

## PASTURE DEVELOPMENT IN SOUTH AFRICA\*

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When I was invited to read a paper of my own choice at this meeting, I was in some doubt as to what that choice should be. Then someone pointed out that as one of the original pasture research team it would be a good idea to trace the development of pasture work in this country before all the old stagers disappeared from the scene. Having worked since *The Awakening* to the importance of pasture research, as Hall terms it, to the present day, I have seen the development of pasture work in its different phases and this might well be worth recording. There is so much knowledge today and there is so much that is taken for granted that, when one looks back, it is difficult to realise how little was known forty years ago.

Hall (*op cit*) gave a very good history of the course of development of knowledge of veld and cultivated pastures from earliest times up to 1934 and I would like to draw attention to various of his references. Sparrman in 1785 referring to overstocking and overgrazing stated that the Hottentots moved their huts and cattle to other places when grazing was scarce so that the grass is nowhere eaten off too short" while the colonists remained in the same areas which became overgrazed and overstocked. He quotes the first reference to grazing control by General de Mist in 1802 who stated "that by allowing cattle to graze only in small paddocks of ground and moving them from one field to the next in rotation, the veld itself will gradually improve and in time the stock will be in better condition". After that and much later in the century there are a few references in the literature to the need for enclosing paddocks but the next reference I can find to veld management is by Kanthack (1907) of the Cape Department of irrigation writing on the evils of "sluiting" as he termed erosion who stated that "It would be necessary to maintain as good a cover on the veld as possible by dividing the farm into paddocks, properly fenced, each with its own watering place and so arranged that stock movements would be across and not up and down slopes".

Veld burning received a good deal of attention down the years and various laws against the practice were promulgated in the Cape, Natal, Orange Free State and Transvaal without much effect. Hall (*op cit*) stated that by 1907-1908 veld burning experiments were in progress and Fisher at Cedara intended starting seasonal veld burning experiments "but the general attitude of livestock owners was to look to the introduction of exotic grasses as a means of improving the carrying capacity of their land rather than to any possible improvement of indigenous grazing". Phillips in 1920 and Staples in 1926 and 1930 respectively initiated veld burning experiments just outside Pretoria and at Cedara.

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Conservation of feed from the veld in the form of both hay and silage was recommended as early as 1893 in the Dordrecht area while Burt Davy reported in 1904 and 1905 that much blue grass hay was being made in Natal for the feeding of horses.

The first experiments on the fertilizing of veld were started at Cedara in 1907.

The interest in cultivated pastures was much greater than in the management of veld. As early as 1861, it was recommended that imported grasses should be tried under irrigation at Worcester and on dry land at George. One day in 1901 Sir Percy FitzPatrick was talking to Cecil Rhodes on Land Settlement when Rhodes said "Speaking generally in South Africa, with the exception of strips in the valleys and limited areas where irrigation is practicable, a man could not farm successfully on less than 6 000 acres". FitzPatrick disagreed saying that there were immense areas which, year by year, without fail produced enormous quantities of grass. Rhodes interrupted, "What is it worth? Nothing! Rank and worthless, you can only burn it". FitzPatrick replied, "Exactly, my point is that the soil, climate and rainfall which produce so much bad grass, are capable of producing the same amount of good grass". Rhodes then said, "You're quite right. You're quite right. Now that will be your job. Find the grass". Sir Percy took these words to heart and on his farm, Buckland Downs between Harrismith and Warden in the Orange Free State, he started a search for pasture grasses with the help of the Agricultural Department and by 1910 he had more than 2 000 acres of sown pastures. In the Cape there was considerable interest and by 1906 there were 4 492 pasture trials with 1 491 farmers. All this was with exotic grasses but it is rather interesting to note that, at this time, J.W. Gatherer considered that native grasses should be investigated starting with *Eragrostis curvula* and *Anthistira imberbis* (Rooigras).

In the Transvaal the greatest activity took place — under Burt Davy — who had tested out 212 species or varieties by 1908 and carried out many co-operative trials. According to Hall, a single plant of Kikuyu was brought from Kenya and given to Burt Davy in 1908 but according to Melle this introduction took place in 1913 and he gives Pole Evans credit for his "untiring endeavours to bring to the notice of farmers and others, its very remarkable qualities as a pasture and also as a lawn grass". Unfortunately Burt Davy was asked to devote his attention to one annual grass — *Zea mays* — and so very little more work was done on pastures for many years.

A series of droughts before and after the First World War made the public conscious that all was not well with the

country and the Government appointed the Drought Investigation Commission to investigate the whole matter of droughts and stock losses. Its Final Report (1923) stated that there was no evidence to show that the mean annual rainfall had altered but it was obvious that the economic value of the rainfall had been greatly reduced by alteration in the properties of the surface of the country for which man was responsible. Soil erosion was rife and was caused mainly by deterioration of the vegetal cover. It was recommended that the Department of Agriculture should carry out investigations on the improvement of veld cover and the management of veld to provide better stock feed.

For a while after the publication of the report, very little action followed. Staples in 1926 initiated work on veld burning and veld management at Cedara, Hall and Meredith in 1940 carried out experiments on the fertilizing of pasture at Umbogintwini and on the veld in various cooperative experiments and Pole Evans turned his attention to the collection of promising indigenous grasses. Following on the work by Melle in 1918 at the Groenkloof station Pole Evans developed the Prinshof station in Pretoria with Pentz in charge and then extended to Rietondale where van Rensburg was assistant foreman under Pentz. Good work was also being carried out at the University of Pretoria. At this time practically all work was concentrated on the search for pasture grasses.

At the end of 1932 Phillips at Witwatersrand University wrote to me to say that General Smuts had told him that the agricultural future of this country lay in grass and that he was about to start a grassland research station at Frankenwald and invited me to join him. Work on veld was initiated in conjunction with African Explosives and Chemical Industries on the fertilization of veld and many ecological studies were initiated. Very good work was carried out over the next fifteen years and many well known workers such as Story, West, Glover, Rose Innes, Bunting and Altona were trained there.

However, it took the great drought of 1932/33 with all its stock losses to arouse public opinion and government action. It was decided that veld and pasture research should be carried out on a wide scale. Two posts of ecologist were advertised and I was appointed in September 1933 and John Rowland in November. We were given a caravan and told to make a survey of the veld and erosion problems of the country and then put forward a programme of pasture research. We travelled far and wide but, at the same time, when in Pretoria between trips, we started a research programme. It was agreed that research should be carried out on two main lines — veld and pasture management which included fodder conservation, and reclamation which included the restoration of the veld and old lands, veld burning and bush encroachment. The first reclamation work was carried out on the old Outspan in Pretoria known as the Donkey Camp and the first experiments on veld and pastures were carried out at Rietondale. Towards the end of 1934, after a great drive by Dr Pole Evans, the first

research station was started at Towoomba in the Transvaal Bushveld, and not long afterwards, Irvine was appointed pasture research officer there. He carried out a big programme of management and reclamation as well as a very fine vegetation survey of the Northern Transvaal. Soon afterwards a station was started near Vereeniging to deal with the problem of old lands and here Story and, later, Foster were appointed. This was followed by the Athole station in the Eastern Transvaal to which Preller was appointed where the main problems were veld management, veld burning and fodder conservation.

In the meantime work was also being carried out at the Colleges of Agriculture, the University of Pretoria, at Frankenwald and by African Explosives and Chemical Industries. Theron carried out some interesting work on veld burning at Potchefstroom (1937), and Fisher at Cedara (1932) showed the value of Kikuyu grass by producing 1 000 gallons of milk per acre. Next Acocks was appointed to carry out a survey of the Vermeerbos areas of Griqualand West after which he went to Dohne, Warmbaths and Estcourt before going to Grootfontein where he completed his Veld Types of South Africa in 1952.

During 1935 a small research station for cultivated pastures run by the botanist, Baker, was started at George. The Rust der Winter station to deal partly with grasses under irrigation and partly with the reclamation of denuded veld was placed under van Rensburg. I had a big programme of work here and it was shown that unless the harvester termites were dealt with, reclamation was impossible but, if they were poisoned, revegetation was a simple matter. In the middle of 1935 Pentz was sent to Natal to make a vegetation map of the Drakensberg Reclamation Area between the Mooi and Tugela Rivers and he followed this up with a survey of the vegetation of Natal and Zululand. At the end of 1935 a farm was purchased for the Dohne Research Station to which Botha was appointed as Pasture Research Officer, and in 1936 land was acquired from the Municipality for the Estcourt Research Station and a farm was bought for the Tabamhlope Research Station. In December 1936 I was transferred to Estcourt to take charge of the work on the research stations and the Reclamation of Watersheds and West accompanied me as pasture research officer. In 1938 Pentz produced a report (1938) giving his map of the Drakensberg Reclamation Area and pointing out that the amount and type of erosion on any farm depended on the farming system applied.

In the meantime a grass breeding section had come into being at Prinshof under de Villiers and later under Codd while seed production was investigated first by du Toit and then by Liebenberg.

Up to 1938 the research programmes on veld management on the different stations had been directed by Rowland and the reclamation experiments on the same stations had been directed by me. This was not proving very satis-

factory so it was decided that in the future the staff of each station would be responsible for all the work carried out there.

In 1940 two new research stations were opened at Rietvlei and at Koopmansfontein respectively and a pasture section was started at Potchefstroom College of Agriculture and in 1941 the Minister of Agriculture announced that there were now sixteen pasture research stations and he hoped to increase the number to twenty six.

Prior to this a very wide range of experimental work had been carried out on most research stations. In the veld management work various combinations of resting and grazing were tested out with a rather heavy accent on spring rest in the sourveld areas. This later proved to be the wrong approach but the results made it possible to recommend definite systems in fourteen different areas of the country by 1947 and by 1952 to evolve definite principles on which to base grazing management. Fertilizing of veld also received a good deal of attention, but, because nitrogenous fertilizer caused a change in species away from the sub-climax grasses, this work was not followed up on most departmental research stations for many years although it was continued at Frankenwald where Rose & Altona showed that it was economical to produce milk on fertilized veld.

Reclamation work on denuded veld was carried out with considerable success on a number of stations but the early work of introducing different species into the veld was not followed up. A large number of experiments on veld burning was carried out on different stations and far reaching results were obtained. Several of these experiments are still extant. Bush encroachment received a good deal of attention for some years and some promising methods were evolved but until recently nothing more was done.

Each station had a large nursery of grasses and fodder plants but there was not the staff to devote the necessary attention to this type of work except at Rietondale which was more or less a living museum to which grasses were introduced and from which they were distributed.

Thus the pasture work on most stations was spread over a very wide field but this was unavoidable in the early stages.

The next phase of development was the introduction of the so-called unit experiments where an effort was made to integrate veld management or pasture production with crop and animal production. Pretoria University initiated this work with a big experiment on milk production from crops and leys (1952 and 1958) and Rowland followed at Rietvlei with a wide range of units with different ratios of arable land to veld or pastures (1951) and the unit experiments became the vogue on many stations. Most of them failed because there was not enough information available on one or other aspect of production although

a very successful one on beef production off the veld was carried out at Estcourt for twenty years. Here, however, all the preliminary information had been obtained before the experiment was started. However, the unit experiments demanded so much time and attention that the tempo of research in other directions was not maintained.

Then in 1945 Pentz followed up his paper of 1938 with another in which he pointed out that correct land use should be determined by a study of climate, soils, topography and vegetation and that farming should be classified as extensive, semi-intensive or intensive according to the combination of these factors. He further pointed out that if an area was suitable for extensive farming, the main attention should be directed to veld management, veld reclamation and bush encroachment. In a semi-intensive area veld management, veld burning and dryland pastures should receive attention while in intensive areas the main attention should be focussed on cultivated pastures. This concept of correct land use had a big effect on agricultural planning and the direction of research in different areas.

The next phase in research was on leys. Haylett in 1952 and Theron in 1952 were instrumental in initiating this work and over the period 1943 to 1956 a good deal of work was done. The results showed that properly fertilized leys could not only produce much feed but also build up the productivity of arable soils. The Department of Agriculture actually initiated a scheme whereby farmers were encouraged to grow leys by providing a subsidy for their fertilisation but the amount of fertilizer allowed for was so low that the scheme was a complete failure.

During this period Botha was transferred to Athole and Preller to Dohne and Botha discovered the value of *Acroceras macrum* as a pasture grass. It looked as though this grass might revolutionize farming in the Eastern Transvaal when it was hit by rust and smut and it is only recently that Theron, at Cedara, has been able to isolate strains that are resistant to these diseases.

About this time there was a good deal of interest in cultivated pastures in the cane belt of Natal and extensive areas were planted to pasture. Some estates had up to 500 acres and considering that fertilization was very low, the production was remarkably good.

In 1948 the Faculty of Agriculture was founded in Pietermaritzburg and here the first chair in pasture management and soil conservation in South Africa was created, of which I was the incumbent. Pretoria University created a similar chair a few years later to which Botha was appointed and in 1958 the University of the Orange Free State created a chair in pasture science in its new Faculty of Agriculture of which Roberts was the first incumbent. Two new research stations in Natal and East Griqualand and one near Bloemfontein were opened to serve the needs of the new Faculties. In these departments of pasture science, the emphasis in research shifted to aut-ecological studies — research

on the individual constituents of the veld and over the years much work has been carried out by post graduate students.

In 1949 Liebenberg received seed of *Eragrostis curvula* back from the United States where it had proved most useful. He distributed it and local strains which he collected far and wide. This was a grass which Gatherer in 1906 and Melle in 1918 felt should be studied but it was not until the Americans had shown its value, that it found its rightful place in this country. Today it is our most widespread hay and ley grass.

Then in 1950 there was a big drive to popularise the growing of fodder trees and an officer (Juriaanse) was specially appointed to work on these trees. After a few years in which much propaganda was made, very little more was heard of them.

After this two grasses obtained a great deal of publicity and some people made a good deal out of the sale of roots or seed. These were Ronpha grass which produced enormous quantities of herbage but which proved to be unpalatable and Columbus grass (*Sorghum almum*). The latter was widely tested but today is used mainly in the drier, western parts of the Transvaal and the Orange Free State.

It had long been recognized that poor seed was one of the reasons for failure in pastures and in 1958 the Department of Agriculture introduced a scheme for seed certification and legislation was passed governing the sale of seed.

In 1961 the Soil Science Department at the Faculty of Agriculture in Pietermaritzburg obtained the services of van der Eyck to carry out a pedological survey of the Tugela Basin. This survey was later extended to include most of Natal and has been followed in some of the other regions. With this knowledge of soils it has been possible to work out on a rational basis what pastures should be planted and how they should be fertilized. Today very little advice is given on the cultivation of pastures without a knowledge of the soils on which they are to be established. The search for suitable grasses and legumes has received a great deal of attention, particularly from Theron in Natal, over the past few years and in addition a good deal of work has been done on adapted strains of rhizobia for legumes.

In 1966 pasture work in Southern Africa received quite a fillip with the inauguration of the Grassland Society of Southern Africa. The first meeting, held at Pietermaritzburg was opened by William Davies and very successful meetings have since been held annually. This has made it possible for pasture scientists from all over Southern Africa to meet regularly, discuss their problems and learn what is happening in other parts. At this first meeting Acocks presented a paper on "Non-selective grazing as a means of veld reclamation" which created quite a stir. His co-workers Mr and Mrs Howell claimed that the carrying capacity of veld could be doubled or trebled by non-selective

grazing and this, of course, created much interest amongst farmers, many of whose farms were already overstocked. This was followed by Savory (1969) in Rhodesia who made even more extravagant claims. However, it served a good purpose and caused a great deal more interest to be taken in veld management. The whole concept of multi-camp systems has now been taken into review and is receiving attention in various areas. Two new approaches to the multi-camp system have now been developed — one known as High Utilisation Grazing on the lines of Acocks' heavy non-selective grazing and the other as High Production Grazing with light, extremely selective grazing. These can be applied to both veld and pastures.

About 1965 one of my past students remarked to me that it was a pity that most veld research in the past had been hampered by what he called "the Rooigras mentality". He pointed out that Rooigras was the dominant grass in so much of the country because it was adapted to conditions of low fertility. Because of this, its feed value and productivity were lower than many other grasses lower in the succession and we should ignore its successional status and replace it where possible by grasses having higher production and feed value. This could be done in various ways. Since then a great deal of work has been done in Natal and other areas on the fortification or re-inforcement of the veld. Edwards pointed in 1970 out that there were thousands of acres of veld in high rainfall areas which were not arable but, under correct treatment, could be very much more productive than they are today. Theron has followed this up with a very big programme of work. He has sought out suitable species with which to reinforce the veld, he has worked out techniques for the introduction of other grasses into the veld and determined what fertilizer treatments are necessary. He has designed a sod-seeder which has been very successfully used and, with fertilizing and re-inforcement of veld has increased the carrying capacity of the veld many fold. The fertilizing of veld in the high rainfall areas is coming into its own but a great deal of attention will have to be paid to grazing management if it is to be economic.

In 1972 Phillips produced a bioclimatic map of Natal which is an up-to-date refinement of Pentz's agro-ecological map of Natal. It is being used as the basis for planned land use throughout the Region and will determine to a large extent the role that veld and pastures will play in the different areas. At the same time a research team is developing systems analysis by the very latest methods to integrate our knowledge of veld and pasture management into planned land use on different farms.

And so the pendulum has swung. Hall and Meredith carried out many experiments on the fertilizing of veld in the early 1930's and now we are back to veld fertilizing with veld re-inforcement. Pole Evans cast his net far and wide in the search for suitable pasture species and now Theron and associates are following up this work. Most of the unit experiments were discarded owing to insufficient knowledge

in earlier years but now, with increased knowledge, they are coming back as systems analysis. Cultivated pastures, particularly in the high rainfall areas are assuming greater importance because of a better understanding of soils and their management. But all this has been made possible because in the intervening years so much information has been collected. Much knowledge which was not available forty years ago is today taken for granted and further developments have been made possible by the work that has gone before.

Now what of the future? Since my first bulletin on veld management was published in 1947, very many papers have been published and recommendations made for different veld types throughout the country. A great deal of knowledge has been accumulated on the establishment and management of cultivated pastures. We know how to reclaim bare veld. We know a great deal about veld burning in different parts of the country. Yet little of this is being applied in actual practice. It was to assist the farmers of the land that all this work has been done over the years and how few apply the results. The Soil Conservation Act of 1946 made provision for the planning of farms, and farmers were given subsidies on fencing, dams and other improvements in order to carry out such plans. The

Department proudly claims that most farms in the country have been planned and yet it has been established that on less than 10 per cent of the planned farms on which subsidies have been paid, is veld management being applied as planned. No wonder it is stated that erosion in this country increased by more than twenty five per cent in the twenty five years after the Soil Conservation Act was passed — the act that was designed to control soil erosion!

What is needed is a campaign to create awareness of the problem — that erosion is on the increase and unless that can be checked and the productivity of our veld be increased, famine and starvation lie ahead. We need another campaign like that carried out by C J J van Rensburg in 1943—45 when every man, woman and child in the country was aware of the dangers of soil erosion and veld deterioration. But where we need to start is with the planners. Only a low percentage of our Extension Officers have more than a perfunctory knowledge of veld and pasture management and a few are veld enthusiasts. There are also too few of them — the number of farmers per extension officer does not compare with a country like Rhodesia — and so with all their multifarious duties, the story does not get across. Something must be done before it is too late.