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Revisión Científica

Nota de la Dirección

La dilatada vida profesional del *Profesor Alec Lazenby* le ha permitido conocer personalmente la evolución del enfoque de los temas de investigación de pastos, desde el estudio de factores simples, que predominó en los años 50 y 60, hasta la situación actual en la que el objetivo principal es desarrollar sistemas sostenibles de manejo de pastos, no sólo desde el punto de vista agrícola y económico sino también desde el punto de vista medioambiental. Pero, lo más importante es que toda su carrera profesional estuvo básicamente orientada a la formación de investigadores y a la creación de equipos de investigación con el objetivo de resolver los problemas desde un enfoque multidisciplinar, lo que ha conseguido con notable éxito, que le ha hecho merecedor de un reconocido prestigio a nivel internacional. Por eso, le hemos pedido que plasmase por escrito su experiencia personal, a lo que amablemente accedió escribiendo el artículo *"Leadership, management and training in grassland research: some personal experiencies and impressions"*. Estamos seguros de que su contenido será de gran interés para los lectores de PASTOS y un buen punto de referencia para los profesionales dedicados a la siempre difícil tarea de enseñar y formar a las nuevas generaciones.

LEADERSHIP, MANAGEMENT AND TRAINING IN GRASSLAND RESEARCH: SOME PERSONAL EXPERIENCES AND IMPRESSIONS

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SUMMARY

The experiences of the writer as a young research worker at the Welsh Plant Breeding Station, a demonstrator and lecturer at Cambridge University, Professor of Agronomy at the University of New England in Australia and Director of the Grassland Research Institute at Hurley in Britain, are described. Their effect, together with the influence of a number of leaders in grassland research, on the development of his style of leadership, management and training, are analysed. Some of the challenges he faced in the positions which he held, and the opportunities they presented, are mentioned, and an indication given of the methods used in attempting to achieve the objectives which were set.

Following his return to Australia, he was involved in the enactment of Plant Variety Rights legislation; this has had both positive and negative effects which are briefly described. An opportunity was provided to participate in the national debate on the organisation, priorities and funding, of rural research and development in Australia, and the writer was able to play a part in determining funding priorities for pasture plant improvement in the public sector. Recently, he has helped analyse opportunities for funding of priority projects for grassland research and development in southern Australia. Such work will require leadership skills, sensitive management and appropriate training, not least for farmers, if systems which not only improve pasture output, but are sustainable agriculturally, economically and environmentally, are to be developed.

Key Words: Pasture plant breeding, grassland improvement, postgraduate students, research co-ordination, challenges, opportunities.

SETTING THE SCENE

The writer has been privileged to have been associated with grassland research, largely in the UK and temperate areas of Australia, for more than 50 years. He has experience as a student, researcher and teacher, in the development of research teams,

and in leading and managing research programs. During this period, considerable changes have occurred in the type of research undertaken (Humphreys, 1997) and in its methodology, and a number of fairly distinct phases can be recognised in the main focus of investigations and in techniques used. For example, in the 1950s and much of the 1960s, most research was concentrated on the effects of single factors e.g. species and varieties, fertilisers, particularly nitrogen and phosphorous, and defoliation/management, perceived to be important in influencing the level, and later, the efficiency, of dry matter production and/or grassland output. Reductionist studies remain as a necessary component of grassland research. However, other work, on simulation and modelling, resulted in a greater holistic focus of some of the investigations and led to the development of a more systems approach to grassland research. An increasing appreciation of the potential of changing grassland practice on the environment has been reflected in the incorporation of such considerations in the design and analysis of more recent investigations. The challenge now is to develop grassland systems which are sustainable, not only agriculturally and economically, to provide the producer with a viable income, but also environmentally. Possible social consequences on the wider community of major changes in systems are also a factor in some studies.

A number of circumstances have contributed to the changing focus of grassland research. For example, on occasion, major problems have been solved, rendering unnecessary any further investigation of the topic. At other times, the advocacy of influential farmers, or pressure from the wider community, has drawn attention to problems of increasing importance and requiring more intensive investigation. Nevertheless, there can be no denying the pivotal role of leadership, and the major influence of management and training, in shaping grassland research during the past half century.

Major advances, both in our understanding of grasslands and in their management, have flowed from the research, with many of the significant milestones being listed by Reid (1994). It is not the intention of this article to attempt a comprehensive analysis of either the changing focus, or the achievements, of grassland research. Rather, an essentially autobiographic account will be presented. Mention will be made of people and circumstances which have influenced the writer's thinking and practice in developing his style of leadership, management and training, and in pursuing a number of opportunities in research and development. Also incorporated are some personal experiences and impressions of the role of these factors in improving our grasslands since the middle of the 20th century, a period embracing a constantly changing environment for research. Further, some indication of opportunities for future work will be included.

THE ABERYSTWYTH SCHOOL AND GRASSLAND IMPROVEMENT

Seeing two pastures growing side-by-side on the farm of his cousin and her husband, a pioneer grassland farmer, was a defining moment in the writer's career. The contrast between the green and palatable herbage on one field and the obviously inferior vegetation on the other, immediately stimulated his interest and resulted in his decision to study grassland science at the University College of Wales, Aberystwyth [UCWA], rather than enrol in a more prestigious university. The decision reflected the reputation of the Welsh Plant Breeding Station [WPBS] (associated with UCWA) for its contribution to grassland improvement - just one aspect of the leadership which Stapledon and his colleagues had given to this work.

Fifty years ago, it was much easier for new graduates to find employment in their area of choice than it is today. Thus, after completing his honours degree in Agricultural Botany, the writer did not even have to apply for a position, being offered a job in the field of grassland research in three organisations, two in the public, and one in the private, sector.

The WPBS, where he chose to work, had been established in 1919, as a result of an endowment, and its main objective was to breed improved varieties of herbage plants. The inaugural Director, Sir George Stapledon, was a visionary, widely accepted as the father of grassland research. He was the first to arouse national interest in the potential of British grasslands but realised that the pasture seeds then available commercially were of poor quality and unsuitable for permanent swards. Stapledon's experiences when studying the ecology of upland areas in central Wales appear largely responsible for his conclusion that seeds of native types of plants, with characteristics similar to those growing in good pastures, were the basic requirement for high producing, long-lived swards (Evans, 1987).

The writer's direct contact with Stapledon was restricted to two half days when he was privileged to accompany the great man on a round trip made in 1952 between Aberystwyth and Bangor. He was struck by his charisma, his powers of observation on the countryside, his interest in a wide range of topics, not least sport, and his definite opinions on so many things. It was easy to appreciate his qualities of leadership and ability to inspire his colleagues.

The writer's overall impression of Stapledon, gained from anecdotal evidence, reading and limited personal contact, was of a man who saw the big picture, thought strategically and had little time for detail. In common with a number of other great achievers, he had his own characteristics and style of leadership. An Englishman, said to have had a Celtic temperament (Evans, 1987), he was colourful in character and dress,

and was not always an easy colleague. Yet he was inspiring, imaginative and passionate, and attracted great loyalty from his staff.

Stapledon led from the front, knew what he wanted and was determined to do things in his own way, sometimes against the wishes of the authorities. For example, he insisted that his senior staff should be the people that he wanted. As a result, most of his departmental heads at the WPBS were sons of Welsh farmers, who were his former students and graduates from the Department of Agricultural Botany, UCWA. TJ Jenkin was appointed in charge of grass breeding [except cocksfoot, which Stapledon retained] and R D Williams of clover breeding. William Davies became responsible for pasture research whilst Martin Jones was an agronomist who subsequently made seminal findings on the management of pastures [see later]. A new department headed by Gwilym Evans was established later to investigate problems in seed production. As a result of these appointments, the strengths and shortcomings of the Aberystwyth school were cemented and its long term influence on the direction of grassland research in the UK and overseas was ensured, happenings not lost on the writer.

Stapledon attended committee meetings only if he had a prominent part to play and gave as few lectures as he possibly could, preferring to spend his time in research, writing and speaking. He believed in big differences which farmers could see, rather than those which needed statistical analysis to demonstrate. In breeding improved cocksfoots, Stapledon relied on his powers of observation, rather than on formal genetics, to select mother plants for his new and successful strains (Evans, 1987). A prolific and rapid writer, he produced an array of publications including detailed accounts of the work of the WPBS and writings of wider agricultural interest, including the *The Land: Now and Tomorrow (1935)* which had such an impact on national agricultural policy and practice. The book incorporates much of the philosophy of the Aberystwyth school, namely grassland improvement through means of the ley, involving the frequent use of the plough and sowing improved varieties of pasture plants.

Stapledon was a man of rare influence, both with farmers and on government, and there can be no doubting his key contribution to the then ever-increasing reputation of the WPBS. Said to be at his best when addressing farmers, he succeeded in convincing them that improved pasture varieties were essential for their grassland (Evans, 1987). Stapledon gained government support for the establishment, in 1940, of the Grassland Improvement Station at Drayton, near Stratford-upon-Avon, and the authorities had so much confidence in him that they made available two other farms in central England for him to study grassland improvement.

He left Aberystwyth in 1942 to become Director of the Grassland Improvement Station, apparently only because of his differences with the then Principal of UCWA (Evans, 1987). In any event, his influence on the activities of the WPBS continued, both

up to the time the writer was appointed, some 7 years after Stapledon had left, and throughout the period that he was a member of the staff. For example, not only did the focus of the institute's philosophy and research remain true to Stapledon's ideas, but his earlier directive to senior staff - to take Wednesday afternoons off during the winter months, but only to play golf - was still accepted as part of the working week. It is hard to imagine any present-day director making, let alone getting away with, such a decision!

Jenkin, as well as being responsible for most of the grass breeding, became the first Assistant Director of the WPBS. He had a personality very different from, but complementary to, that of Stapledon. An essentially quiet, deliberate man with great patience, Jenkin collected material from the best old pastures and bred a range of improved strains of perennial ryegrass, meadow fescue and timothy which were leafy and able to withstand heavy grazing. He introduced rigour into grass breeding, accumulating endless detail in his work, which was highly successful not only in producing improved varieties but also in the considerable contribution he made to our knowledge of the genetics of grasses.

Jenkin succeeded Stapledon as Director in 1942 and held this position when the writer joined the staff. Both he and ET Jones, the senior cereal breeder who followed Jenkin as Director in 1950, were internal appointments with a long association with Stapledon. It is thus not surprising that the focus of the work of the WPBS continued to reflect Stapledon's philosophy of grassland improvement throughout their incumbencies.

Some achievements of the WPBS - a brief analysis

There can be no doubt that the establishment of the WPBS was one of the great milestones in grassland studies throughout the world. In retrospect, its greatest achievement was probably the awakening of interest in grassland and making those who mattered [farmers, government, researchers and advisers] aware of its potential. Stapledon himself was the prime mover of the campaign to plough up vast areas of land, which had "tumbled down" to poor quality grass in Britain since the first World War [WW I], in order to increase food production. So successful was he that the then Minister of Agriculture opined that, without Stapledon, Britain would have been starved of food during World War II [WW II] (Waller, 1962).

The pasture plant breeding program at the WPBS was highly successful, with the grass breeding program outstanding. Bred varieties ranged from short-lived to genuinely perennial, this latter group typified by S 23 perennial ryegrass which some thought the most notable single achievement of the WPBS. As a result of the breeders' efforts,

farmers could select grass varieties for specific purposes and have confidence in their performance. For example, for conservation, they could grow a range of such varieties differing in the time of their inflorescence emergence, thus spreading their workload more evenly with little loss of quantity or quality. The authenticity and quality of the seed of improved varieties, which became available during the 1930s, were such that they largely replaced the pasture seeds then available commercially in Britain.

Yet, persistence excepted, little tangible evidence existed, at least until the 1980s, of any increases in animal production that could be attributed directly to the greater use of bred varieties. [It was not until later that evidence emerged from the WPBS that different varieties could result in significant differences in animal output (Munro *et al* 1992)]. No research institute or school can be expected to cover all aspects of grassland research and the prime responsibility of the WPBS was to improve pasture plant varieties. Yet Stapledon did work closely with Fagan, the Professor of Agricultural Chemistry in UCWA, on the nutritional value of grasses (e.g. Fagan, 1929). [Similar investigations were being undertaken in Cambridge (e.g. Woodman *et al*, 1930) and at the Hannah Research Institute in SW Scotland (Hannah Dairy Research Institute, 1951)].

However, it can be argued that the Aberystwyth philosophy of grassland research, including the work undertaken at Drayton, never really embraced the reason for growing grass on the farm - namely to feed the ruminant. Continued concentration on the breeding and evaluation of new cultivars meant relatively few early investigations on the growth of grass and its use for animal feeding, both of which are of much greater importance in affecting animal output, at least once good varieties became available.

The activities of the WPBS remained focussed on the breeding of new pasture plant varieties for many years and succeeding directors clearly felt that their evaluation should be a national priority. [The writer can recall a number of vigorous discussions, held in the late 1970s with the then Director of the WPBS, who advocated that a significant effort on variety evaluation should be included in the program of the Grassland Research Institute [GRI]]. Further, the normal method of measuring production - as dry matter yields of herbage harvested from cut plots - has both resulted in questionable advice on grassland management being given, and played no small part in the separation of plant and animal which characterised for a long time much of the research and thinking in Britain.

The philosophy of the Aberystwyth school dominated grassland R & D in Britain for some 50 years after WW I. Many of the great names involved with grassland came from the WPBS. In addition to Stapledon and Jenkin, they included William Davies, who succeeded Stapledon as the greatest exponent of the potential of grassland. Further, most

of the early grassland advisers were trained in Aberystwyth and proved effective advocates of the philosophy of grassland improvement developed there.

Effect on the writer's approach to grassland research

In retrospect, it is clear that the writer's experiences at Aberystwyth played a very significant part in shaping his approach to grassland research. It was at the WPBS where he first came to appreciate the potential of grassland, specifically in raising the productivity of British agriculture. He also accepted the proposition that the ley was integral to achieving this objective, an opinion subsequently amended somewhat [See later]. For most of his stay in Aberystwyth, the writer did not challenge the doctrine that, under practically all circumstances, grassland improvement depended essentially on selecting good plants and the rest would follow. However, a meeting in the early 1950s between researchers from the WPBS and New Zealand [NZ], who disagreed on the relative importance of improved varieties and pasture management in determining the level of grassland output, had a profound effect on the thinking of the writer. It was the catalyst for his realisation that a number of factors could limit grassland production.

Whilst in Aberystwyth, he first learnt of the classic experiments of Martin Jones. An early appointment to the WPBS, Jones was on the staff of the Imperial Chemical Industries Ltd [ICI] when he demonstrated some fundamental principles of pasture management (summarised in Jones, 1933). He showed that the timing and intensity of grazing by sheep could influence the botanical composition of grasslands to such an extent that, within a few years, they could become swards which were either highly desirable or of poor quality. The work of Jones, which has never been accorded the credit which it deserves, had a major impact on the writer's thinking on grassland improvement, specifically on the potential influence of the grazing animal on pasture composition.

The writer learnt something about the importance of leadership and the influence a Chief Executive could have both within and outside an organisation. This included some inkling of the value of developing good relations with farmers and relevant government bodies.

Experiences as a junior member of staff were also valuable in helping determine his style of staff management and some principles for supervising research students. Appointments to the WPBS were expected to participate in the 'core' activities of a department, in the writer's case in selecting improved varieties [in the grass breeding department] and in evaluating them [in the agronomy department]. In addition, new staff were encouraged to choose one or more topics on which to undertake personal research.

In pursuing this, the writer came to realise the importance of a clear objective and the need to choose a problem which, for a higher degree particularly, was both sufficiently discrete and able to be completed within an appropriate time frame. Further, he felt it important both to have a good reason for his choice of a topic and to use methodology and techniques based on good science.

He chose two problems to investigate, one on an important weed in many Welsh pastures, and the other in grass breeding techniques. This latter followed concerns of the writer that the growing conditions under which mother plants of improved varieties were selected, namely their performance as widely spaced plants, were very different from those where their performance really mattered, i.e. in the sward. The senior staff to whom the writer was responsible for his personal research were always ready to provide help and advice, an important consideration for a young researcher, but he did experience the difficulties of answering to two bosses!

An interest in teaching and training was stimulated by the few lectures that he was asked to give to Agricultural Botany honours students and the limited contribution he made to the supervision of students. These experiences were major factors in his decision to apply for a teaching position in the School of Agriculture at the University of Cambridge. Other attractions included the opportunity provided by the nearby Plant Breeding Institute [PBI] to continue his research study, and the National Institute of Agricultural Botany [NIAB], which was adjacent to the School of Agriculture Field Station.

THE CAMBRIDGE PERIOD

The writer's responsibilities in Cambridge included the design and presentation of an Agricultural Botany course to graduates who had been appointed by the then Colonial Office to serve as overseas agricultural officers, most of them in Africa. He consulted widely and sought help from a number of people and sources, but he himself had to make decisions on the content of the lectures and practical classes which reflected his own thinking. Whilst grasslands featured prominently in the course, there were also other components embracing tropical as well as temperate issues. The proximity of research centres proved invaluable. Staff of the PBI especially, with their experience in a range of relevant topics and with a wide range of material available, proved very willing demonstrators, thereby adding both value to the content of the practical classes and interest to the students.

Like most university staff, the writer was expected to develop his own research interests in Cambridge. Decisions on the research to be undertaken were normally made

by the scientist(s) involved, often reflecting only their own interests. However, the writer always used a second criterion, namely that the results should also have some practical implication. In the early 1950s, many of the staff at the School of Agriculture, like those at the WPBS, had no research degree, with those with a Ph D being in the minority. Nevertheless, there was increasing pressure on younger staff, including the writer, to study for such a qualification. As in Aberystwyth, he worked on two different topics. One of these, for a PhD, was an investigation of a weed plentiful on arable land in the area, whilst the other was a continuation of the research on grass breeding techniques begun at the WPBS. He was fortunate to have the opportunity of developing a mutually rewarding joint research program on grass breeding techniques with Hugh Rogers of the PBI.

Whilst in Cambridge, the writer learnt that funds were available from the then Agricultural Research Council [ARC] to undertake university research, provided a good case could be made. He took advantage of this situation to apply for funding, initially for one, and subsequently a second, post graduate student. In developing a small research group, he appreciated for the first time the need to develop a protocol listing the responsibilities of the student and supervisor in the research; this included what the writer perceived to be their role in the choice of topic, the need for their continuing interaction throughout the student's experimental program, including the collection and analysis of the data, the writing of the thesis and the publication of results. At that time, when most research was reductionist in its objectives, a Ph D training was designed to enable an individual to become an independent investigator.

The value of the Cambridge period

The writer's stay in Cambridge extended his experiences, broadened his perspective and had a significant effect on his approach to the roles of teaching and training in grassland research. His teaching responsibilities resulted in him taking a wider view of important issues, rather than him having an entirely British focus. He learnt of the difficulties and opportunities of preparing and presenting a course for postgraduate students, many of whom had studied agricultural botany in their undergraduate degree, and developed his first real interest in overseas students. His initial experiences as the sole supervisor of Ph D students made him think carefully of the responsibilities not only of supervisors but also of the students in undertaking their research project.

Supervision of undergraduates in the Cambridge system and as a College tutor provided an insight into the attitude of students to learning, the way they responded to academic and personal problems and the value of the right type of help and guidance.

The Cambridge Local Examinations Syndicate gave the writer a range of experiences associated with secondary students in Britain and overseas, including demonstrating the importance of the teaching of agricultural science in East Africa. In addition, time spent on the Governing Body of NIAB and Chairman of the Institute's Herbage Seeds Advisory Committee was invaluable in developing his attitude to committees and broadening his interests in an institution responsible for the national evaluation of improved varieties.

THE UNIVERSITY OF NEW ENGLAND [UNE]

Leadership opportunities and style

The position of Inaugural Professor of Agronomy at UNE, situated in the small city of Armidale in northern New South Wales [NSW], Australia, to which the writer was appointed in 1965, provided an opportunity for a leadership role both in the teaching and training of students, and in developing a research school. As the first professor, he was particularly fortunate to have the chance of laying the foundation for the development of the department. The challenge was to develop teaching courses, training programs and research which covered the field of agronomy, were forward-looking, attractive to students and both relevant to the region and of more general application.

At the time of his appointment, Agronomy was a department in the Faculty of Rural Science at UNE with Professor GL [Bill] McClymont as Dean. McClymont believed that the approach to teaching agriculture should be through the ecosystem, a holistic method of studying production based on the interaction of a multitude of factors affecting the soil, the pasture and the ruminant, with some economic and sociological considerations also included. The development of the Faculty at UNE, including the seminal role of McClymont, is described in the book *Rural Science; Philosophy and Application (1996).*

The great value of the holistic approach to undergraduate teaching in rural science was in training students to consider the whole picture rather than focussing on the analytical, reductionist approach, which then characterised undergraduate courses in agriculture in the other Australian universities offering the subject. Rural science graduates from UNE, trained to think broadly, were widely sought after for employment, not only in various aspects of agriculture, but in other fields. [At least two other Australian universities subsequently based their undergraduate courses in agriculture on McClymont's ecosystem philosophy]. Undergraduate courses in Agronomy were part of the degree of Bachelor of Rural Science, the only undergraduate degree then available

within the Faculty. It was a challenge to design undergraduate courses in Agronomy which were compatible with the McClymont philosophy.

The writer believes that, unless there are strong reasons to the contrary, the professor in a one-Chair department should both be the Head of department and present the introductory undergraduate courses in the discipline. This latter provides him or her with opportunities to: present the foundation of the discipline to the students in relatively simple language; show how it relates to other disciplines; indicate likely future developments and opportunities; and, stimulate the interest of students such that some might decide to make a career in the field through direct employment or post graduate study.

Professors of a particular discipline may well have a common vision and broadly similar objectives for their department. However, the way they set out to achieve these aims depends on their individual style of leadership and management of the human and physical resources available to them. The leadership of the writer is more pragmatic than visionary and, whether developing undergraduate courses or building up a research program, his general approach is to identify opportunities and explore means of obtaining the resources necessary to undertake such activities. Further, in developing a department [or research institute or university for that matter], he believes it important to build on any strengths that there might be, giving due credit to the achievements of his predecessors.

When the writer arrived at UNE, the Department of Agronomy had good staff and research in soil science, and a small number of excellent post graduate students. However, there was less emphasis on grassland agronomy in the undergraduate teaching than he thought desirable, and little concentration of research in pasture improvement. Fortunately, he was able to make two outstanding appointments in pasture agronomy, namely Graham Swain and John Lovett. They were not only key members of the undergraduate teaching program but became invaluable in the research team, choosing topics which fell within their areas of responsibility, both for their own work and for post graduate students.

The writer's leadership style is based on a team effort. It is thus characterised by wide consultation with colleagues; no one has a monopoly on ideas and it would be arrogant to think that any individual always has the right answer! However, he is not a democrat, bound always to accept the majority view. He believes strongly that the head should (i) have the authority to take hard decisions, based on what he/she thinks is best for the department [research institute or university], not on the vested interests of any one individual or group, and (ii) be responsible for the consequences of such decisions.

[There was only one occasion in the Department of Agronomy that he found himself in a minority on an important issue].

In undertaking his responsibilities for managing the academic staff, there were regular formal meetings and informal contact at any time was encouraged. All academic staff were expected to undertake teaching and research roles in clearly defined areas. Once these responsibilities were agreed, staff were free to choose the subject matter included in their teaching courses and research topics for themselves and their post graduate students. Whilst there were few formal meetings with the support staff, the writer made it a rule to walk around the department frequently, meet support staff individually and encourage them to both make suggestions to make their work more rewarding and efficient and air any problems which they might have.

All academic staff were expected to manage their activities within the resources available to them, with any unspent funds being carried over from one year to the next, a practice compatible with the university policy.

Building a research school

Armidale is located in the Northern Tablelands of NSW, an important pastoral region with wool and beef cattle the main enterprises. The writer thus decided that the research school he wished to build should focus on (i) increasing our understanding of the growth of pasture plants, and (ii) investigating problems limiting grassland output primarily, but not exclusively, in the region. Pasture growth on the Tablelands is frequently limited by shortage of available soil moisture during much of the year and by low temperatures in winter, whilst summer temperatures are more favourable to C_4, rather than the C_3 plants normally used in improved pastures. The pastoral system in the region is more extensive than that found in the UK, being based on a legume [normally white clover] to supply the nitrogen needed for grass growth.

Because the climate and soil conditions for pasture production on the Northern Tablelands are quite different from those in Britain, it was important to take some months before making long-term decisions on research, particularly on specific projects suitable for post graduate students. It turned out that there was an abundance of appropriate research topics both to increase understanding of pasture plant growth and for the study of factors and practices which could significantly influence pasture output. The species most commonly used for pasture improvement - perennial ryegrass and white clover - failed to persist when the rainfall was below-average, or even average, whilst pasture establishment was uncertain. Further, the succession from clover- to grass-dominant pastures, distinctly recognisable stages in pasture development on the

Tablelands, and important because of the association of high clover content with bloat in cattle, were not fully understood.

Amongst the topics investigated were :

- Studies of the growth and development of a range of species and cultivars of grasses (C_3 and C_4) and legumes, and factors affecting such growth and development, particularly available moisture, temperature and fertility level.
- Investigations on the various constraints affecting pasture establishment.
- Work on fertiliser application and pasture succession.
- Competition studies between introduced and native species and between improved C_3 and C_4 plants.
- The effect of cutting and grazing on the growth of cereals, and
- Pasture management and animal production.

The late 1960s were propitious for agronomic research in Australia and we were able to attract some 12 high quality post graduate students in less than three years. Not only did a significant number of able students wish to enrol for a higher degree, but funds for post graduate study were available from a number of sources. These included Commonwealth post graduate awards, University teaching fellowships, where students had some teaching responsibilities undertaken in parallel with their higher degree studies, industry bodies such as the Australian Wool Board [AWB] and the Meat and Livestock Research and Development Corporation, which were sympathetic to requests for supporting projects relevant to their interests, including post graduate scholarships and post doctoral awards; one student was supported by private industry.

It was particularly fortunate that the building of a research school in the Department coincided with the initiation, by the NSW Department of Agriculture [NSW Ag], of a policy of not only encouraging its most promising staff to undertake a higher degree but also funding their training. A number enrolled in the Department of Agronomy, such that at one time there were six such members of the NSW Ag studying for a higher degree, all except one for a Ph D. Post graduate students are the lifeblood of any university department. However, those from the NSW Ag were a particularly valuable component of the developing research school in the Department of Agronomy. They were a bit older [with ages ranging from 25 to 30] and more mature than most others studying for a higher degree. Having had some research experience, they knew what topic they wished to investigate and had a good appreciation of the value and limitations of their findings.

Post graduate training

The type of post graduate course in which students were able to enrol depended on their previous qualifications. For example, students graduating from an Australian or British university with a First or Upper Second Honours degree in an approved discipline, or who had a relevant Master's degree, could enrol directly for a Ph D. Others were enrolled initially for a Master's degree or, in the case of those with first degrees from some overseas universities, in a post graduate diploma which involved course work and a small project. These students were able to upgrade their qualifications, provided they reached a minimum standard during their first year of study. It was incumbent upon their supervisor to select a research topic which was compatible with any such change in enrolment.

Masters and Ph D degrees awarded in the Department of Agronomy were all research degrees. However, the writer adopted the policy of requiring students to attend specific courses to overcome any deficiencies in their knowledge of material relevant to their studies. The most common requirement was to update their knowledge of Statistics and Field Experimentation. Fortunately we had a first class statistician who both gave the necessary courses and provided any statistical advice needed in a student's research program.

Some students had a single supervisor, often requested by the student, and others were allocated joint supervisors. In any event, it was important that there should be a broadly standard protocol in the Department defining the rights and responsibilities of students and their supervisors. Building on his experiences in Cambridge, the writer produced a departmental memorandum covering a range of such issues. In choosing a research topic, it was important that the investigation, including any field work done in the uncertain environment of the Northern Tablelands, could be completed in a maximum of 4 years for a Ph D and three years for a Master's degree. Students were encouraged to choose the research topic but it was the responsibility of the supervisor to ensure that the specific program was sufficiently discrete for a higher degree and that it could be completed within the above time frame. In addition to formal meetings arranged between them, it was expected that supervisors would also be available for any help and advice which students might need during their post graduate study. The writer operated an open door policy for his students, encouraging them to see him before 8.30 am if possible.

Formal departmental meetings of all research students and academic staff occurred weekly. At each meeting one research student was expected to present an account of the progress of his or her work clearly and simply, and within a time frame of 20 minutes,

following a procedure developed by a colleague in another department (Leng, pers. com.). The methodology and techniques used and experimental results obtained were then critically evaluated by their colleagues, with research students from the NSW Ag, particularly, demonstrating their previous experience in such constructive criticism. The meetings were also valuable in helping an individual to develop confidence in public speaking. Students were thus made aware of the whole of the Department's research, their specific role in this program and their potential contribution to the achievements of a team.

Prior to deciding details of his/her research program, a student was expected to review the relevant literature and make a convincing case for the work to be undertaken. A particular responsibility of the supervisor was to ensure that the methodology and any specialised techniques used in the work were scientifically sound, whilst the writer believed that both student and supervisor had a role in interpreting the experimental results. He also felt that, in writing the thesis, the student should demonstrate understanding of the subject and make clear the potential value of the work. The information presented should flow logically and, if possible, be built up through the thesis; it should be easily interpretable, with the tables and figures unambiguous and as simple as possible. The concluding chapter is particularly important, with the value and limitations of the experimental results critically assessed and the findings put into perspective. A summary of some few pages briefly describing the experimental program, its objectives, methodology and major findings not only helps the reader but is invaluable to the examiners.

In assisting their post graduate students to become independent researchers, supervisors have to make a judgement on how much help they should provide to them. Nowhere is this more important than in the writing of the thesis, where supervisors often have their own method of helping their students. The writer's practice was to go through one of the early experimental chapters with great care, amend any points that were unclear, rewriting sentences or even paragraphs where necessary, such that the information was presented logically and was easily understood. He then suggested that his students take careful note of the amendments and use them as a guide for the other chapters to be written in the student's own writing style. Before a thesis was submitted for examination, supervisors were required to certify that it was in a form suitable for examination. The writer took a tough line and only signed such a declaration when he felt sure that a thesis satisfied this requirement. Students were not always happy with this practice, but it resulted in few concerns for the examiners and thus no problems in their theses being accepted for higher degrees.

Limited value attaches to results of higher degree study unless they are published, and the writer developed his own criteria to determine whether to be a co-author in the

papers from the higher degree programs of his students. Put simply, if he was satisfied that his contribution to the work, e.g. conceptually and/or in the writing of the papers, justified it, he was happy to be the second author. Some students found writing papers more difficult than did others and after the writer became Vice-Chancellor [VC] of UNE in 1970, most opportunities for helping them occurred either early in the morning or after dinner at night. At least two stayed with him for several days in order to ensure that their work was published!

Assessment of grassland research in the Department

It was important to the writer that there should be an independent assessment of the Department's grassland research, including both an evaluation of the overall program and an assessment of each research student's project and progress. Dr Ray Brougham, the then Chief of the Grasslands Division of Scientific and Industrial Research [DSIR] in New Zealand, undertook this role and made some very valuable comments and suggestions.

Involvement as Vice-Chancellor of UNE

After some 5 years as Professor of Agronomy the writer left the Department with some regret to become VC of UNE, particularly as his work in the Department was the most enjoyable and fulfilling of his career. However, he was determined to maintain contact with developments in his discipline and continued to supervise his research students for a further three years until all received their Ph Ds. He then gave an undergraduate course in grassland agronomy; this was valuable in helping ensure that his knowledge of the material covered was up-to-date and in enabling interaction with students on both agronomy and wider university matters.

Achievements

Whilst activity in the Department had built up to what was probably an optimal level by the time the writer became VC of UNE, not as much had been achieved as would have been likely had he remained in Agronomy for two or three more years. Nevertheless, the fact that he retained his research students until they had completed their graduate work meant that some solid progress was made, particularly when taken together with the results of other research on grassland improvement undertaken in the Department during the period. Notable advances included increased knowledge on :

- Factors affecting pasture establishment, which resulted in the normal time for sowing on the Northern Tablelands being changed from spring to late autumn.

- The potential and shortcomings of a range of species and cultivars, including some analysis of the morphological and/or physiological response of a number of populations to environmental variables, especially available moisture and temperature. The work showed the potential of tall fescue including the value of Mediterranean populations of the species for winter production.
- The effects of differing fertiliser regimes, especially annual rates of superphosphate application, on pasture development. The work also shed light on bloat incidence and provided one avenue for its control.
- Competitive studies between (i) native and introduced pasture grasses and their differing responses to available moisture, temperature and fertility level, shown to be the key factors determining their performance in pastures, and (ii) improved C_3 and C_4 grasses indicating conditions where growing both together can result in higher dry matter yields.

The contribution of the Armidale years

The period during which the writer was Professor of Agronomy was of great benefit to him. It was a time when he worked with high achieving colleagues, who were committed to the development of grassland research in the Department and to working in a team, very able graduate students were attracted to enrol for higher degrees, funding was plentiful whilst the attitude of colleagues in related areas and of the University management was always positive and helpful. No inaugural professor could wish for a better environment in which to develop his or her department.

He appreciated for the first time the extent of the responsibilities of a head of a university department. He learnt something of the challenges and opportunities in: devising a broad undergraduate curriculum in agronomy; presenting some of the courses as integrated parts of a wider teaching program; and, developing a research school in grassland science.

Management of the staff and students required the development of interpersonal skills especially important in convincing some individuals that they had an important part to play in the Department's activities which thus depended on a team effort. He also came to learn just how important it was to ensure that the operation and funding of departmental activities should be transparent. This objective required agreed protocols and a high level of administration of the available funds.

The writer's thinking on factors influencing grassland output was widened and became more critical as a result of his experience in an environment contrasting widely with that with which he had been familiar. He learnt a little of both the dangers, and

value, to an agronomist of investigating problems where factors affecting grassland output could be so different from those he had known. For example, he came to realise that, in many parts of Australia, the first requirement in a pasture plant is survival, whereas in the UK this characteristic is taken for granted.

Whilst he had long appreciated that pasture output depended on a number of variables, it was not until he met McClymont that he thought critically about its dependence on their interaction. Yet, when presented diagrammatically, McClymont's ecosystem was very complex. It showed the possible relationships between a multitude of factors, but did not indicate which were likely to be important in influencing production under different circumstances nor did it attempt to quantify their effects . Thus, whilst it was an excellent teaching concept, the writer found it of limited value for research where he was much more influenced by the approaches of Brougham (1970) and Spedding (1970). The former thought in terms of systems but concerned himself only with those factors he thought important in influencing production; similarly, in his modelling and simulation studies, Spedding only included factors which he considered to be of real significance in potentially affecting output.

Whilst serving as VC, the writer developed his thinking on how long a Chief Executive of a university or Director of a research institute should remain in office. He feels that any such incumbent should remain in the post sufficiently long to demonstrate commitment to the institution involved but not for such a lengthy period that all his/her ideas had been used. He set a minimum of 5 years and a maximum of 10 as his lower and upper limits for remaining as a university vice-chancellor or director of a research institute. He believes strongly that any organisation needs to be reviewed periodically and requires fresh ideas from a new Chief Executive, perhaps involving changes in strategic objectives and work focus. Senior research personnel and perhaps professors would fall into a different category; the writer feels that they could retain their position indefinitely providing they discharged their responsibility to keep up with their discipline through reading and their own research.

THE GRASSLAND RESEARCH INSTITUTE [GRI]

In contrast to the situation in the UNE Department of Agronomy when the writer was appointed, the GRI had been established for almost 30 years when he arrived in August 1977 to fill the position of Director. Located in Hurley, a village in Berkshire in the south of England, the Institute had a well deserved reputation for its many contributions to grassland research. Perhaps the most seminal work was that of Raymond and his

colleagues on pasture quality (Terry,1974) and the pioneering studies of Spedding and his co-workers in developing a systems approach to grassland research (Brockington, 1974).

Leadership opportunities

The writer's style of leadership and management had been developed by the time of his arrival in Hurley. He interpreted his leadership role to include an evaluation of the vision and strategic objectives of the GRI, determine whether the focus of the research program was appropriate to achieve such objectives, develop good relations with the staff, who would in the end determine just how successful the institute would be, and build constructive relationships with its stakeholders, especially the Governing Body, government, represented primarily by the Agricultural Research Council [ARC] and the farming community; a determined effort seemed necessary to increase the profile of the institute with grassland farmers.

The writer was fortunate to have amongst his colleagues some outstanding researchers in soil science, plant physiology, agronomy, ruminant nutrition and production, and simulation studies. There was also an excellent program on permanent pasture, initiated by his predecessor, Dr E K Woodford. However, in line with his philosophy, it seemed important to make some critical evaluation of the research program, to build on areas of achievement and make any changes thought necessary in the focus of the activities, in order to both achieve the strategic objectives appropriate for the GRI and provide personally satisfying work and career opportunities for the staff.

Further, at a time of increasing accountability, the ARC wielded considerable influence on the programs of research institutes in Britain, not least the GRI. Staff of ARC were not slow to criticise the Institute's research program, which, they said, was less influential in grassland circles than it should be. However, as a result of the recommendations made by Lord Rothschild and submitted to, and accepted by, the British Government in the mid-1970s, ARC funding became restricted to the basic studies in research institutes. Competitive support for more applied research was available through the Ministry of Agriculture. This arrangement in itself provided a challenge in a program where the research covered both basic and applied work and was planned to be seamless. Thus, in seeking funding, it became important that applications were written to satisfy the differing requirements of the respective funding bodies, even though support was being sought for similar research!!

Changing the focus of the research program

Much of the research at the GRI in the mid-1970s was analytical, being undertaken within the confines of the specialist disciplines of the investigators. Yet most agricultural problems are multidisciplinary. Thus, the writer concluded that any increase in the practical relevance of the GRI's work and in its reputation amongst grass farmers depended on more problem-oriented research being undertaken. This required staff specialising in different disciplines to work in teams. It is almost inevitable that such major changes in the activities of any organisation result in losers as well as winners. Thus changing the focus of the GRI research presented a challenge, as did managing the change.

Most GRI staff who were on the staff when the writer arrived had been appointed because of their specialised knowledge and/or achievements in their disciplinary field. Some felt more comfortable working as individuals or with others with similar specialised knowledge than in multidisciplinary teams. There is no doubt that team research doesn't suit everyone. It was thus important that, whilst encouraging staff to participate in team work, no attempt should be made to force unwilling individuals into such an arrangement, particularly if this meant a loss of their work commitment. Yet many staff welcomed their inclusion in team research with colleagues having differing specialist skills; some indicated that it provided an opportunity to see the practical relevance of their more basic research, thus adding a desirable new dimension to their work. Cross disciplinary problems of significance in grass farming were not difficult to identify and included: the pasture/animal interphase; the effect of the grazing animal on N loss; modelling the digestion processes in the ruminant; and the effect of differing conservation strategies on the profitability of milk production.

Enhancing the profile of the institution

The writer made a deliberate attempt to (i) increase awareness of the potential of grassland in British agriculture and (ii) develop a greater role for the GRI in achieving such increased output. In addition to the numerous articles and papers which he wrote, a number of other steps were necessary if these objectives were to be achieved. It seemed important that the GRI should develop links with various individuals, groups and organisations which would both enhance the profile of the Institute, especially with those who could influence its work program, and make increased use of the human and physical resources available. The writer felt that his first priority should be to strengthen the institute's links with the farming community, especially with the high performers who, as producers of milk, beef or lamb, depended on grass for their livelihood.

In this context, a visit made in 1967 to the then Grasslands Division of DSIR in Palmerston North, NZ, had shown what could be achieved by developing close ties with the farming community. A meeting between the Chief of Grasslands, Ray Brougham, and NZ farmers, who had an obvious input into the research being undertaken, demonstrated to the writer the close ties between the activities of Grasslands and the needs of the farmers, who were clearly the main stakeholders in the program. [The value which many NZ farmers put on the work of the Grasslands Division was subsequently shown at the International Grasslands Congress, held at Lexington, Kentucky, USA in 1981, when more than 20 such farmers attended. They clearly felt the round trip between NZ and the US was a worthwhile investment of their time and money].

This visit had a major influence on the writer's attitude to grassland research, particularly the value of developing close relations with the farming community. In seeking to achieve this, he first spoke about the role of GRI in achieving substantially higher output from grassland in presentations made to many local Grassland Societies, with their majority of grassland farmers. Secondly, he undertook a more important initiative, namely to invite some 100 successful British grassland farmers to become Associates of the GRI. The vast majority accepted the invitation and willingly paid an annual subscription of £15, entitling them to participate in two meetings a year, which were held at the Institute. The work of the GRI was outlined to the Associates during the mornings of the meetings, and one or two topical research projects relevant to their enterprises were selected for more detailed discussion. Following lunch, provided by GRI as part of the package, the farmers were given an opportunity to indicate which problems they felt should be included in the Institute's R & D program. This very successful development helped enhance the profile of the GRI amongst the farming community. It also provided the Institute with ambassadors for its activities and resulted in some influential input into important decisions affecting the work program.

It was also very important to work closely with the Ministry of Agriculture, particularly with the officers responsible for advising farmers on grassland improvement and management. Although the Advisory Service was separated from research institutes and universities shortly after WW II, a grassland adviser was stationed at the GRI. Whilst good relations, fostered by formal and informal meetings, existed between staff of the Institute and the Advisory Service, the latter was always at pains to demonstrate its independence and the writer was unsuccessful in his attempts to persuade the Ministry to purchase a block of grassland adjoining the North Wyke research centre [see later] to site joint grassland experiments and demonstrations.

The writer also felt it important to work with private industry in areas which brought benefit to both participating organisations. Particularly good working relations were

developed with the Agricultural Division of the Imperial Chemical Industries [ICI]. The GRI research program had much in common with the objectives of this Division, namely determining and achieving the potential of grass for milk production. Regular meetings were arranged between staff of the two bodies to discuss ways and means of achieving these objectives and presenting the results of relevant research and practice. One outcome of the co-operation was the important publication *"Milk from Grass"* (1982), a monograph with contributors from staff of the two organisations on Grass Production, Winter Feeding, Grazing, The Integration of Conservation with Grazing, and Economics of Production.

The GRI was situated within a few miles of Reading University which had an enviable reputation for its contribution to agricultural teaching and research. Further, one of the professors in the School of Agriculture at the University was Colin Spedding who, apart from his pioneering work on modelling, was a former Deputy Director of the GRI. Both he and the writer felt that steps should be taken to develop a joint Masters Degree in Grassland Science, particularly as no such comparable course was then available. There was ample teaching capacity at the University and the GRI and specialised equipment was available at the institute for any experimental work that might be included in a largely coursework degree. The favourable attitude for such a development at both the GRI and the University, combined with the human and physical resources which were available, made the proposed course a reality. Masters students can still enrol in the course.

Location of grassland research

One of the questions which exercised the writer was why the GRI should be located in an essentially non-grass growing region of England, especially since little research was being undertaken on permanent grassland which is concentrated largely in the western and northern parts of the country. It is conceivable that the establishment of the institute at Hurley was based on Stapledon's philosophy of the importance of the ley in land improvement; this would give some logic to the original decision. However, the use of the ley in British agriculture had declined markedly by the late 1970s, when it covered only 6% of the enclosed land in England and Wales. It seemed inconceivable that such little direct investigation was being undertaken on permanent grassland [then occupying 53% of the enclosed land in England and Wales (Lazenby, 1981)] and the writer felt strongly that a research centre in a typical permanent grass area was needed to provide relevant information for the adviser and farmer.

He was extremely fortunate that the lack of direct research on Britain's most important crop coincided with the tenure of the then Chairman of the Governing Body of the GRI, Mr Oscar Colburn, who was also a Crown Commissioner. He was sympathetic to the need for a research centre for work on permanent pasture and said that, if a suitable area could be found, the Crown Commission would purchase it for the use of the GRI, provided the Institute paid a commercial rent. Again, we were very lucky because a private company, Fisons Ltd, had just relinquished its grassland research station at North Wyke in Devon. This was conveniently located in an area covered predominantly by permanent pasture and typical of the land in the south west of England where 40% of the dairy cattle in Britain were concentrated. It had a large manor house, suitable for staff offices, some laboratories and 250 ha of land. The Crown Commission bought the research station in 1981 and agreed with GRI on an annual rent of some £ 3 000 at that time. A number of the Hurley researchers were immediately transferred to North Wyke and more investigations were added later. It is now a thriving research centre for permanent grassland. It is only unfortunate that its increasing importance has been at the expense of the Institute in Hurley, which was closed in the late 1980s even though it housed a valuable ongoing research program, especially on ruminants.

Staff management

Working closely with, and supporting, people is a key element of the writer's style of leadership and management and essential in developing good personal relations with all members of the research and support staff. Senior staff were encouraged to articulate their ideas, develop their own research program within the overall objectives of the GRI and make other decisions in their sphere of responsibility, always with the proviso they kept within their budget. The writer made a practice of standing by any decisions made by his deputy whilst acting director even if occasionally he might not agree with them, believing that loyalty, in both directions, is an invaluable ingredient of a successful team. He is convinced that the positive effects on the level of trust in, and respect for, a Chief Executive resulting from being open, honest and consistent in dealings with colleagues, far outweigh any occasional negative consequences which might arise from this approach.

A number of steps were needed to develop good personal relations. These included frequent formal meetings involving the Director and heads of department, in which significant happenings were reported and any other matters raised were discussed. More informal contacts, which were an important part of the process, involved the Director visiting staff frequently to talk to them about their work and any problems which they

might want to discuss. He also adopted an essentially open-door policy whereby staff were able to discuss any matters which concerned them. Staff were encouraged to undertake whatever professional training or higher degree study was relevant to their career, and it goes without saying that visiting research workers were always welcome at the Institute.

During his period at the GRI, the ARC requested directors of research institutes to organise a so-called Joint Annual Review [JAR] of the work undertaken by all staff. Staff and their supervisors had to agree on the responsibilities of individuals and their achievements during the preceding 12 months. The Director's main role in the process was to talk to individual members of staff perceived by their supervisors to have made unsatisfactory progress, using their JAR reports to discuss not only deficiencies in their work during the previous year but also their future career prospects. Initially, the writer felt that the JAR was a waste of time, but changed his mind after seeing the results of the discussions he had with the 7 members of staff whose work had not reached an acceptable level. By using the JAR positively to provide an early warning of their unsatisfactory performance, and to consider the options open to these staff, it was possible to save the careers of all except two.

Relations with the Governing Body

No Chief Executive could hope for a more supportive Governing Body than the writer had when he was Director of the GRI. In addition to the very close working relations he established with Oscar Colburn, who was Chairman for most of the time, comments received form the Governing Body were always helpful, with any criticisms of the current or planned research program entirely constructive. The Governors were particularly supportive of the proposals to develop close links between the GRI and the farming community, increase the work on permanent pastures and acquire a centre dedicated to such research.

Relations with the ARC

Some tension is inevitable between 'the administration' and 'the staff', whether in a university or research institute. Considerable tension was apparent on occasion between directors of institutes and the ARC, a situation not surprising as their agenda were often different. It was thus a greater challenge for the writer to develop a good relationship with the ARC than it was with his Governing Body. Yet, as it turned out, there were few issues of any consequence where there were serious differences of opinion. The first, which was relatively minor, concerned the timing of an ARC review of the GRI research

program, which the writer felt was premature. Another occasion related to the appointment of an agricultural economist. Even though the writer felt that such an appointment was vital to increase the credibility of the institute's experimental results with the farming community, it took months to convince the ARC to accept this proposition. Even then, we disagreed on the choice of the most suitable candidate, with the ARC wanting to appoint someone who the writer felt was singularly ill-equipped to undertake the role as he saw it. However, remembering the attitude of Stapledon to making staff appointments, he persevered and the right man was selected, ultimately. He turned out to be an outstanding addition to the staff.

For organisational purposes, the ARC divided research institutes into two groups, namely crops and animals. The writer felt that this structure impacted adversely on the GRI which had legitimate interests in both groups. He always suspected that not all the considerations relevant to GRI interests were taken into account when the ARC determined policy or made a decision affecting the Institute. It was thus necessary to make a special effort to ensure that the attitude of the GRI was conveyed to the relevant officers in the ARC before any decisions were finally taken.

Overall, the writer believes that the GRI was well treated by the ARC during his period as Director. It was very supportive of the changes made to the research program, with its increasing emphasis on problem-oriented work and on permanent grassland, and to the efforts made to strengthen links with the farming community. It was also positive in its attitude to the use of North Wyke to enable permanent pasture research to be developed. The writer has no doubt that the generally good working relationships between the two bodies flowed largely from the positive links developed with relevant ARC officers.

Some effects and achievements

The years spent at the GRI were very happy and personally rewarding for the writer. They provided an opportunity for him to be director of a research institution, which had a particularly important role to play in British agriculture, and where there were problems and challenges of real significance, both in understanding grass growth and in affecting pasture output. He was privileged to lead a dedicated group of researchers some of whom had not only made an impact in Britain but had a high reputation the world over. Being provided with varied opportunities extended his experiences of working with a range of people and organisations which needed the development of different skills to achieve positive outcomes.

A combination of a short period of 5+ years as Director, followed by his immediate translation to Australia, would make it presumptuous, if not impossible, for the writer to attempt any assessment of the effects of his stewardship. Suffice to say that he believes that the interrelated shift to work on permanent pastures and the acquisition of facilities at North Wyke, together with the links established with outside stakeholders, especially the farming community, and the good relationships built between the staff, were all things that he can look back on with some pride.

RETURN TO AUSTRALIA

Plant Variety Rights

The writer returned to Australia late in 1982 as Vice-Chancellor of the University of Tasmania, where his direct involvement with grassland was restricted to a short course of lectures given annually to undergraduates. However, in 1985, he was asked by the then Minister for Primary Industry, the Hon J C Kerin, to undertake 'An Inquiry into Australia's Plant Breeding Needs in the context of the ongoing discussions in the community on the desirability of introducing a Plant Variety Rights scheme'. Although Plant Variety Rights [PVR] legislation had been in operation in the UK for more than 20 years, no such protection was then available in Australia.

Findings and recommendations of the review included:

- Australian agriculture would benefit from an increase in breeding of a range of crop and other plants - including pasture plants.
- Private breeders should be encouraged to become involved in the improvement of a wide range of our plants, and
- Proprietary protection of improved varieties should be enacted through legislation.

The writer felt that the benefits of PVR to Australian plant breeding programs, namely access to improved overseas cultivars, most of which were protected, together with potential sales in overseas markets of Australian bred varieties, outweighed the legitimate concerns about such a development raised during the inquiry (Lazenby, 1986). Many Australian plant breeders were still focused on local rather than regional, national, international or commercial issues and he felt that PVR legislation was necessary to give them an opportunity to put their work into a more global context.

PVR, later amended to Plant Breeders Rights [PBR], legislation was enacted in 1987. It was a key factor in the sweeping changes which have occurred in the breeding and

marketing of pasture plant cultivars since that time. Public funding invested in the improvement of grasses and legumes has been reduced considerably during the past 15 years and there is now a much greater private sector investment in pasture plant improvement, with an increasing proportion of proprietary varieties sold. The quality of seeds has improved overall, whilst the level of seed production of protected varieties is better controlled than that of public varieties which are often either in glut proportions or in short supply. As a result, the seed price of proprietary cultivars is more stable than that of unprotected varieties.

All the main seed companies in Australia are now overseas-owned and there has been some rationalisation of their activities, such that all the breeding undertaken by a company on one or more species may occur at a single world location, with testing of new cultivars undertaken in target countries. Long-term alliances have been developed between some public breeding programs and seed companies to make better use of the expertise and physical resources available for breeding and marketing improved varieties. Greater investment in biotechnology, especially in transgenics, has occurred in both the private and public sectors, with an increasing use of molecular assisted selection to make breeding more precise and speed up the release of new cultivars.

There have been some disadvantages. Reduced investment has put a number of public pasture improvement programs at risk, especially where seed sales of varieties are insufficient to make their breeding commercially viable; these include a number of valuable niche varieties. Resolving the question of whether to continue to fund the improvement of these varieties presents a major challenge to the public system. Further, there has been some restriction in the availability of genetic material for plant improvement as a result of PVR and patent protection. Whilst the PVR legislation was written to allow unrestricted use of proprietary varieties in breeding programs, biotechnology processes and products are normally protected by patents and can only be used following the payment of a royalty. A higher than justified proportion of funds for pasture plant improvement is now being invested in biotechnology at the expense of traditional breeding. For example, the state of Victoria, which had the most comprehensive public breeding program in temperate Australia until a few years ago, no longer invests public funds in such activities. Yet the results of biotechnology have to be incorporated into a conventional breeding program, where they simply provide the breeder with more tools for plant improvement.

There is also evidence that some breeders are more concerned with their new cultivars being distinct, uniform and stable, characteristics required for protection under PBR, rather than having improved agronomic or production traits. Many new varieties are less adaptable than those previously available, whilst there are also indications that

advice to farmers is being based more on commercial than agronomic considerations (Harris, 2001).

The funding and organisation of rural research

The writer has had a long held interest in the funding and organisation of rural research. Most conclusions and recommendations on rural research apply to grassland research, especially in Australia, where pastures form such a major part of the landscape. In a submission to the Industries Assistance Commission, Lazenby and Tribe (1975) highlighted the key role of agricultural research in rural development, and the value of such investigations not only for the rural community but also for Australia as a whole. Further, they showed the importance of Australian agricultural research to the developing world. In arguing the need to maintain a high level of such research, they proposed that investigations should be broadened to include the social sciences as well as the biological, chemical and physical sciences, as economic and social problems in agriculture were both becoming increasingly important and inseparable from technological problems.

Difficulties preventing the best use of the limited funds available for agricultural research were discussed and attributed, in large part, to the lack of both a national policy for agricultural research and any overall co-ordination of the research being undertaken. Problems implicit in encouraging (i) multidisciplinary research, increasingly necessary to solve agricultural problems, and (ii) co-operation between various organisations, were analysed in the situation where State Departments of Agriculture, CSIRO and universities all went to great lengths to protect institutional interests and independence. The establishment of a national body was proposed to make recommendations to the Australian Government on the needs and priorities of a national program and its funding. It was also recommended that specific research programs should be contracted to institutions judged to have the best expertise and facilities to undertake the work (Lazenby and Tribe, 1975).

Considerable changes have occurred in the objectives of agricultural research since the writer first came to Australia. Whereas, then, it was focused almost entirely on increasing production, and systems studies were in their infancy, 20 years later a much greater effort was concentrated on sustainable production, in the face of cost/price pressures. Further, since 1975, there had been a marked increase in the funding of short-term research designed to solve practical problems, with reducing support for basic, strategic and long duration investigations. Such was the situation when stakeholders [funding bodies, researchers and clients] met in 1988 for lengthy discussions on the level

of funds available for agricultural R&D, their use, and the overall organisation of the work. The writer was asked to summarise and assess the views expressed at the workshop (Lazenby, 1988).

Other changes in the research environment since the paper of Lazenby and Tribe (1975) highlighted at the workshop included:

- More general appreciation of the need to make best use of available resources.
- Greater acceptance that researchers would be increasingly accountable for their performance as all stakeholders want value for their investment.
- Increased pressure to commercialise research findings, and
- A change in funding sources with reduced public investment and greater industry contribution to the research.

A number of consequences and problems flowed from such changes. For example, the pressure to commercialise R&D results has resulted in some change in the focus of research providers, with many increasing their effort on short-term, problem-solving investigations. The pressure to undertake such work caused problems in planning, as funds for basic and longer-term investigations could not be guaranteed. Further, the greater emphasis on competitive short-term funding required considerable time and effort to prepare submissions for both the support of projects and the frequent progress reports demanded by funding bodies. Whilst there was general appreciation of the need to add value to research results where appropriate, it was clear that only a small proportion of investigations produced results that were amenable to commercialisation.

There was unanimity in the conclusion that a major and continuing public investment was needed to support basic and strategic research and to tackle problems of national and regional significance, e.g. water use, soil degradation and environmental pollution, all of which are vital issues in grassland research. It was also clear that public- and private-sector research in rural R&D had different objectives, with the latter expected to deliver commercially available ideas and services quickly to maintain competitiveness and profitability.

Duplication of work was still the major deficiency of rural R&D. Fragmentation of research inevitably results in both less than optimum funding of multidisciplinary problems, and poor use of such funds. Since 1975, a number of discussions had been held between research providers and funding bodies, giving rise to some optimism that the co-ordination of rural science would be improved. Yet, relatively little change was detected in the attitude of a number of research bodies and individual researchers towards becoming part of a more co-ordinated national program. A number were still defensive, inward looking, focused on local problems, and going to great lengths to

protect their own interests. There was some evidence of leadership by the Rural Research and Development Corporations [RDCs] in the steps being taken to co-ordinate research for their industries e.g. the Meat and Livestock Corporation [MLC] had taken an initiative towards the rationalisation of research funding for the beef industry in northern Australia, and had made proposals for a similar co-ordination of research activities for temperate pastures in southern Australia. However, overall, there was much less co-ordination of rural research than desirable and taking steps to rationalise such activities remained perhaps the biggest challenge facing the stakeholders.

In order to investigate major problem areas, the writer felt that there should be some aggregation of expertise and resources into bigger research groups than then existed, thus enabling a clearer focus for the work and its increased funding (Lazenby,1988). He envisaged that these larger groups would almost inevitably include individuals from different organisations, although all participants need not necessarily be sited in the one place.

The need to establish national centres of excellence was again advocated strongly in the meeting of stakeholders held a year later to deliberate on the organisation and priorities in rural R&D (Lazenby, 1989).

[A number of Co-operative Research Centres [CRCs] were established on university campuses in 1991, with staff from universities, CSIRO and other organisations from the public and private sectors. The activities of these CRCs, and those established later, were focused on specific topics, with a number, e.g. the Centre for Legumes in Mediterranean Agriculture and the Centre for Molecular Plant Breeding, of relevance to grassland research. The CRCs enabled a critical mass of staff to investigate defined areas and brought an increase in research activity to universities. The Commonwealth Government envisaged that a major objective of the Centres would be to develop links with industry, which would assist in both determining the experimental program and the transfer of technology].

A number of strong arguments for an Australia-wide strategic plan were advanced. They included the conclusion that a national response was needed to properly undertake research on many important rural problems such as water use, environmental degradation and the need to develop sustainable production systems; it was also agreed that an integrated approach in biotechnology was desirable. Further, industry funds had become so important that they were now central, rather than peripheral, to rural R&D. Research providers were becoming increasingly dependent on industry funds for their experimental programs, adding strength to the case for better co-ordination of rural research overall. A national plan and strategy are also necessary to determine research

priorities and to ensure that the work is targeted, objectives which require an accurate data base on the type and funding of experimental projects and programs in progress. [A Register of Rural Research in Progress [ARRIP] was established in the early 1990s]

Developing a national strategic plan is one thing; implementing it is another. The influence of political considerations was recognised as important in determining research priorities and vital in determining whether they could be implemented, especially if this involved a major change of direction. Yet there is no doubt that such changes are necessary to make best use of available resources, maintain a vigorous and relevant research program and retain the competitiveness of Australian agriculture.[Some steps have now been taken in most states towards the rationalisation of the resources available for agricultural R&D]. The leadership of research managers is a vital ingredient of a successful research program, especially of one involving the redistribution of resources. Managers must be convinced of the priorities, consistent [not to say persistent] in advocating why a change in research focus is required, and strong enough to resist the inevitable criticism which will follow (Lazenby, 1989).

Industry funds and pasture plant improvement

The RDCs, established through joint Commonwealth and industry funding to represent industry interests, have made considerable investments in grassland R&D, particularly since 1990. The investments cover a range of issues and opportunities potentially important in influencing grassland output and which may have economic, environmental or social ramifications. The writer is most familiar with the help which the RDCs have given to pasture plant improvement, with MLC (now Meat and Livestock Australia [MLA]) contributing some A$6.4m to such objectives between 1990 and 2002 (Lazenby *et al.* 2002). The Australian Wool Board [AWB] (now Australian Wool Innovations Ltd [AWI]) and the Grains Research and Development Corporation [GRDC] concentrated their support on improving annual pasture plants with the Dairy Research and Development Corporation [DRDC] and MLC focusing on perennials. Provision of industry support has normally operated through (i) a contribution, for a limited time, to the funding of projects judged of importance to the relevant industry, and (ii) leverage of funds from other bodies.

An initiative of the RDCs resulted in the establishment of a National Pasture Improvement Co-ordinating Committee [NPICC] with responsibility for co-ordinating the pasture plant improvement programs in the public sector. Initially, NPICC had members representing the interests of the Commonwealth and State governments and the RDCs, together with the co-ordinators of the plant improvement programs [see below]

and an observer member of the Seed Industry Association of Australia [SIAA] was invited to join later. NPICC operated through two program committees, one responsible for making recommendations for co-ordinating the improvement of annual pasture plants and the other for perennials.

The writer co-ordinated perennial pasture plant improvement in the public sector between 1995 and 1998, when the committee was disbanded after most public perennial pasture plant improvement programs had become associated with private seed companies. The co-ordinator's role was concerned largely with management issues, though there were opportunities to show leadership, e.g. in suggesting and preparing position papers on his perception of problem areas for R&D. Management responsibilities included (i) organising annual meetings of collaborators [representatives of Commonwealth and State governments, plant breeders, and the RDCs], (ii) facilitating their role to nominate priority problems and their funding, (iii) reporting such recommendations to NPICC for approval, and (iv) communicating the results of the two committees to a larger group of some 100 stakeholders.

The RDCs agreed to contribute to the funding of the highest priority projects, and governments accepted their responsibility to continue their support of such work. Hence, the leadership shown by the RDCs resulted in better co-ordination of public improvement programs and continuing support for work of highest priority. In spite of some negative comments from a number of stakeholders, who likened industry support to 'the tail wagging the dog', there can be no doubt of the positive influence of the RDC initiative in making better use of the funds available for pasture plant improvement. Further, a range of improved varieties, especially of perennial ryegrass and lucerne, were products of the rationalised program.

The Australian Pasture Plant Evaluation Committee [APPEC] was established by NPICC to develop a national system for the evaluation of new cultivars of perennial pasture plants. In addition to an independent Chair (a position which the writer held for some 5 years), there were four members, two representing each of the interests of the public sector and the SIAA. Leadership was required to develop a national protocol for variety evaluation, whilst arranging and undertaking inspection of the evaluation plots needed a modicum of management skills. Further, training courses were needed for those responsible for undertaking the field testing of new varieties.

Although APPEC no longer exists, it had a major influence on shaping the attitude of SIAA to variety evaluation and on the way information on cultivar performance is presented in company brochures. Further, the APPEC protocol has been incorporated into the code of practice of SIAA [a legal document] and the use of data on cultivar

performance is subject to the body's code of conduct (Neilson, pers comm), thus making a significant positive impact on the quality of variety evaluation and the reliability of the data available on cultivar performance.

Developments in grassland research and practice since 1990

A fundamental change has occurred in our thinking on grassland research and practice in Australia since about 1990. It followed an increasing awareness of the need to consider grassland as an integrated system involving the interaction of the range of factors which can have a significant impact on output and profit, and provide the basis for better management decisions. Predictably, the transfer of research findings has lagged behind the acquisition of knowledge. Nevertheless, major improvements in animal output and farm income from improved pastures in southern Australia have flowed from systems research and the transfer of findings. Research scientists, extension agronomists, consultants and, not least, producers, have all shown leadership, playing a significant part in improving grassland output and profit.

The private sector, with its much greater role following the reduction of public services, has made a significant contribution to the changes in attitude and practice. Agribusiness has become the new element for change and now offers a comprehensive range of services to producers covering seeds mixtures, pasture establishment, grazing management, weed control and stocking rates. The advice provided by the private sector is sometimes at odds with that of extension agronomists, the traditional source of information. One agribusiness chain, which is now responsible for most of the advice on pasture management on the Northern Tablelands of NSW, claims more than 95% success for pasture establishment. Its recommendations for seeds mixtures suitable for improved pastures on the tablelands differ from traditional advice and include the use of proprietary lines of pasture plants, including grasses - especially tall fescue - legumes and herbs for perennial pastures, and short-rotation and perennial ryegrass for special purpose fattening pastures. These recommendations and those on management techniques have been accepted enthusiastically by many producers (Lazenby, *et al* 2002).

The factors responsible for improving the output of grasslands in southern Australia since 1990 differ from one region to another. In the so-called wheat and sheep zone [WSZ], found typically in Western Australia [WA] and South Australia [SA], but also represented in Victoria [Vic] and NSW, the increasing availability of improved annual legumes, especially of subterranean clover and annual medics, has been a major factor in improving the productivity of the short-lived (ley) pastures. A rethink on the focus of

legume research for the WSZ occurred in the early 1990s when it was felt that further breeding of subterranean clover and annual medics would result only in marginal improvements. A decision was made to select other annual legumes adapted to niche areas which lacked suitable plants, e.g. some better adapted to waterlogging and others with different patterns of hard seed breakdown. New annual legumes which are now becoming available include balansa clover (*Trifolium michelianum*), yellow and French [pink] serradella (*Ornithopus compressus and O. sativus*, respectively). One cultivar of the latter plant is being adopted rapidly in WA and was sown on some 500 000 ha of predominantly sand plain soils in 2002. The beneficial effects of lucerne in reducing the ravages of salinity, a particularly widespread problem in WA, are also becoming widely accepted, and more than 500 farmers in the State now grow lucerne.

In contrast, new pasture plants have had less influence on output in the improved perennial pastures in the high rainfall zone [HRZ], found typically in south eastern Australia. There, appropriate management, in the form of continuing use of superphosphate and moderate to high stocking rates, together with an increasing awareness of the need to consider the whole system, have been the key to the improved level of pasture output. A number of experiments and extension programs, many based on integrated grassland systems, have increased the awareness by HRZ farmers of those factors which are significant in managing their pastures and stock, thus providing the basis of improved management decisions. The projects show the importance of extension, farmer participation and training in the transfer of research findings into practice. They have also helped to effect a remarkable change in the attitude of many producers, not only to their grassland management but also to increasing their knowledge of factors affecting output, including enrolling in courses to increase their profit (Lazenby et *al* 2002). So significant have these projects been in stimulating change and improving pasture output, in improved pastures in the HRZ of Australia, that a number merit special mention, especially as some contain an important training component.

An investigation showing the effect that phosphorous [P] can have on pasture yield and quality, stocking rate, animal output and gross margin, The Hamilton Long-Term Phosphorous Experiment (Saul *et al.,* 1999), was visited by hundreds of people from all parts of Australia. It demonstrated the potential of high-input systems and 'had a large impact on the grazing industries of SE Australia' (Sale, 1999). The greatest value of another long-term study, the Farm Monitor Project (Beattie and Hamilton, 2001), was in enabling benchmarking of the performance of the participants. The pasture output and gross margins of the best performers [the top 20% had a gross income some 25% greater than the average] provided individual producers with both an indication of what was

possible and a target for their own enterprises (Beattie and Hamilton, 2001). A further project, the Grassland's Productivity Program, involved some 200 farmers from SE Australia working in small groups to undertake paired-paddock comparisons of the then current practice and high-input systems. A marked improvement in financial performance was characteristic of high-input systems in a project also designed to develop the skills and confidence of farmers to manage productive pastures (Trompf and Sale, 2000).

The Sustainable Grazing System [SGS] and the Temperate Pasture Sustainability Key Program [TPSKP] were initiatives of MLA, planned to shed light on productivity, profitability, sustainability and social issues. Interrelated activities were designed to train producers to develop their skills, determine regional priority issues, and develop principles, tools and indicators for improving profitability and sustainability. Some 10 000 producers were associated with work which resulted in improved plant and animal management, and increased recognition and understanding of environmental issues (Kemp *et al.*, 2000, Mason and Kay, 2000). The fact that 80% of participants changed their practice shows how instrumental SGS and TPSKP were in catalysing change in the management of pastoral systems.

PROGRAZE, a management support system developed by NSW Ag, is built on modelling research. Aimed at improving on-farm decisions, by the year 2000 more than 5 500 producers in NSW alone had been attracted to its courses on improving skills in pasture and animal management [This had risen to 9000 by 2003 (Allan, pers com)]. The identification of the key factors determining profit - pasture, fertiliser policy, stocking rate, control of internal parasites and supplementary feeding - allows both strategic and day-to-day decisions to be made at property level (Bell and Allan, 2000). A further management support tool, GrassGro, developed by CSIRO, can be used to help determine both short- and long-term risks and estimate profits for a range of pasture-animal enterprises. For example, predictions can now be made on the effects on gross margins of varying stocking rates, year-to-year variability in available feed, and changing joining and weaning dates to supply meat when required by the market (Moore *et al.*, 1997).

Some opportunities for research

The writer's judgement on opportunities for research which have the potential to affect practice in a high-input system derives from a number of simple propositions, namely that: good pasture plants are the first requirement for high output; appropriate fertiliser and management policies are then needed to produce substantial yields of dry

matter and convert them into animal products; and, all major variables need to be considered as interrelated parts of a system, to determine both (i) the potential animal output from the system, and (ii) a level of output which is sustainable agronomically and economically providing the farmer with a continuing viable income, without causing any serious environmental degradation. In determining future research projects, the writer feels strongly that work of national significance should take priority over that which is locally focused, whilst agricultural and environmental objectives should become increasingly coincident. Selected research opportunities, typifying work with potential to make a real impact on grassland practice, will be briefly discussed.

Research projects and programs in this category differ from one region to another. For example, increasing the range of available pasture plants is an important objective in the WSZ. A number of new annuals with desirable attributes, including cultivars of yellow and pink serradella, biserrula (*Biserrula pelicinus*) and gland clover (*Trifolium glandiferum*), will be released in the next few years from the WA-based legume improvement program. The selection of other annual legumes better adapted to specific niches provides a continuing opportunity to increase pasture output in the WSZ.

Salinity threatens the sustainability of farming systems, the livelihood of many farmers in southern Australia, especially in WA and the Murray Darling Basin, damages infrastructure and causes degradation to river systems. It is not surprising that salinity has become the new driver of the plant improvement program, especially for the WSZ. Whilst lucerne is an excellent plant for reducing recharge, it is poorly adapted to acid and waterlogged soils. The CRC for Plant-Based Management of Dryland Salinity has shown considerable leadership in developing a nationally-integrated program to select perennial legumes, perennial grasses, shrubs and other tolerant species adapted to saline conditions. Plants, sourced from Australian and overseas centres, are being screened to identify those able to help stabilise affected discharge areas and reduce salt outflow into rivers. A number of perennial legumes, including species of the genera *Hedysarum, Lotus, Dorycnium* and *Galega* have already shown some potential to achieve the above objectives. Management information packages, listing best practice, need to be available at the time of their release to enable farmers to make the best use of the new annual and perennial legumes (Lazenby *et al.*, 2002).

A genuine opportunity also exists to select plants better adapted to the growing conditions than those presently used in many HRZ pastures, where lack of a persistent legume is a particular problem. In Tasmania, a number of populations have already been identified, including selections of the legumes *Ornithopus* and *Trifolium ambiguum* (Caucasian clover), and some winter-growing cocksfoots, which have outperformed subterranean clover and winter growing grasses, which are normally grown in pastures

in the State. Selection of more persistent and better yielding plants, of which the above are examples, will undoubtedly increase the stability and output of pastures in the HRZ.

Breeding cultivars with greater persistence, improved quality, better seasonal growth and resistance to major pests and diseases all provide opportunities for increasing grassland output, whilst low seed production, lack of tolerance to adverse soil conditions [acidity, alkalinity, salinity and waterlogging] and the presence of toxic substances, are all major constraints to pasture performance. A number of traits, e.g. bloat-free white clover and lucerne, immunity to a number of pests and diseases and lucernes tolerant to high salinity, can only be incorporated into new plants through transgenics, thereby providing so-called quantum leaps in cultivar performance. Whilst such biotechnology has considerable potential to increase pasture output, its many associated problems - delay in commercialisation, uncertain outcome, high costs and negative community attitudes to genetically modified plants - mean that the major and long-promised gains cannot be anticipated in the short-term. In contrast, another use of biotechnology, namely marker assisted selection, can increase the precision of selection and speed up the release of improved cultivars, and thus has greater short-term potential to increase pasture output than transgenics (Lazenby *et al.*, 2002).

Weeds are a severe constraint to animal output in many improved pastures. The losses in animal output caused by such plants, especially serrated tussock grass (*Nasella trichotoma*), in improved perennial pastures on the tablelands of NSW have been estimated at between A$100m and A$200m annually (Vere *et al.*, 2003). Considerable funds have already been invested, with mixed results, in a range of practices designed to achieve weed control. A number of organisations, including CSIRO and MLA, have targeted biological control of specific weeds in pastures; initial results indicate a promising outcome from these investigations. Whilst it is known that both increased plantings of perennial pastures and good grazing management can reduce some weed problems, further research in controlling weeds is justified; if successful, it would considerably improve both the botanical composition of pastures and animal output.

Pasture sustainability and related environmental degradation are important now and will become even more vital issues in the future. A number of systems studies, some involving modelling, are underway to improve management decisions. Others are needed to refine such support systems. Management decisions needed to maintain stability and prevent or reduce environmental degradation are dependent on data collected from long-lived plots or pastures. Whilst further investigations could be undertaken to gather relevant data, experimental plots already in existence, or even long-lived farm paddocks, would provide information, and enable benchmarking, on such indices as botanical composition (reflecting both the proportion of desirable species and

biodiversity), ground cover, water use, salinity levels and nutrient loss through drainage water. An increasing number of systems studies will be needed to study both output and environmental effects of treatments. Three RDCs, namely GRDC, MLA and Land and Water Australia, have recently decided to invest jointly in one major research program - Grain and Graze - designed to determine what mix of pastures, crops and livestock will increase profit and reduce recharge in the WSZ. The desired outcome of this program, like a number of those in the HRZ, is building confidence in decision-making. Key elements include increasing the knowledge and kills of farmers, and improved presentation of the information [including the use of common language and detailed protocols] to cater for different styles of learning (Allan, pers comm). The leadership of the RDCs in tackling this complex opportunity can only be commended.

Opportunities for improving practice

Information provided in a recent in-depth survey (Lazenby *at al.*, 2002) has reinforced previous evidence that scientific and technical knowledge on grassland is generally well in advance of its practical implementation. Thus, there are considerable opportunities for undertaking extension activities to improve grassland practice. They require not only making clear to farmers what information is being presented but how they can find, interpret and use it. The writer has no doubt that a major investment in the national extension program detailed below would not only result in a considerable overall improvement in pasture management but it would also provide the best short-term return on funding of any major R&D activity affecting grasslands in southern Australia. It would also reduce environmental damage and increase the level of farmers' knowledge and skills.

A national integrated decision-support system (DSS) is envisaged which would require (i) the assembling of available information for an agreed set of protocols covering the establishment, monitoring, management and utilisation of pastures for the WSZ and the HRZ; (ii) consultation with researchers, educators, advisers, agribusiness and producers on the use of the protocols to achieve industry benchmarks for the productivity, sustainability and profitability of pasture/livestock systems; and (iii) a national launch of an integrated DSS, using the latest extension techniques (Lazenby, *et al.*, 2002).

The industry protocols would be based on a number of available and successful projects and programs, such as the NSW Ag Prime Pasture Project for pasture establishment (Keys, 1996), Pasture Check with TOPCROP, a system developed by GRDC for pasture monitoring, the Temperate Pasture Sustainability Key Program

(TPSKP) and SGS programs for sustainable pasture management, PROGRAZE, for pasture and livestock management, the Grassland's Productivity Program, GrassGro and the Farm Monitor Program for generating pasture targets and decision support. The existing information would need to be presented simply and consistently for a national audience. Much of the content in the information/training packages required for HRZ and WSZ pastures could be common (Lazenby, *et al.*, 2002).

Farmer training is the key requirement for putting knowledge into practice. The training program needed for the above proposed national DSS could be provided as a self-teaching version [book, manual and web], or as a modular short course available through vocational courses or advisers. The modules could include deciding on an approach (likely outcomes and risks from low-, intermediate- and high-input strategies), selecting pasture species and cultivars for different climates and soils, pasture monitoring and management (soil, weed, pest and disease monitoring, botanical composition and other pasture checks) for production and sustainability, and utilising the pasture for profit (stocking rate, livestock production, destocking/restocking decisions and economics) (Lazenby, *et al.*, 2002).

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Allan in the preparation of this paper. PROGRAZE is a trademark owned by

NSW Agriculture and GrassGro is a trademark of CSIRO.

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LIDERAZGO, MANEJO Y FORMACIÓN EN INVESTIGACIÓN DE PASTOS: ALGUNAS EXPERIENCIAS E IMPRESIONES PERSONALES

RESUMEN

Se describe la experiencia del autor como joven investigador en la Welsh Plant Breeding Station (Gran Bretaña), lector en la Universidad de Cambridge (GB), Profesor de Agronomía en la Universidad de New England (Australia) y Director del Grassland Research Institute (GB). Se analiza su efecto, y el de la influencia de algunos líderes en investigación de pastos, sobre el desarrollo de su estilo de liderazgo y de su labor en la formación de nuevos investigadores. Se mencionan algunos retos con los que se enfrentó en los cargos que desempeñó, y se indican los métodos usados para alcanzar los objetivos establecidos.

Después de su regreso definitivo a Australia, participó en el desarrollo de la legislación sobre Derechos de Propiedad de Variedades de Plantas, lo que ha tenido aspectos positivos y negativos, que se describen brevemente. Tuvo la oportunidad de participar en un debate nacional sobre la organización, el establecimiento de prioridades y la financiación de la investigación y del desarrollo rural en Australia, en el que el autor jugó un papel importante en el establecimiento de prioridades para la financiación de la mejora de plantas en el Sector Público. Recientemente, ha participado en el análisis de posibilidades de financiación de proyectos prioritarios de investigación y desarrollo de pastos en el Sur de Australia. Un trabajo de esta naturaleza requiere capacidad de liderazgo, sensibilidad y formación adecuada, si se pretende desarrollar sistemas que mejoren la producción de los pastos y que, a su vez, sean sostenibles desde el punto de vista agrícola, económico y medioambiental.

Palabras clave: Mejora de plantas, mejora de pastos, estudiantes post-graduados, coordinación de la investigación, retos, oportunidades.