of spineless cactus, saltbush, Mexican aloe or in stocks of fodder from his cultivated lands. By utilising these reserves in lean periods the farmers could prevent a great deal of destructive grazing. Strangely enough those following practices of this nature are exceptional.

Value of Trees.—Viewed in its relation to erosion the basic purpose of good range management is to mantain as nearly as possible the annual addition to organic matter to the soil. Needless to say that, for much the same reason, the destruction of trees should be avoided. More than this, the growth of certain types of trees should be promoted wherever possible. Not only do trees furnish humus, but by breaking the fall of heavy showers, they assist in increasing the amount of rain which penetrates the soil.

A whole chain of consequences follows a high retention of moisture by the soil. Conditions are improved for plant growth, supplies of organic matter are insured, underground water is strengthened by percolation and the flow of springs is established.

The seriousness of the situation in South Africa has been emphasised by so many Commissions and others, that it requires no reiteration, but it is surprising to find how inadequately it is being dealt with by those responsible for combating it.

A question so vital to the conservation of the somewhat meagre agricultural resources of the country cannot be left to the unco-ordinated efforts of a few enthusiats and part-time officials. Surely the appointment of a competent man to one of the existing Divisions of the Department of Agriculture is warranted?

His duties would be manifold, but chief among these would be the following:—

(1) To demarcate the tracts in South Africa where erosion is at present a serious factor.
(2) To ascertain what measures of control have been attempted in other countries and to keep in touch with the workers there.
(3) To study the steps being taken by farmers and by Government officials; to outline the policy for the Union; and, if necessary, to suggest legislation.
(4) To co-ordinate the allied work of the Union civil servants in the various Divisions and Departments and of private individuals in the country: and to indicate the directions in which research should be conducted.
(5) In the affected areas to instruct the extension officers of the Department of Agriculture as to the specific control measures which should be advocated in those areas.
(6) To establish demonstration areas in different parts of the country.
(7) To issue informative publications for the guidance of the general public, teachers in schools and others, and to control propaganda in general.

The control of that part of erosion for which man is responsible involves sustained research, short range investigational work and the application of known remedies. In the compass of a short sketch of this nature it is possible to give only a bare outline of the work involved in combating the evil.

The Botanist's Part.—In long time research, the botanists would have to ascertain changes in flora due to erosion, and the effect on the vegetation of different methods of range management. The workers in

animal husbandry would have to study different systems of grazing; their effect on the carrying capacity of the land and on the condition of the animals; the relation between vegetation and the type of animal and the best order in which the same flora should be pastured by different animals.

Soil experts would be concerned with questions connected with alkali in accumulated silt, in finding out the relationship between soil types and erosion in the effect on the flora and the economic value of fertilizing the veld. Other avenues requiring sustained work could be cited, but sufficient has been said to indicate the scope of long-range research work.

In short-range investigational work a host of problems present themselves. What are the most efficient and cheapest forms of weirs and embankments? What kinds of plants are most successful on accumulated silt? On cultivated land how should operations be conducted to prevent soil washing? What methods of cultivation facilitate the penetration of rain? (In this connection it is interesting to note that the Pretoria University now has plots on which the run-off under different methods of treatment is measured and lysimeters have been constructed by which percolation can be studied). What type of tree is most effective in promoting percolation? How can some of our grasses of promise be profitably incorporated into our pastures? What are the best strains of these grasses? What are the most suitable plants to be grown in reserve paddocks in the different areas? Guided by the experience of successful farmers what is a safe carrying capacity for the land in the different parts? Instructive information on these and similar questions could be obtained within a relatively short period.

Object-Lessons.—Much remains to be done in the application of our present knowledge of the subject. And as the farmer is most quickly convinced

by seeing things for himself, probably the best means of imparting this knowledge to him would be by establishing demonstration plots. These would be started on land suitable in area and character, where possible on town commonages (usually badly eroded) in those districts subject to erosion.

In the main, the choice of the site and the main features of the work to be undertaken would be determined by the officer in charge of erosion investigations, and the actual operations would be under the supervision of the local extension officer. The expenditure involved for the maintenance of the work in these demonstration areas could be obtained, no doubt, on the £ for £ principle, i.e., half would be furnished by the State provided the local farmers' organisations would guarantee the remaining half. Needless to say, the utility of the work would be very much increased were the farmers of each area partly responsible for the maintenance of the demonstration there.

On these demonstration areas the efficacy of the different types of weirs and embankments could be shown; some plants successful on accumulated silt, e.g., Johnston grass, could be grown, small paddocks of fodder trees and shrubs could be established; in some cases the use of flood irrigation, by diverting storm water from dongas, could be demonstrated; photographs, as records, could be taken to show the progress of reclamation; the effects of continuous grazing and by different classes of animals could be seen; and in those districts where the rainfall is sufficiently high small plots of the ordinary fodder plants could be cultivated to familiarise farmers with them.

If situated near the town, not only could the work be inspected frequently by farmers but periodic visits could be made by the local school children—generally the future farmers of the locality.

A keenly observant visitor to the Union recently stated that: "Whether South Africa is to be turned irrevocably into a desert or is destined eventually to rival Argentine in farming production, is entirely within the compass of human effort." It remains for the ingenuity of man to devise ways by which the potentialities for plant growth in the Union can be utilised in building up its resources—a consummation to be achieved only by a complete break from the stereotyped experimentation.

Where Help Should be Given.—Finally, a plea should be made for assisting private individuals, many of whom are doing invaluable work, but who, for lack of funds, are curtailed in carrying their ideas to full fruition. Unquestionably some of the best work in the control of erosion has been done by farmers on their own initiative, and in a number of cases, if assisted financially they would be able to add handsomely to the contributions they have already made to the solution of the problem.

13.

IRRIGATION.

The situation with regard to irrigated farming in the Union has been outlined earlier in this book where it was contended that expenditure on irrigation has outstripped sound agricultural economy.

The State has spent and is spending, millions on irrigation, but before a reasonable standard of living can be maintained under most of the existing schemes, enormous sums will have to be written off. At present irrigators are in a quandary as to what can be grown profitably—a fact which would seem to justify more adequate steps being taken for the introduction of new economic plants from India and elsewhere. In spite of the known situation the spate of expenditure goes on. Are there any other directions in which expendi-

ture would be more profitable? Pasture investigation is certainly one.

The basis of successful farming lies in pastures. As commonly used in South Africa the carrying capacity of the natural vegetation is very poor. But there is evidence to show that artificial pastures can be established in many parts giving a carrying capacity several times as high as that of the natural veld. In fact, if promises are confirmed, it is just possible that in this direction, i.e., proper range management and the establishment of artificial pastures, the country's farming production may be doubled. But a great deal of investigation requires to be done especially in the way of supplying reliable quantitative data. The farmer must be convinced by large-scale experimental work that what has been accomplished on plots can be profitably undertaken on the larger scale on the farm. Certainly this field of work is full of promise. And what is being done? At most a few thousand pounds a year are being spent on this work—work which may be of incalculable value to the farming industry and, of course, to the country as a whole.

In other words we are spending hundreds of thousands annually on fostering irrigation, a branch on which we have already hopelessly overspent, while the obvious enterprise remains relatively unexplored and unexploited. In our present phase of development spectacular irrigation schemes can be only weak palliatives at best; whereas intelligent work on pastures might easily revolutionise and rejuvenate farming effort. And so the country's farming industry flounders along miserably misdirected on the broader issues.

14.

Summary and Conclusions.—The chief limitation to the production from South African farming lies in inadequate moisture supplies and in consequence

the amount of arable land available is restricted to only a small fraction of the area of the country. Palpably then to utilise the natural farming resources of the Union the animal industry should dominate the outlook. Moreover, the trend in the trade in agricultural commodities on international markets seems to favour foodstuffs from animals. Prices of the products from cultivation have dropped enormously and if the output of these foreshadowed materialises then a fairly permanent lower price for these products is likely. Obviously then, apart from fruits, the comparative advantage in South African farming would appear to lie with the animal industry rather than with the production of crops for sale.

In the preceding pages an attempt has been made to indicate that hitherto agricultural policy has been prone to stress the importance of cultivation rather than that of animal production.

A reorientation is necessary. What steps present themselves to effect the necessary changes demanded by a changed policy? They cannot be brought about unless their costs to the country are held in mind. But if the arguments given have any validity, then the country is bearing charges which are not warranted. Savings here could be utilised to promote those enterprises which are more closely allied to permanent welfare. In some cases expenditure might be diverted to more desirable ends.

In summary, the measures to be taken would be as follows:—

1. Curtail the expenditure on spectacular irrigation schemes.
2. The duties on wheat and peanuts should disappear within a period of ten years; those on sugar should be removed, but more gradually, since sugar is peculiarly tied to the large amount of capital invested in machinery

and, in consequence, a profitable substitute in enterprise on this land is almost impossible to find. Sugar planters have invested their capital under an implied promise by the State to protect their production. If this protection were suddenly removed it would be tantamount to a writing off of almost the whole of the capital of these people. The case of the wheat farmer is different; his soils are impoverished or are becoming so; moreover, alternative farming enterprises would employ much of his present equipment and organisation, and further, a change to animal farming, besides reacting to his permanent benefit, would entail comparatively small temporary hardship when compared with what the sugar planter would suffer were the duties on sugar suddenly removed.

3. A substantial measure of State aid would then be freed to help the farmers of the country, principally with their animals, and among others, should be applied as follows—
   (a) To meet the expenses in carrying out a more vigorous policy in conducting pasture investigations. At the moment a little is being done rather superficially and totally inadequately from the point of view of obtaining quantitative data. To obtain the latter, land in several representative areas should be chosen on which to conduct experiments, with a sufficient number of animals to give significant results.
   (b) The problems connected with erosion should be investigated and demonstrations of remedial measures should be given. The whole question is too urgent and important to be left to the casual consideration of

well-meaning committees. It warrants the establishment of an office, in one of the existing divisions, to itself and a thoroughly qualified technical officer should be placed in charge.

(c) Loans, or more generous loans, should be made to reliable farmers for the purchase of animals, equipment, fencing, for providing improved watering facilities and for assisting private enterprise in irrigation.

(d) Adequate provision should be made for the introduction of new economic plants. If possible an agricultural explorer, fully conversant with the farming and agricultural economy of the Union, should be appointed. One of his first duties should be to visit the Orient in an endeavour to obtain plants which will assist the present irrigator in areas subject to frost.

(e) It has been said that if quality is produced in quantity commercial interests will look after the marketing. This is a figurative statement. Much remains to be done in the various marketing functions: in studying the wants of consumers abroad, in processing, storage, transportation and so forth. Here emphasis should be laid on business aspects of material assistance—academic interests might well be subordinated to the former.

(f) Legislation, with regard to the use of better bred sires, should be introduced and enforced.

(g) Any work in progress on a classification of the Union's land should be pushed with greater energy. A stock-taking of resources in this direction would give perspective, would be of inestimable value in directing

policy, and would assist settlers in the choice of their land and enterprises.

Land development should be left to South Africans who know the conditions of farming in the country, and such development should not be artificially stimulated. Economic inducements to those already experienced will give a healthier development than the introduction of novices with inadequate capital. Needless to say, the intelligent newcomer of good character and with plenty of capital should always be welcomed.

General.—Research is, of course, fundamental to the introduction of new practices and to a proper understanding of what agrarian policy should be. The conduct of much investigational work must remain under the supervision of public servants, but where possible State funds will be more efficiently spent by bodies divorced from immediate Govermental control.

In this direction it is to be deplored that Government pressure has induced the members of the Faculty of Agriculture at Stellenbosch University to become civil servants in some of their duties. Such a policy can only result in an emasculated intellectual contribution from the universities, for the research of workers must then largely follow the dictates of the political party in power; they must submit to irksome regulations and routine and, moreover, they must themselves undertake regulatory duties—all giving an atmosphere far from conducive to basic discovery. Finally the work of the bureaucrat is robbed of critical, independent scrutiny.

In conclusion it might be stated that the country awaits a well-defined agricultural policy by those responsible for direction. Such a policy would be of incalculable assistance in engendering a more stable outlook and would be invaluable to those whose duties play a formative role in the country's wellbeing in farming.

The diversity of South African conditions—spread from arid to humid country; from the cultivation of tropical to cool temperate crops; from intensive animal husbandry in dairying, poultry and pigs, to the extensive farming of nondescript sheep and goats, and so forth—renders the formulation of *common policy difficult, and at times, impossible.* A comparative homogeneity of circumstances as found say, in New Zealand, would make the task relatively easy, but because the Union's situation is intricate, is no reason why a constructive policy should not be followed—in fact it makes it more imperative.

Finally, any policy drawn up without giving due regard to the interlocking of the farming industry with others must be short-sighted. In the involved life of a community of to-day the fortunes of agriculture cannot be considered in isolation. An economic balance between agriculture and other economic activities must be maintained.

15.

But farming is a wherewithal in the earning of a living, and what are the prospects of life in this country of uncertainty?

A population, Afrikaans-speaking, English-speaking, Bantus and Indians, of differing aspirations, seeking to earn a livelihood and to establish itself in a land not highly endowed in natural resources and handicapped by its late start in industrial development. To devise a way out seems to challenge the ingenuity of man.

Are the South Africans destined to create a new modus vivendi in racial amity? To survice they must establish peace among themselves and with the military nations of the world. Their bargaining power in production is, and for some time must remain, too small to carry much weight with other peoples, but her metallurgical potentialities must tempt others who

are powerful, avaricious, ambitious, and seeking world domination.

But while her sunniness gives the clue to her low production from farming, it is also responsible for the resiliency in recovery after untoward events. Certainly it is no country of monotony; the very conflicts give a zest to life. Man is being constantly challenged by new relationships in human affairs or by Nature disgruntled—a bracing situation for the robust.

The genetic composition of the whites is good; none of the younger countries can boast better blood. Trained under adverse conditions in accumulating material wealth, and in a school where give and take will have to rule, surely South Africa will be able to produce sons who can assist in adding to human welfare in their own country and in other parts of the world. In contact with the most advanced of Western nations and at the same time with some of the most primitive of peoples, will they not have a perspective in life hard to obtain elsewhere?

Life would be a drab affair if everything were easy. Achievement under difficulties is one of the greatest of stimuli, and the merits of a people can only be measured by finding out what they have accomplished in their given environment. For America, with her illimitable resources, to become powerful was fool-proof; for South Africa to reach a dignified and respected position among nations will require genius and character which the blood of the country is not incapable of furnishing.

South Africa is no land for the weakling. It is a country where hard knocks are given, where enemies form wonderful friendships, and where in some directions the trivialities of life are not allowed to submerge essentials. The finished statue, perforce, must be a rugged figure, but one in which strength, self-reliance and tolerance should be easily discernible.

PART III.

THE LOT OF THE FARMER.

"It is from tillers of the soil that spring the best citizens, the staunchest soldiers; and theirs are the enduring rewards which are most grateful and least envied. Such as devote themselves to that pursuit are least of all men given to evil counsels."—(*Cato—De Re Rustica*).

"They (peasants) may be safely assumed, I believe, to represent the lowest caste among civilised men. They are the closest, both in their avocations and in their mental processes, to primeval man. One may think of them as the sediment remaining in the filter after the stream of progress has gone through."—(*Mencken—Notes on Democracy*).

No doubt in remote times all the members of a community were farmers for all had to exert themselves in foraging for food. But as the knowledge of the cultivation of plants and the domestication of animals accumulated, man became sufficiently efficient in procuring food to produce a surplus at will. When surplusses were first produced some members were enabled to spend part of their time in making bows, earthen pots and so on. In fact, a division of labour became possible the prototype of the specialised economy of to-day.

Was it the weakling or the more intelligent of the community who took on the office of potter or maker of bows? And to-day who is the farmer? Is he the dullard, insensible to the finer amenities of life taking the lowest rewards of any industry for his services; or, is he a man, robust, a lover of conflict, independently furnishing his own mind from the close contact he has with Nature?

Were the Romans, Napoleon, Bismarck and others right in supposing that a military nation must be one composed largely of farmers? For to them the farmer

was the best soldier. Inured against physical hardships by his buffeting against and with Nature, and with a steadfastness of character bred by the difficulties and length of his productive enterprises, he certainly made a wonderful soldier in the days when endurance was the chief criterion of the soldier. But will he be the soldier of the future with alertness and agility of mind and body as the criteria? It, and much else affecting the character of the farmer, depends on what the requirements for survival on the land will entail.

How is the farmer rewarded for his services to-day? And what trends conditioning his future status are discernible? These and similar questions must be probed.

2.

Farming, in furnishing food and in supplying raw materials for manufacture, is basic to the structure of society. It is only when people are able to produce a surplus of food that some are enabled to pursue other callings. But the food supply must be assured before other enterprises can be initiated. To-day, by means of labour-saving machinery, improved varieties of crops and animals, the use of better cultural methods, and by employing remedial measures against pests and diseases, one farmer can produce food for himself and for several others; in addition, he produces much of the raw materials to keep those employed whom he has liberated from the task of getting food.

But man's innate urge for more and more refinement in his wants, his food supply forthcoming, places a premium on the services of those supplying those wants. The same degree of specialisation in food is not demanded, and in consequence the farmer is relatively underpaid for his services. In time, the pressure of population on the world's food resources will cause a high value proportionately, to be placed on procuring food, and the farmer will then be better

remunerated for his labours. But that day is a very distant one; and because of the safety valves, contraceptives and synthetic foods, now at the disposal of the human race, it may never eventuate.

3.

How are the results of the farmer's efforts conditioned?

Basically he is of the land, the yields from which are largely beyond his control, for they are in the main dependent upon the vagaries of the weather and the consequent uncertainties of plant and animal growth. His brother, the manufacturer, in his operations is little affected directly by weather changes; relatively he can control his conditions under which he works. Further, because of the area over which the farmer's operations are spread, supervision in farming is more difficult than in manufacturing and commerce, where activities are more concentrated. Finally, with regard to land, because it is limited in area, diminishing returns prevail. That is, successive does of capital and labour put into a given acreage ten to give proportionately less increase. For example, three men spending £100 on fertilisers and other necessities may procure 3,000 bushels of wheat in the cultivation of 100 acres; but six men spending £200 on the same 100 acres will not get 6,000 bushels of wheat, but would probably get about 4,500 bushels. In manufacturing and commerce, because of the economies effected in large scale operations, the opposite is generally the rule, that is, increasing returns obtain.

With regard then to one of the prime factors in his production, the farmer is at a distinct disadvantage. Obviously, fortitude, self-reliance and patience must be contained in the character of the successful farmer. Fortitude to withstand hard knocks by the weather,

pests and diseases; self-reliance in trusting his own judgment in adopting quick changes of operations when the weather and market demand changes; and patience, knowing that, robbed of his rewards now, he may be recompensed in the future.

Moreover, largely because the law of diminishing returns holds sway in his operations, the limits of his income are well within sight. The business man may become a millionaire; the farmer rarely, if ever, accumulates vast wealth. In consequence his outlook comprises at best little beyond the possibilities of a moderate income. In phantasy, the manufacturer may picture his own yacht in the Mediterranean, the farmer merely a change from a Ford car to a Buick!

4.

Without capital and labour, his land would be of no use to the farmer. How does he stand in respect of these factors of production?

A graph of the labour required on a farm shows peaks and troughs; peaks during planting and harvesting, and troughs during other periods of the year when activities have slackened off. But the labourers to perform the peak loads must be retained throughout the year; in consequence during slack periods, the farm labour is not employed to its maximum capacity, and so the farmer's profits are decreased. The manufacturer can take on, or pay off, men according to his requirements; the farmer, a labourer himself, cannot do so. Again, the farm worker is required to perform a hundred or more different tasks during the year; obviously, he cannot reach the same proficiency in specific tasks as can the worker in other industries where the worker year in and year out specialises in only one or two operations.

The farmer is probably tied a little more closely to his capital invested in land and equipment than is

the business man; but it is in procuring credit that he suffers relative hardship. He has little to offer in the way of attractive security. Moreover the length of the productive processes in farming, the irregularity of income and the uncontrollable risks in farming production, mean that the farmer is often looked upon as an unsatisfactory borrower because he is frequently unable to meet his commitments with the regularity that is common to many others debtors. Further, in other industries, money can be raised by subscription, an avenue closed to the farmer.

Certainly then, the farmer is at a disadvantage with regard to labour and especially so with regard to credit.

5.

But probably his chief disability is to be found in connection with the limitations in the organisation of his industry. Here his difficulties are legion.

In the United States there are ten million workers in agriculture of whom six and a half million are farm owners or tenants, i.e., 65 out of very 100 are entrepreneurs. In manufacturing only three out of every 100 are working for themselves. Obviously supervision must be less expert in the former than in the latter. Commenting on the above, Ostrolenk and Mead, in their excellent little book "Harvey Baum," add: "It is doubtful whether there are 6½ million people in the whole world who can run their own business." Naturally then the individual farmer must suffer because his industry as a whole is handicapped by a great deal of inexpert management on the part of many of his brothers.

Collectively, farmers are at a disadvantage because of the isolated manner in which they earn their livelihood. Their industry is composed of small independent productive units, competing in the production of foodstuffs with each other to fill the limited

stomach capacity of the people. In furnishing raw material, too, their efforts are unco-ordinated. Hitherto agriculture has shown little evidence towards an integration of industry and, this in one showing the greatest of instability in its production. The fact that the farmer buys retail and sells wholesale is only one example among many that may be taken to show the chaotic state of his organisation.

Needless to say, he has no influence over monetary fluctuations, and yet because of the lag between the movements of agricultural and other prices he is probably harder hit by changes in the purchasing power of money than any other worker. If to-day at £1 per bag, 1,000 bags of maize met his obligations, then if the purchasing power of money increases (and prices in general fall) so that a bag only fetches 10/-, he must now produce 2,000 bags to meet the same obligations; and added to this situation is the fact, of course, that because the demand for foodstuffs is in general limited, the more he and his fellows produce in order to retrieve themselves, the lower is the price obtained for agricultural goods. His capital and his home are bound up with his land, which in a period of low prices he cannot sell; he therefore has no alternative but to produce, and so aggravates the situation.

He is handicapped, too, by a slow turnover, the rate of which varies with the type of farming. The average turnover in farming takes about eight years; so that, as somebody said, "A business that has a turnover three times a year has as good a chance to get adjusted to deflation in a year as does agriculture in a generation."

The interjection, as to why the successful farmer is of a conservative type, may be made here. He really pays in kind. If he commits himself heavily during a boom, because of the length of his productive processes, he must often pay, when money has

appreciated in value, by the sale of goods at the lowest prices, and so the adventurous type is most frequently badly knocked. The more conservative is not committed so deeply, and consequently is not enslaved for as much or for so long.

His supply is inelastic; he cannot stop his output as can the manufacturer. Moreover, his production is governed in the main by weather conditions, and even he and his brothers restrict their cultivated acreage, favourable weather conditions for growth may frustrate their endeavours to avoid a ruinous glut. The gestation period in his productive processes, too, is so drawn out, that he cannot quickly adjust his operations to sudden changes in demand, and his estimate of future prices may be hopelessly wrong when he is ready to sell. Further, the fear of the goods he produces being substituted by synthetic goods, especially in the case of raw materials, has foundation; and, so at the end of his productive process he may be robbed not only of his profits but of much of his capital.

6.

For the difficulties under which he has to labour is the farmer compensated by favours in his manner of living. What leisure has he and what are his recreations? What opportunity has he for self-improvement? Compared with the townsman, is his life richer?

The Pacific Islander may have ample leisure time, but has he had the education which will enable him to spend this time fully to the health of his body and his mind?

The requirements for what the economist calls "the good life," and others "a full life," are health, education and leisure. The education of a person in poor health can produce only meagre results; and

leisure is of little use unless the mind has been developed to an appreciation of the environment and its possibilities.

Slums are quickly disappearing, and to-day the physical health of the average townsman is better catered for than that of the average farmer. The former has a wider choice of diet at his door, medical facilities are easily available, and ample opportunity exists for physical exercise. Contrary to popular opinion the diet of the farmer is often monotonous and poorly balanced; and his maladies receive medical supervision only when well advanced, often after irremedial injury has taken place.

The school instruction of the farm child is usually undertaken by the less competent teachers of the community, and the child suffers, too, in general education from a lack of knowledge of many of the higher interests connected with human relationships. He or she has little opportunity to see or to hear the work of the best artists, to listen to the foremost speakers, or to see the results of organised effort on a large scale.

On the average farm the farmer and most of his family have little time for leisure, and what spare time they do have occurs irregularly. Moreover, their work often calls for exhausting effort, and in consequence little energy is left for the development of other interests.

Obviously then, the farmer is handicapped in his equipment as a citizen. Is it to be wondered at that he shrinks into conservatism from new contacts—a role in which he often knows his ignorance will pass unobserved?

Politically his claims are poorly presented, because his representatives, if farmers, have usually had insufficient experience in fighting the more clamorous advocates of the industrial and commercial interests.

7.

With so much to contend with, why do so many remain farmers?

It is a hard life, but in many respects a robust, independent life, and one in which the results of effort are easily visible. The man who plants and harvests a hundred acres, or who sends fifty bales of wool to the market, feels he has achieved something, and achievement not only increases self-respect but it is a powerful stimulus. Moreover, it is a life in which the worker is not dictated to at every turn, and subordination to others is irksome to many.

Some, of course, farm through force of circumstances, and some start farming misapprehending its many difficulties. To some fine types, among whom are often found the bravest and most tender-hearted of soldiers, close contact with Nature outdoors has an irresistible appeal. To them, this amenity value is beyond that of pearls and the fripperies of life.

It is true a great deal of uncertainty exists in farming and large fortunes are rarely made. On the other hand, with reasonable care, the more successful farmers are deprived of their livelihood only very slowly, and no doubt this security in earning a living induces many to farm. If times are bad, the farmer and his wife can work harder and longer, and by producing their own food they have an economic advantage over the townsman, who must pay more than the farmer's cost of production for his food, and food is always a big item of the family's budget.

Other advantages too are found. Certainly the farmer more generally succeeds in securing for himself a home and a small capital than the men of other industrial classes. On the distribution of wealth Nourse says: "It is true that the opportunities to acquire a vast fortune are greater in the towns than

in the country, but it should not be overlooked that these opportunities are relatively few, and that rural wealth is not marked by that inequality of distribution so characteristic of urban wealth." Added to this farmers have a controlling voice in determining the conditions under which they labour—more so than the average wage-class. And finally the farmer is often less disastrously affected than others by panics and commercial depressions for the following reasons: (a) Many of the products of the farm are articles of absolute necessity. People must eat and in consequence the farmer always has a market. (b) The farmers sells less of what he produces and buys less of what he consumes than many other classes in industrial society. (c) And lastly, Nourse maintains that: "The farmer is also less under the necessity of realising immediately on his labour than is the worker in cities. The efforts of the former crystallise to a large extent into products which need not be sold immediately, whereas the services of the latter must be sold day by day or be lost forever."

But people do drift away from the land. In fact the history of nations is really a history of their urbanisation. This migration from rural to urban areas is no doubt due to the increase in efficiency taking place in agricultural production, but it is also due to the greater attractions of the towns where the remuneration for services is higher, where intellectual contacts are more easily made, and where more leisure is obtained.

Apart from the fact that the farmer produces the food and most of the raw materials for the community his role in national life is an important one. His mode of living forces him to recognise essentials; and to survive, stability of purpose and a certain conservatism must form part of his character. These features do not make for the agitator, and in times of national

crises the nation having a large proportion of farmers is unlikely to be stampeded into precipitate conflicts.

8.

But if equity is to rule, surely the farmer must receive more consideration in State politics?

Much can be done, and is being done, for the farming communities by the State in assisting co-operative enterprises in the selling of their produce and the buying of their requisites; by furnishing data with regard to supplies and markets; by assistance in making more liberal credit facilities available; and by supporting research designed to stabilise the industry and to lower the costs of production. Aid of this nature, and more, must be given the agricultural industry if the farmer is to be justly rewarded for his services to the community.

With a few exceptions, under the present circumstances those left on the land must gravitate towards a poor type—people who are willing to remain underpaid, or who are incapable of remedying their lot.

On the need for joint concerted action on the part of farmers, Sir Daniel Hall writes: "I agree that the situation of the farmer is becoming extraordinarily difficult in modern civilisation. Either he has got to learn to combine so as to maintain his position in the struggle against the other great commercial organisations, or he will remain a peasant on the bare margin of existence."

Indeed, at times when in pessimistic mood, one is apt to wonder whether the white farmer during the last two centuries has not enjoyed an artificially high standard of living, higher than Nature has ordained in past ages for the toilers of the soil? Has not abundant land in the relatively undeveloped, or developing younger countries together with the unprecedented expansion in industry and commerce—based on the new technology given by the discoveries and

inventions in physics and chemistry during these two centuries—obscured the real position of the farmer in a matured country? After all the Oriental, living on "the smell of an oil rag" producing the bulk of the world's foodstuffs and raw materials, is in a sense the marginal producer in farming. Inexorably, then, must not the white farmer be forced in time by the disabilities of his profession to a much lower comparative standard of living than he has enjoyed during the last two centuries of Western development? Is the soil a relentless mistress, callously grinding down her lovers? Can the Western farmer escape the lot of his brothers—the ryot in India and the cultivator in China—of the older civilizations?

On the other hand, when in optimistic vein, the view might be maintained that in regions predominantly pastoral, as opposed to those overwhelmingly arable, the tendency might be towards a survival of a higher type on the land. Evidence is not lacking, in America and elsewhere, to show that the unit of land in ordinary farming is increasing. Pastoral farming, especially under conditions of precarious production, requires a large unit and much capital. In a country like South Africa, for example, possibly the survival may require men of means and of decided managerial ability—a type very remote from the small cultivator. If this view prove true, then an accelerated efflux of the less competent from the countryside may be expected, leaving in the farming industry of such a country a body of very efficient and desirable citizens.

Urbanisation to-day with the expert medical, architectural and other guidance available, does not harbour the dangers of half a century ago. Conditions now favour the town-dweller, and it behoves those responsible to see that a large section of society is not handicapped by having less than a fair share of the modern amenities of life.

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