CHAIRPERSON'S SUMMARY PAPER
Session 60: Ley pastures-arable crop systems

"Being Realistic about Ley Farming"

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The structure of a farm system at any time ...depends on all technical economic, social, cultural, and political influences that impinge on the farmer... Hans Ruthenberg

...the light which experience gives is a lantern on the stern, which shines only on the waves behind us. Samuel T. Coleridge

INTRODUCTION

The organisers titled the theme of this session the "Role of ley pastures in sustaining crop rotations and production in different climatic and social zones," and they invited papers to focus on mediterranean and tropical zones respectively. The papers capably reveal major differences in problem settings and opportunities for ley farming both within and between these two major geographic zones. Tropical Africa suffers declining production capacity as a result of increasing cropping pressure, shortened fallows, and spread of cropping into marginal grazing lands, but barriers to more intensive production technology (including ley farming) are high. In the tropics of Latin America, there appear to be opportunities for intensification of production of grazing lands, and there is high interest by R&D institutions in a ley farming approach. In the Mediterranean basin, there are difficult economic and social-political barriers to adoption of leys. In Australia, where ley farming has been well established for 50 years, it is under threat.

Against these differences, two similarities stand out. Firstly, in most places, no longer can it be said that knowledge of the feasibility of ley farming is precluded by the nonexistence of well-adapted pasture legumes. The development of tropical pasture legumes in the past two decades has removed this constraint. Secondly, everywhere, it seems, there is disappointment and concern about low interest of farmers in ley farming. In both West Africa and the Mediterranean basin, where R&D has not only produced well-adapted pasture legumes but succeeded in stimulating producers to invest in leys for a period, there is little indication of this persisting, let alone spreading. In the Australian wheat-sheep zone, the most cited case of successful ley farming, researchers are distressed at the trend of greater time-area under crops and less under leys and reduced investment in pasture productivity. The real champions of ley farming everywhere are agricultural scientists (e.g., Mohammed Saleem & Fisher 1993; Reeves & Ewing 1993; and several papers in Osman et al. 1990).

In reflecting on this, I find the words of Hans Ruthenberg particularly helpful. In introducing his book, *Farming Systems in the Tropics*, he wrote, "The hypothesis in this book is that farmers are intentionally rational in organising their systems, given their objectives. In describing farming systems and their possible avenues of development, three working hypotheses are consequently adopted in this book.

1. There is always a reason why farming is carried out in one way rather than another, and the reason is often but certainly not always an economic one.
2. Change in the environment of the system generally produces discrepancies between the actual farming system employed and the optimum solution, given the farmer's possibilities and preferences.
3. Farmers tend to adapt their farming to changing circumstances provided the change is "satisfying" in terms of the additional benefits."

Acceptance of this view does not imply accepting farmers as all-wise. The possibility that ley farming may prove to be a better adaptation for some farmers than a current, apparently unsustainable, system is sufficient reason for some degree of persistent professional attention. However, it may be time to question our faith in this solution and critically examine the adaptiveness of ley farming for different contemporary circumstances. My aim is to encourage and assist this in a modest way.

As do Mohammed Saleem & Fisher, I use the terminology of Ruthenberg (1980 p. 110). *Unregulated leys* are pastures that regenerate naturally in fallow periods ("grass fallows") and are characteristically grazed communally. *Regulated leys*, on the other hand, are characterised by individual ownership of land, fenced holdings and paddocks, management of grazing, the sowing of desirable pasture species, and, almost always, the application of phosphorus fertiliser to pastures.

The paper by Mohammed Saleem & Fisher concerns intensifying from unregulated leys to regulated leys (hereafter "ley", unqualified, refers to a regulated ley). If there is to be a role for leys in the tropics, the challenges concern the achievement of the managerial control and capital inputs needed to reap the increased labour and land productivity of this transition. The paper by Reeves & Ewing concerns the widespread intensification beyond regulated leys towards continuous cropping which is occurring in southern Australia. Here, the key question is whether this adaptation to economic pressures is ecologically sustainable.

FOCUS ON TROPICAL LEY FARMING

The concept of ley farming was prominent during the period of British colonial efforts in agricultural development. It was clear to many that the features of this system which had been so beneficial in Britain, e.g., (a) enhancement of the economic efficiency of integration of crops and livestock and (b) restoration of the soil productivity following cropping were needed even more in the tropics. The fact that there were few tropical legumes with promising attributes was not seen as a particularly serious impediment because there were plenty of suitable grasses. Not until the 1960s was it shown conclusively that it was primarily legume N fixation, not physical improvement by fibrous grass roots, that provided the benefit from leys in Europe (Cooke 1967). Sown grass leys were trialled widely in the tropics, and it became clear that while "the grass ley probably has a modest, direct, beneficial effect on the nutrient and physical status of the surface soil..., unfertilised grass leys are no more effective in maintaining fertility than are (grass) fallows of natural regeneration" (Webster & Wilson 1967, quoted by Ruthenberg 1980).

The selection of tropical pasture legumes in the 1960s in Australia, prompted a second wave of interest in leys for the tropics. This was initiated by the recognition of the benefits of naturalised Townsville stylo (*Stylosanthes humilis*) in tropical Australia and followed by collection of and selection from a wide range of legumes, especially stylos. This led to pasture legume programmes in South America and Africa especially by CIAT and ILCA, the home institutions of the authors of the tropical paper in this session. As revealed in this paper, these programmes have released a number of well-adapted legumes which, together with some from Australia provide a germplasm basis for ley farming in parts of Africa, Latin America and Asia (Simaraks, 1993). This removal of a virtually absolute constraint is a significant achievement. But even with the new legumes, which are of much higher nutritive value than tropical grass pastures and which substantially increase soil N and yields of subsequent crops, it is clear from these same authors that ley farming is not happening in subSaharan Africa nor, to date, in South America.

Hans Ruthenberg was an agronomist who realised that the key to more successful agronomic R&D was a better perspective of the farming systems which were the targets of change. While much has been written about tropical farming systems and research of them, Ruthenberg's chapters, "Fallow systems" and "Ley systems and dairy systems" in *Farming Systems in the Tropics* provide a framework for assessing recent experience in tropical ley research (Ruthenberg 1980). Ley farming has nowhere in the lowland tropics evolved spontaneously from an indigenous farming. Where a ley system can be found, it is in a restricted area which has at least one of seven features, and these are found in a number of high altitude large-farm areas (p. 111). Not only are these areas climatically most like temperate

areas where ley farming has evolved, but several have a European connection, e.g., the former "white highlands" of Kenya. When writing the last edition of his book, completed shortly before his untimely death, Ruthenberg watched with interest the active research on leys using the promising new tropical pasture legumes. He did not rule out the possibility of a successful ley farming system in the lowland tropics in the future, but his analysis of the characteristics of the technology and of the fertiliser and labour economies of ley farming gives clear indication of what conditions would have to change for this to occur. Many pasture agronomists tend to be dismissive of both Ruthenberg's logical framework and the scenarios constructed using it. Others, including myself, have felt that he simply failed to appreciate how good these new legumes were. A recent study of crop-livestock integration in Africa included field surveys in ten countries, many of which had pasture ley R&D using these legumes which Ruthenberg was observing with great interest. Significantly the only case of farmers sowing forages was in the highlands of Kenya (McIntyre et al. 1992), and here tropical legumes are not used.

In their paper, Mohammed Saleem & Fisher present the logical arguments and conclusions of Ruthenberg and the findings of McIntyre et al., and then conclude that popularisation of ley farming will depend on scientists finding answers to a host of technical questions concerning the performance of ley systems. I submit that the more appropriate response is to seriously question the appropriateness of ley farming as a development option and of further major R&D except under special circumstances. Our credibility as professionals in R&D may depend on our ability to recognise when these circumstances do not exist and on our willingness to then advise that the priorities, at least for now, are other than the technical and ecological.

Although the paper by Mohamed Saleem & Fisher says little about Latin America, it was revealed in the general discussion of this session that large areas are targeted for development projects based on leguminous pastures in rotations with grain crops. The prospects would seem brighter than in Africa owing to individual ownership of large farms, ample capital, and strong government support.

One final observation of Ruthenberg: the tendency in the tropics is, rather than intensification of unregulated leys, for the area of unregulated leys in each holding to shrink until permanent cropping is practised. Usually it is more profitable in smallholdings to expand the area of high yielding cash crops and/or, where high value animal products are produced, to zero-graze fodder from croplands rather than to intensify leys. This is aided by technological advances in crop cultivars, chemicals, and machines, and increased accessability of fertilisers (Ruthenberg 1980, p. 124). Perhaps the most important factor is that before the barriers preventing intensification to regulated leys are overcome, population pressure tends to rise to levels that requires intensification to go beyond that of ley farming to continuous cropping (Ruthenberg 1980, p.108). The problems of sustaining productivity with continuous cropping are awesome and the tendency of scientists is to rebound to the ley farming solution; but faced with Ruthenberg's logic and the findings of McIntyre et al. (1992), we must ask ourselves if this is more than wishful thinking.

However, conditions in the tropics do occasionally appear to be suitable for ley farming. Although not significant in economic or social terms, the new ley system in the Northern Territory of Australia reported in a poster in this session appears to be well adapted (McCown et al. 1993). But such large farms with well established grazing enterprises and advanced chemical and mechanical technology are uncommon in the tropics. The case of small holder dairying in Thailand (Simaraks 1993) while not yet working to design, appears to have some promise, albeit remote.

FOCUS ON MEDITERRANEAN LEY FARMING

An important distinction has to made between ley farming in the mediterranean climatic zone of Australia and in the Mediterranean region. Reasons for the failure of indigenous tropical farming systems to evolve to regulated ley systems appear to apply equally well to the Middle East and North Africa (see Springborg 1990). Agriculture in the Mediterranean basin has features that impede adoption of ley farming, e.g., lack of integration of livestock and cropping, livestock products a small proportion of farm income, and little cropland production of forages (Grigg 1974). While the paper of Reeves & Ewing focuses on ley farming in Australia, the proceedings of a conference in 1988 provides a helpful comparison of the vision of scientists for ley farming in the Mediterranean basin and the actual status of legume leys (see Osman et al. 1990). Impressive progress has been made in recent years in provision of adapted pasture legumes, but even after large development projects, there is little evidence of adoption of pasture leys. Papers on the state of legume-based agriculture in respective countries of the region painted a sobering picture of micro-economic, social and policy barriers to ley farming.

In Australia, the wheat-sheep ley farming system is presently under enormous economic pressure, with simultaneous downturns in wheat and wool prices. Hutching's paper in Session 53 depicts the effect of this on farm management. Farmers are in survival mode, and investment in pastures for high quality feed and future soil fertility is at a minimum. Leys have diminished in area and are managed less intensively. The paper by Reeves & Ewing deals with the adaptations farmers have made in response to a longer term rise in costs and decline in commodity prices. Over a period of decades, there has been a shift away from leys towards more intensive cropping with increased inputs of nitrogen fertiliser and grain legumes because these are more profitable. Since this is the normal way farming systems evolve, the only reason such a change warrants mention is the concern in professional and policy circles about various threats to long term productivity of this more exploitative system. This is not straightforward because other practices, e.g., reduced tillage and residue retention tend to slow soil degradation. However, the paper convincingly demonstrates the continuing need for leys in managing disease and weeds, and for periodic restoration of soil organic matter after cropping phases.

The play on the word "phase" made by Reeves & Ewing deserves mention. In the increasingly cropping-intensive Australian system, when a cropping area is sown to pasture, this tends to be for an extended period, although not as long as cropping. In recent years, the term "phase farming" has been used to distinguish this adaptation from "traditional" ley farming, in that (a) pasture and cropping phases of rotations are longer than those which have characterised Australian ley farming and (b) there is a lesser proportion of time-area under ley than 50%. Although these differences are real and significant, use of existing terminology would be more useful in communicating the attribute of flexibility in ley farming. In his historical account of ley farming in the British Isles, Davies (1952) is concerned about clarifying the term "ley". He argues that as long as pastures are developed with an aim to future crop production they are leys and that the principles are the same whether it be for one year or decades. In connection with long-duration leys Davies quotes Howard (1880), "If corn-growing should again become profitable, the same land would for many years be far more valuable for arable purposes because of the rest it had in grass". If, as Reeves & Ewing conclude, ley farming is not a passing phase (in their second meaning of "phase"), the important adaptations in the Australian ley system dealt with in their paper, while of great importance to economic survival, can be described as a shift to longer leys between longer cropping phases, with increased inputs to the latter. The fact that the more intensive system is still very importantly a ley system was emphasised by Reeves in the general discussion.

If the cost price pressure on this system continues to increase and grain production remains more profitable than wool, continued shift in the direction of continuous cropping can be expected. Ruthenberg observes that under such conditions, a pattern of continuous cropping on the most favourable land and permanent pasture on the poorer land tends to result. The importance of this pattern in the Australian system emerged during the general discussion.

CONCLUSIONS

Legumes suitable for leys were introduced into the British Isles in the 17th century, but ley farming systems did not develop rapidly until a century later after introduction of a freehold land system (Davies 1953). Repetition of this evolutionary pathway in much of the developing world cannot be presumed. In many cases, by the time land tenure barriers are removed, pressure on land will be too high for ley farming (e.g., Eastern Kenya, McCown et al. 1992).

The strength of the ley system is its flexibility to respond to need for reallocation of resources between crop and animal production and the elegance of the soil restoration linkage. As appealing as ley farming is, it appears to be adaptive economically and socially only

in conditions that occur in but a few places and times. In spite of the provision of several well-adapted pasture legumes, the evidence indicates that the prospects for ley farming in most of the tropics and the Mediterranean basin are poor where it is not already well established. Because the reasons for this lie mainly beyond technology and production ecology, the returns for continued R&D can be expected to be low. There may be places within these large regions where conditions may favour a ley system. If so, R&D that can eventually be viewed as effective and efficient will begin with research which elucidates the existence of such a niche, and only then proceed to a plan for filling it.

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