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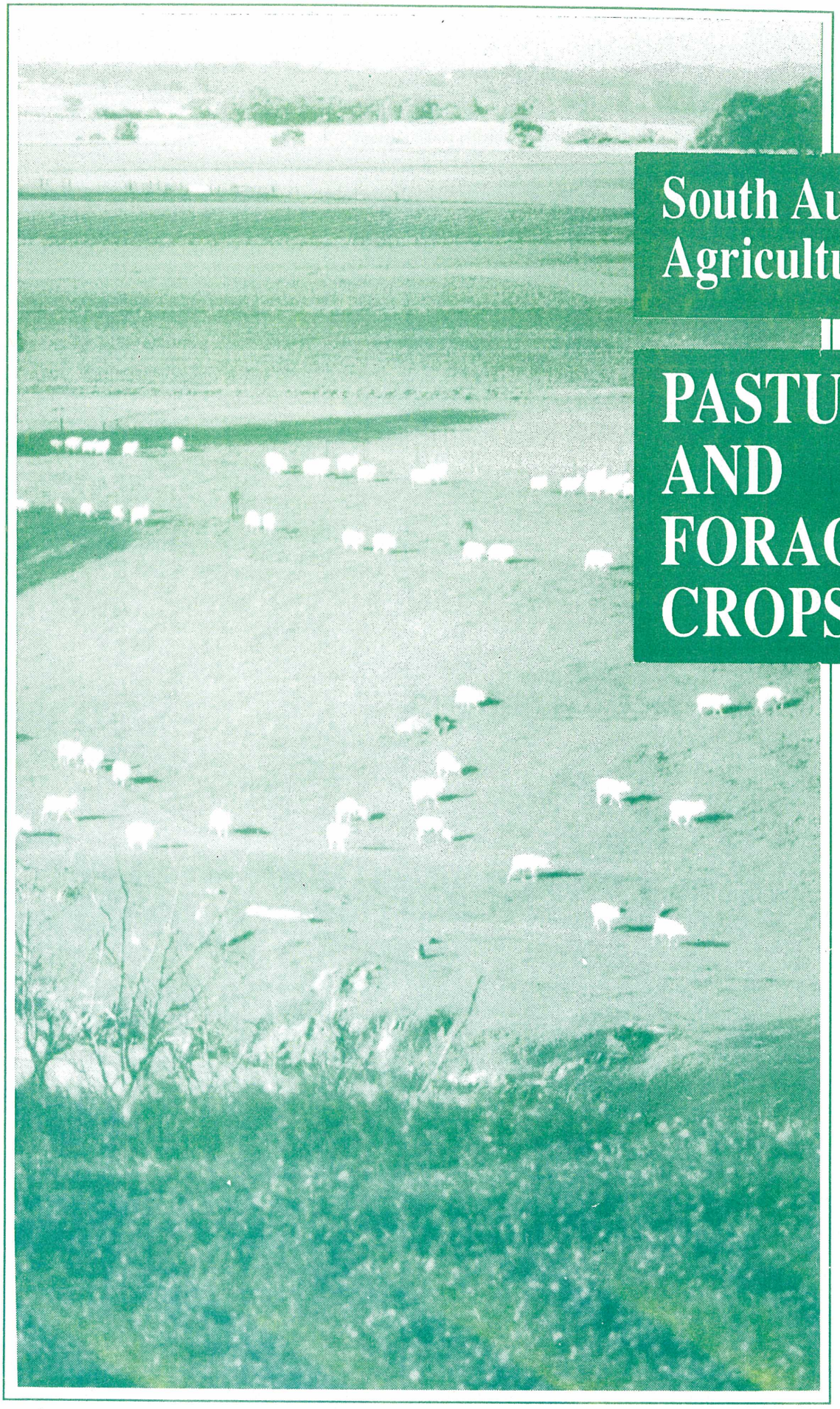

South Australian Agriculture

PASTURE AND FORAGE CROPS

DEPARTMENT OF AGRICULTURE
SOUTH AUSTRALIA

January, 1992

FOREWORD

This strategic plan is one of a series which has been developed for the principal South Australian agricultural industries and the services provided by the Department of Agriculture.

Agriculture contributes a greater proportion of returns to the State's economy than that of virtually any other state in Australia. It is therefore important to review the potential for the further development of agriculture in South Australia. These plans have been prepared by the staff of the Department of Agriculture in association with representatives of the respective agricultural industries and farmer organisations. The aim has been to identify the production potential and the market potential for the respective commodities and to thereby evaluate the opportunity which the state has to further develop its agricultural industries. At the same time, consideration has been given to identifying the most important issues to be addressed in the coming years to enable the state to achieve its maximum economic potential from agriculture. These plans will be valuable for determining the future provision of services to the rural community.

I should like to acknowledge the hard work and creative thought which both departmental staff and participants from industry and the farming community have put into the preparation of these plans.

John C. Radcliffe

(John C Radcliffe)
DIRECTOR-GENERAL OF AGRICULTURE

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1. FARMING SYSTEM CHARACTERISTICS

1.1 The Environment

The agricultural regions of South Australia have a Mediterranean-type climate with cool, wet winters and hot, dry summers. The rainfall has a marked seasonal and yearly variation due to anti-cyclones that move from west to east across the state at intervals of a few days. Soils are generally poor, shallow and low in nutrients.

Pasture production is largely governed by the seasonal distribution of rainfall and temperature. Following the germination of annuals or the commencement of new growth in perennials in the autumn, limited pasture growth occurs in the winter followed by abundant growth in the spring. Pastures then senesce during the summer when temperatures and rates of evaporation are high usually resulting in an over-supply of dry residues. There is a small but important area of irrigated pasture and forage which is more production and reliable than the dryland areas.

South Australian grazing industries are therefore mainly based on low-cost, non-intensive, year-round grazing of a fluctuating feed supply and rely on exploiting the ability of the ruminant animal to buffer itself accordingly.

1.2 Historical Development

Prior to 1900, marked changes occurred in the composition of South Australian pastures. Native perennial grasses and forbs, poorly adapted to grazing by sheep and cattle, were replaced by chance introductions of many annual plants, ie. grasses, clovers and other species, from the Mediterranean basin.

From 1900 to 1930, the use of fertilizers on pastures had its beginnings with emphasis on greater feed production but with little appreciation of its influence on soil fertility. During this period there was growing recognition of the extreme infertility of most South Australian soils.

After 1930, farmers were encouraged to grow pastures containing annual legumes, which in many cases were already present and, following large increases in the price of wool in the early 1950's, there was widespread sowings of annual legume pasture fertilized with superphosphate. It was this latter combination of inputs, leading to large increases in soil fertility, that contributed most to the rapid increase in productivity of pastures and cereals that occurred at this time. In the period 1947 to 1963, there was a 90% increase in livestock numbers in South Australia with only a 20% increase in area of pastures. On an Australian basis, 48% of the total increase in livestock numbers that occurred in this period could be associated with pasture improvement.

The area of sown pastures increased until the mid 1970's and a major part of this improved pasture area was sown in rotation with cereals with a corresponding decline in the area of fallow. However, during the late 1970's the profitability of cereal crops

increased rapidly compared to that of livestock enterprises and there was a corresponding decline in the area of sown pasture in South Australia.

1.3 Area Sown to Pasture

Since 1981, the area sown to pasture and grasses has remained relatively constant and of the total area of agricultural establishments in South Australia in 1989 (58.03 M ha), 2.96 M has was sown to crop and 3.76 M ha was sown with improved pasture species. In all years since 1980, the area sown to pastures and grasses has exceeded the area sown to crops.

2. PRODUCTION AND REGIONAL FEATURES OF PASTURE BASED INDUSTRY

Pastures sown with grasses and legumes are a basic resource in the production of livestock and a commonly used optional component of farm management in the cereal cropping zone. Therefore the value of pastures forage and hay can only be estimated after inputting the contribution of pastures and related products to animal and cereal production. Pastures support a grazing-based animal industry worth about $940M and contribute to the fertility and sustainability of the cereal industries worth $1,000M annually.

The distribution of the area of sown pasture varies markedly between the predominantly agricultural statistical divisions of the State (Table 1). Most sown pasture (over 1/3rd) is in the South East Division; the other major areas are in the Murraylands and Eyre Divisions and the central regions of the State containing the Outer Adelaide, Yorke and Lower North Divisions.

The dominance of sown pasture is also highest in the South East Division (79.3%) and is also high in Adelaide and Outer Adelaide (the Adelaide Hills, Barossa Valley and Kangaroo Island). The ratio of sown pasture to crop is lowest in the cereal zone (Yorke/Lower North, Eyre and Northern Divisions).

The value of animal production in each Division (see individual livestock and animal product commodities) emphasises the strong association between rainfall and productivity of pastures. The highest productivity is from irrigated pasture, forage and hay production.

The area of production of hay, green feed, silage and pasture seed (Table 2) is 4% of the total area of sown land and is a significant component of land utilization and production in the State. The reported production (526, 513 tonne of hay from 191, 750 ha) is probably an underestimate and does not indicate the area of cereal-legume hay mixtures in the cereal livestock zone.

The value of sown pastures as a soil ameliorant in the cereal production zone is difficult to calculate, even though they are important for maintaining desirable levels of soil fertility. Estimates of inputs and nitrogen by pasture are usually in the range from 10 to 15 kg N per hectare.

Pastures in the pastoral zone relate almost entirely to conservation issues. They are based on browse shrub and ephemeral species supporting production which is dependent upon the distribution of highly variable rainfall patterns.

TABLE 1: Land Utilisation and Major Production Components in South Australia (Year ended 31 March, 1989)

Statistical Division	Total Area of Establishments (1,000 ha)	Area of Sown Pastures and Grasses (1,000 ha)	Area used for Crops (1,000 ha)	% of Total SA. Area Sown to Pastures	% of Division Sown to Pasture	% of Division Used for Crops	Ratio Pasture/ Crops	% of Division Sown with Pasture & & Crops
Adelaide	39.7	12.4	11.6	0.3	31.2	29.2	1.07	60.4
Outer Adelaide	775.2	377.2	138.4	10.2	48.7	17.9	2.73	66.5
Yorke/ Lower North	1,666.9	305.8	682.2	8.2	18.3	40.9	0.45	59.3
Murraylands	3,650.0	855.2	570.8	23.0	23.4	15.6	1.50	39.1
South East	1,712.8	1,358.6	107.7	36.6	79.3	6.3	12.59	85.6
Eyre	5,234.2	667.6	1,135.5	18.0	12.8	21.7	0.59	34.4
Northern	44,949.9	138.4	314.8	3.7	0.3	0.7	0.44	1.0
TOTAL SA	58,028.6	3,715.2	2,960.9	100.0	6.4	5.1	1.25	11.5

TABLE 2: Area Cut for Hay, Green Feed or Silage and Harvested for Pasture Seed (Year Ending 31 March 1989)

STATISTICAL DIVISION	HAY			GREEN FIELD/SILAGE			SEED	TOTAL
	CEREAL	PASTURE	TOTAL	CEREAL	PASTURE	TOTAL		
Adelaide	858	1,616	2,474	265	302	567	0	3,041
Outer Adelaide	12,803	26,591	39,394	3,224	825	4,049	1,685	45,128
Yorke/Lower North	12,975	16,260	29,235	7,406	116	7,522	3,202	39,959
Murraylands	17,148	15,400	32,548	13,117	752	13,869	2,128	48,545
South East	3,862	50,546	54,408	4,501	2,221	6,722	12,544	73,674
Eyre	18,166*	4,586	22,752	16,316	52	16,368	167	39,287
Northern	5,552	5,388	10,940	4,532	81	4,613	1,989	17,542
TOTAL SA	71,363	120,387	191,750	49,361	4,348	53,709	21,715	267,174

* Including an unusually high 4,790 ha of wheat. The long term area is 11-14,000 ha.

3. MARKET OUTLET

(a) Trading in pasture and forage crop commodities is usually restricted to the production sale of hay and seed. However, it can also include the 'sale' of pasture or forage crops in the form of 'on-farm' grazing or agistment.

(b) Statistics on the trading of pasture, in terms of agistment, are not available, but it should be recognised as an option in the marketing of pasture and forage crops.

(c) It is difficult to quantify the trade of pasture hay. Of the estimated 530,000 tonnes of hay produced in 1988-89, most would be retained on-farm and fed back to livestock.

(d) Market outlets for hay and fodder include direct sales to livestock feed lots and other farms both within South Australia and interstate, to feed mixing companies for further processing and to exporting companies.

(e) Export of animal feedstuffs in 1988-89 was about 94,000 tonnes worth $19 million.

4. INDUSTRY REGULATION STATUS REPORT

4.1 Export from SA

(a) Western Australia requires a certificate of freedom from certain scheduled weeds - some of these weeds are common in SA.

(b) Victoria prohibits the importation of hay, unless the hay comes from a district more than 100 km from a known outbreak of annal ryegrass toxicity. All hay imported into Victoria must be accompanied by a certificate and delivered to an area specified on the certificate.

(c) Tasmania restricts entry of fodder containing peas (due to pea weevil).

(d) Fodder exports to overseas countries are subject to the specific quarantine restriction of the importing country. Fodder exported overseas usually requires a phytosanitary certificate.

4.2 Import into SA

(a) There is no restriction on the import of fodder into SA, from interstate unless the fodder contains soil.

(b) There are severe restrictions applying to the import of fodders from overseas, except for plant material for New Zealand and grain, brans and pollards derived from cereals grown in Canada, USA and New Zealand. Some oilseed meals can also be imported from Canada, USA, New Zealand and Papua New Guinea.

However, processed pelletized fodders may be allowed entry if the processing is deemed to kill harmful pathogens.

5. PROCLAIMED PLANTS

The policy of the SA Animal and Plant Control Commission with respect to proclaimed plants is set out in a booklet published by the Commission on 16 February 1990.

The sale and movement of fodder containing proclaimed plants is restricted or prohibited. This includes the import of such plants (or seeds) into SA.

6. PROCESSING

There are two phases of processing of pastures and forages for feed production. On-farm processing produces hay, green feed and silage. This is a significant industrial activity in SA. (526,513 t of hay in 1988-89). Hay is also moved off-farm into trade and industrial processing. Trade in hay is difficult to estimate. There is a relatively stable market for hay to intensive industries (dairying, feedlots) and to hobby farms,

particularly for horses, and an opportunistic market driven by regional and seasonal shortfalls of feed.

The industrial processing of hay and fodder is mainly conducted by one plant (Kapunda). The total production of pellets, dumped hay ie. bales compressed smaller than farm-gate size, and chaff is about 130,000 t per annum.

Cereal (oat) - vetch hay is preferred for processing of pellets. In 1989 it contributed 60% of total production. Other inputs were straw 25%, lucerne hay 15%, and barley lupins, peas, oilseeds, clover hay and phalaris hay. The supply of cereal/vetch hay has been unreliable, but the increasing area sown to cereal-vetch mixtures may stabilize supply and production.

The major markets are Japan, Hong Kong, Singapore, Malaysia, the Middle East and North Africa.

About 95% of the product is exported. The export market is viable because product is being sold into regions where there is a nett deficit of feedstuffs and high value for animal products, while in SA hay production is economically competitive with animal product production on the farm.

7. INDUSTRY POTENTIAL

The production potential of pasture and forage has two components; product sold directly into markets (hay, fodder, seed, inputs for feed processing, and rented pasture) and product which is used on-farm to produce end point commodities.

The motivation to sow pastures to support commodity production is economic. Improved pasture species are an important component of the grazing industry, and in the cereal-ley farming system. The area under improved pastures is correlated to the relative profitabilities of these farming activities.

At the State level the physical potential of direct and indirect production from sown pasture is much higher than that which is economical or sustainable. The economic constraints are markets for product, risk to the environment (eg from over-grazing) and increasing instability of cash-flow if high inputs are used in partially uncontrolled systems (eg rainfall dependent production).

Pasture and fodder plants with characters to permit adaptation to specific environments which can assist environment conservation have high potential. Examples are salinity tolerance, acidity tolerance, and adaptation to sands prone to drift and soils prone to water erosion.

At the level of the individual farming enterprise three factors are operating:

(a) identifying the management strategies needed for long term ecological stability and minimization of environmental and financial risk.

(b) defining specific areas which have potential for increased productivity through research.

(c) developing strategies to off-set declining terms of trade that is endemic to the agricultural sector. This generates on-going pressures for the pursuit of improved efficiencies of production. In the grazing industries this is achieved

in the form of improved pastures and increased awareness of pasture production systems which support more economically efficient production.

8. POTENTIAL IN THE CEREAL - LIVESTOCK ZONE

In cropping-grazing farming systems the potential for the pasture component relies upon its contribution to the integrated whole farm enterprise. Pasture must support more economically efficient animal production, contribute also to increased cereal yield and quality and assist the maintenance of soil fertility.

Since 1987 there has been a minor decline in the area sown to cereal crops (from 2.73m ha to 2.54m ha). There has been a corresponding increase in area reported to be under improved pastures (3.59m ha to 3.71m ha). With very little new land development occurring in South Australia it is suggested that swings are following the general fortunes of cereal and livestock enterprises. With the short term outlook in favour of cropping it is likely that the above trends would reverse.

The recent attention focussed on the importance of a legume pasture in a cropping rotation to improve grain quality is likely to see more sown pastures in a rotation sequence. However, there is the need for a survey of land utilization strategies and their relationship to farm profitability and risk minimization. In the absence of strong economic evidence that increased usage of sown pastures is profitable there will probably not be a significant increase in the use of sown pastures in the cereal cropping zone.

The keys to increased usage of sown pasture and forage in the cereal cropping zone will be the introduction, identification, breeding, development and increased adoption of the most productive cultivars and defining optimum management strategies for those cultivars in each ecological area of the zone.

9. POTENTIAL IN THE HIGH RAINFALL ZONE AND IRRIGATION

There are two main areas for potential growth in sustainable production and productivity.

(a) increased economic efficiency through better management. The main areas for improvement are (1) utilization and grazing management (2) soil and fertilizer management, including long-term strategies to counteract increasing acidity (3) weed and pest control, and (4) re-establishment methods and efficiency, including identification of the most suitable species.

(b) Expansion of research in genetic resources and population ecology in permanent pastures. Pasture instability and decline should be reduced by identifying those legumes and grasses for particular areas which can form a stable but botanically diverse pasture which can be established once and retained by appropriate management.

10. MARKET OPPORTUNITIES

10.1 A large potential market exists for pasture and fodder seeds produced in Australia. However a redirection of selection criteria will be required to take into account the specific requirements of export markets while continuing to ensure that cultivars are also available to domestic users. This subject is considered in detail in the Seeds Commodity Statement.

10.2 Potential exists, particularly to the Asian region, in the export market of processed forage crops, with the principal importers being Japan, Korea and Taiwan. The USA and Canada are the major suppliers to this market and it is expected that these countries will continue to develop their capacity for exporting. With the increasing demand, especially from Japan, for a regular supply of fresh forage products throughout the year, the potential exists for Australia to supply high quality fresh hay during the Northern Hemisphere winter seasons, when supplies from North America are reduced.

10.3 The farming technologies developed in South Australia involving pastures and forages could support consultancies and resistance packages in relevant programmes of farm development in other countries.

11. BARRIERS TO ACHIEVEMENT OF INDUSTRY POTENTIAL

Seventeen barriers were constructed to encompass the limitations on the achievement of optimum productivity from pastures which we identified. The barriers are listed in descending order of rank of priority but it must be emphasised that all the barriers were given a rating of high priority except barriers 16 and 17, which were rated intermediate.

The **Barriers** and their associated **Outcomes** are:

BARRIER 1: Lack of government funding for basic staff resources within the department is restricting the overall pasture research effort, the availability of well experienced pasture agronomists for extension purposes and the ability of the department to supply services.

Outcome

Ensure that a framework of staff appropriately qualified to solve problems associated with the pasture based industries in South Australia is put in place.

BARRIER 2: Relevant, financially based and technically sound information on pasture establishment and management within farming systems, where available, is not reaching or being understood by farmers.

Outcomes

(a) Find out why farmers are not adopting new technology in relation to pastures.

(b) Construct new programs for technology transfer.

Other outcomes discussed which were relevant to this barrier included.

(c) Increase farmer awareness and adoption of recommended pasture management practices.

There was also considerable discussion on using groups of farmers as points of entry into farms for new technology.

BARRIER 3: Low and declining levels of soil fertility and poor soil structure are limiting current pasture productivity and threatening economic viability of agriculture.

Outcomes

(a) Define the current fertility status of SA soils in terms of organic carbon, available P, K, N, pH and structure and from this identify areas where soil macro- and micro-nutrient deficiencies restrict pasture growth.

(b) Define the effects of the various components of ley farming systems on soil fertility (organic matter, aggregate stability, etc) and record economic details. Define those components which will achieve and maintain adequate soil fertility and economic viability.

BARRIER 4: Financial benefits of pastures are indirect and difficult to assess, particularly in ley farming systems. There is a paucity of rigorous means for evaluating the economic returns from pastures in terms of both livestock and crop product.

Outcome

Develop a rigorous means of evaluating economic returns from pastures in terms of both livestock and crop product within a total sustainable farming system.

BARRIER 5: In many ley farming areas, lack of appropriate management has lead to poor legume persistence and consequent declines in yields and system sustainability.

Outcome

Define ley pasture management methods which produce reliable and productive pastures of adequate legume content.

BARRIER 6: There is a need to research alternative methods of pest disease and weed control to reduce chemical use, so that pest/weed resistance to pesticides is avoided, and risks to the environment reduced.

Outcome

Develop more effective pest and weed control methods with reduced chemical use.

BARRIER 7: Problems exist in the definition of soil macro- and micro-nutrient deficiencies and toxicities, and in the potential for improved N fixation and P, K and S efficiency in pasture legumes.

Outcome

Improve the efficiency of N, P, K and S usage and N fixation to optimize economic returns.

BARRIER 8: In many regions and agricultural systems, there is a lack of critical technical and economic information or confidence to apply that information to optimize fertilizer use, stocking rates, pasture utilization and management.

Outcomes

(a) Establish economic information on the value of pastures in a cereal-livestock system for both crop and livestock product.

(b) Define sustainable agricultural systems for cereal/livestock farming systems.

(c) Establish economic information on the benefits of renovating pastures in high rainfall areas.

(d) Develop management systems for optimizing livestock production from permanent pastures.

(e) Define simple and reliable systems for establishing and maintaining pastures.

BARRIER 9: There is a lack of easily managed, well adapted , persistent pasture cultivars (both for existing and evolving farming systems) and/or suitable rhizobial strains for pasture legume cultivars.

Outcome

To breed, select and ensure the commercial adoption of easily managed, well adapted, persistent pasture cultivars and/or suitable rhizobial strains for pasture legume cultivars.

BARRIER 10: Information on alternative systems of management necessary to optimize animal and crop production over a season (eg use of fodder crops, feed reserves, deferred grazing etc) is limited.

Outcome

Optimize animal and crop production by integrating fodder crops and alternative feed sources into the grazing system.

BARRIER 11: Increasing areas of chronic and acute salt affected land is resulting in yield declines and the loss of productive land.

Outcomes

(a) Identify, develop and ensure the commercial adoption of salt tolerant plants.

(b) Identify the causes of salinization and develop countermeasures.

BARRIER 12: Lack of appropriate management systems in the pastoral zone is leading to land degradation, the loss of desirable species and reduced productivity.

Outcome

Develop management strategies to ensure long-term stability and productivity of the pastoral zone.

BARRIER 13: There are increasing areas of land with pH that has fallen to a level where both pasture productivity and nitrogen fixation are reduced.

Outcome

Arrest the effects of declining soil pH on pasture, animal and crop productivity through liming and plant selection and breeding.

BARRIER 14: In permanent pasture zones, lack of appropriate management has lead to poor legume persistence and consequent declines in yields and profitability.

Outcome

Initiate development and effective extension of strategic management systems to improve legume persistence and productivity in permanent pasture zones.

BARRIER 15: The unsuitability of some locally bred legume cultivars for establishing and developing overseas markets.

Outcome

Develop cultivars for seed production and release which have adaptation in overseas markets to facilitate the growth of seed exports.

BARRIER 16: Increased profitability from the use of new cultivars is being delayed through both the slow rate of seed build up and of new cultivar adoption.

Outcomes

(a) Develop a formal management structure for the commercialisation of new pasture cultivars.

(b) Develop a global perspective for identifying potential markets for new cultivars.

BARRIER 17: The potential for hay and fodder exports is being severely restricted by the high cost of freight and wharfage, as well as variation in quality and quantity of fodder products.

Outcome

Establish standards of quality for hay and fodder which are acceptable in appropriate markets.

PART B: MANAGEMENT OF RESOURCES FOR PASTURES AND FORAGES

1. TECHNICAL PROGRAMMES

1.1 The management of resources used for pastures and forages were reviewed in five technical programmes and one overall management and policy programme.

The six programmes are:

(a) **Management and Policy**
(b) **Technical Programmes**

- (i) **Farming Systems and Farm Management**
- (ii) **Soil Management and Plant Nutrition**
- (iii) **Genetic Improvement of Pastures and Forages**
- (iv) **Plant Protection**
- (v) **Market Development**

Obviously there are inter-relationships between the technical programmes. The development of research and extension objectives within a programme without consideration of the opportunities or constraint presented by other technical areas can lead to sub-optimal use of resources and poorly defined objectives.

The technical programme subdivisions were used to:

(a) develop strategies to counter the identified barriers
(b) analyse resource allocation

2. ALLOCATION OF BARRIERS TO TECHNICAL PROGRAMMES

The barriers were allocated to technical programmes as follows. The barriers' major components are listed.

2.1 Farming Systems and Farm Management

Barrier 2:	Need for transfer of sound technological advice
Barrier 4:	Lack of rigorous financial evaluation in ley farming
Barrier 5:	Lack of appropriate management of legumes in ley farming
Barrier 8:	Lack of critical technical information for managers
Barrier 10:	Limited information on alternative management systems
Barrier 12:	Degradation in the pastoral zone
Barrier 14:	Lack of management of legumes in permanent pastures

2.2 Soil Management and Plant Nutrition

Barrier 3:	Low soil fertility threatening productivity and viability
Barrier 7:	Nutrient supply and efficiency of use
Barrier 11:	Increasing areas of chronic salinity
Barrier 13:	Low pH reducing productivity and N fixation

2.3 Genetic Improvement of Pastures and Forages

Barrier 9:	Lack of easily managed, well adapted, persistent cultivars

2.4 Plant Production

Barrier 6: Alternative methods of pest, disease and weed control

2.5 Market Development

Barrier 15: Unsuitable local cultivars for overseas markets
Barrier 16: Increased profitability of new cultivars lost through delayed commercialisation
Barrier 17: Freight and wharfage costs restrict hay/fodder exports

Barrier 1 was allocated to the overall Management and Policy programme.

From this point the commodity review of pastures and forages was developed within the framework of the six programmes.

3. SURVEY OF RESOURCES AND PROJECT INVOLVED IN RESEARCH AND EXTENSION ASSOCIATED WITH PASTURES AND FORAGES

A survey of the Department was used to construct a database of all activities in the Department associated with pasture and forage production, except quarantine, regulation of imports and exports and seed production which are captured by other commodity groups.

The survey obtained the following data:

(a) Research and extension activities at the project level
(b) The supervisor of each project
(c) State funding in 1990-91
(d) Other funding (RIRF, Industry, NSCP, etc.) in 1990-91
(e) Total funding (summarisation of (c) and (d))
(f) Actual staff time allocated to each project (in full-time equivalents)
(g) General classification of staff
(h) The site of the project (Head Office and Northfield/Region)
(i) The zone of the project (Irrigated-High Rainfall/Cereal-Livestock/Pastoral)

In addition information was collected about:

(j) New projects submitted for 1991-92 funding. This included new projects to continue projects terminating in 1990-91.

(k) Proposals and ideas for projects not funded and not in submissions for 1991-92.

The survey was extremely successful. The commodity committee is unaware of any project which failed to respond. **The very high level of response almost certainly indicates that staff involved in pasture and forage related activities view state-wide management and review as a beneficial activity.**

It is proposed that the committee (or its continuation as the former Pasture Management Committee which had evolved from the Pasture Research Review) conduct the survey regularly and attempt to reconcile its data with the database of the Accounts Section for expenditures in pastures.

The survey did not collect data on the capital base (research centres, laboratories, equipment, glasshouses etc.) used primarily for pasture research.

3.1 Results of the Survey

The database was used to allocate the resources employed in pastures to:

(a) Barriers identified by the commodity review
(b) State and Industry funding
(c) Employment of Staff
(d) Technical Programmes
(e) Production Zones
(f) Head Office (including Northfield)/Regions

Resource Distribution Between Barriers

The allocation to barriers of budget and staff is presented in Table 3.

The budgetary and staff resources are almost evenly divided between state and industry sources. The largest allocation relates to overcoming Barrier 9 (the lack of easily managed, well adapted, persistent pasture cultivars and suitable rhizobial strains for pasture legumes).

Table 3: Budgetary and Staff Resource Distribution over Barriers

BARRIER	BUDGET 1990-91 ($)			STAFF (F.T.E.)		
Bar	State	Industry	Total	State	Industry	Total
1	0	0	0	0.00	0.00	0.00
2	291,400	170,080	461,480	7.06	2.00	9.06
3	4,000	100,000	104,000	2.14	0.10	2.24
4	0	0	0	0.00	0.00	0.00
5	32,500	7,500	40,000	1.27	0.00	1.27
6	227,400	155,800	379,200	6.60	0.30	6.90
7	194,000	144,400	338,400	4.20	2.00	6.20
8	170,100	171,500	341,600	3.31	2.12	5.43
9	653,100	1,003,200	1,656,300	14.80	28.36	43.16
10	18,400	40,000	80,000	0.38	0.05	0.43
11	44,700	80,000	124,700	0.32	0.00	0.32
12	73,400	42,300	115,700	2.00	0.00	2.00
13	153,000	99,000	252,000	1.35	2.00	3.35
14	36,390	0	36,390	0.32	0.00	0.32
15	14,400	43,000	57,400	0.20	1.00	1.20
16	0	0	0	0	0	0
17	0	0	0	0	0	0
TOTALS	1,912,790	2,056,780	3,991,170	43.95	37.93	81.88

Four barriers have no directly identifiable allocation. Barrier 4 (Financial benefits of pastures and indirect and difficult to assess, particularly in ley farming systems. There is a paucity of rigorous means for evaluating the economic returns from pastures in terms of both livestock and crop product) is critical in the cereal-livestock zone. It is alarming that no projects are directly related to the evaluation of the ley farming system as a total farming system, although about 25% of resources an allocated to the other barriers allocated to Programme 1, Farming Systems and Farm Management, (Barriers 2, 5, 8, 10, 12, 14). See the Programme analysis in the next section.

The other three barriers without an allocation are: Barrier 1, which is related to Management and Policy and has its associated costs included in the allocations of the technical programmes; Barriers 16 which has resource allocations in the Seed Services commodity programme, and Barrier 17, which has no direct allocation.

The allocation of resources to barriers was reviewed as part of the review of the relevant Technical Programmes.

3.2 The Budget Distribution between Zones and Regions

The budget allocations to land use zones and administrative units are presented graphically in Figures 1 and 2. The allocations to zones suggest that the proportions approximately reflect the relative values of production of the zones. A more precise analysis is achieved within technical programmes because dividing resources between zones does not indicate if all particular technical issues have resource allocations.

The division of resources between administrative units is misleading because many projects are applicable beyond their administrative centre. For example, research in genetic improvement based in the divisions and central region has applicability in the Southeast, Murraylands and Eyre. Consequently further analysis of resource allocation focuses on the technical programmes and ensuring that resources are distributed to zones according to the priorities set within each technical programme area.

3.3 The Sources of External Funds

The sources of external funds ($2.06m) are presented in Figure 3. Many factors determine the relative contributions including the size of the individual fund, the expertise of staff and the relationship of the Department's requirements to the fund's corporate strategies. Therefore the proportion of funding from a particular source is dependent upon the presentation of competitive and successful submissions to the technical programme areas of appropriate funds.

3.4 The Distribution of Resources between Technical Programmes

The distribution of funds and staff resources between technical programmes and the division between state and external funds, principally funds from rural industry research corporation, are presented in Table 4 and graphically in Figures 4 to 9.

Table 4: The distribution of resources between technical programmes

PROGRAMME	BUDGET ($)			Full-time Employee Equivalent		
Technical Programme	State	RIRF*	Total	State	RIRF*	Total
1. Farming Systems	643,790	431,380	1,075,170	14,34	4.17	18.51
2. Soils and Nutrition	395,700	423,400	819,100	8.01	4.10	12.11
3. Genetic Improvement	653,100	1,003,200	1,656,300	14.80	28.36	43.16
4. Plant Protection	227,400	155,800	383,200	6.60	0.30	6.90
5. Market Development	14,400	43,000	57,400	0.20	1.00	1.20
TOTALS	1,934,390	2,056,780	3,991,170	43.95	37.93	81.88

* Rural Industry Research Funds.

The diagrams emphasise:

(a) The high correlation between the subdivisions of the state budget and state full-time employee equivalents (FTE)s between programmes which reflects the high salary component in state expenditure.

(b) That state resource allocations to Programs 1 and 3, farming systems and genetic improvement respectively, are the largest and approximately equal and receive approximately one third of the resources each.

(c) That Programmes 1 and 3 contrast in their levels of RIRF support. Plant Improvement receives almost half of all RIRF funding (Figure 6) which is expended on about three quarters of all RIRF FTEs (Figure 9) and increases the total resource allocation to Programme 3 to about one half of all financial resources (Figure 4). In contrast, Programme 1, Farming Systems and Farm Management receives proportionately less RIRF than state support, compare Figures and consequently its total resource allocation is about one quarter (Figure 4).

(d) Programme 2, Soil Fertility and Plant Nutrition, has a balanced proportion of about one fifth of resources from state and RIRF sources for funds and FTEs.

(e) Programme 4, Plant Protection, receives a proportionately smaller allocation of resources, particularly RIRF FTEs (Figure 9). It could be argued that this disproportionately low allocation of resources has been reflected in a lower level of research and extension in plant protection than the perceived interest amongst farmers would suggest. Some elements of plant protection are included in programmes 1 and 3.

(f) Programme 5, Market Development, contains only one project and consequently has only a small proportion of resources. Within a business unit framework of Departmental management this programme will expand through input from Plant Improvement and Farm Management.

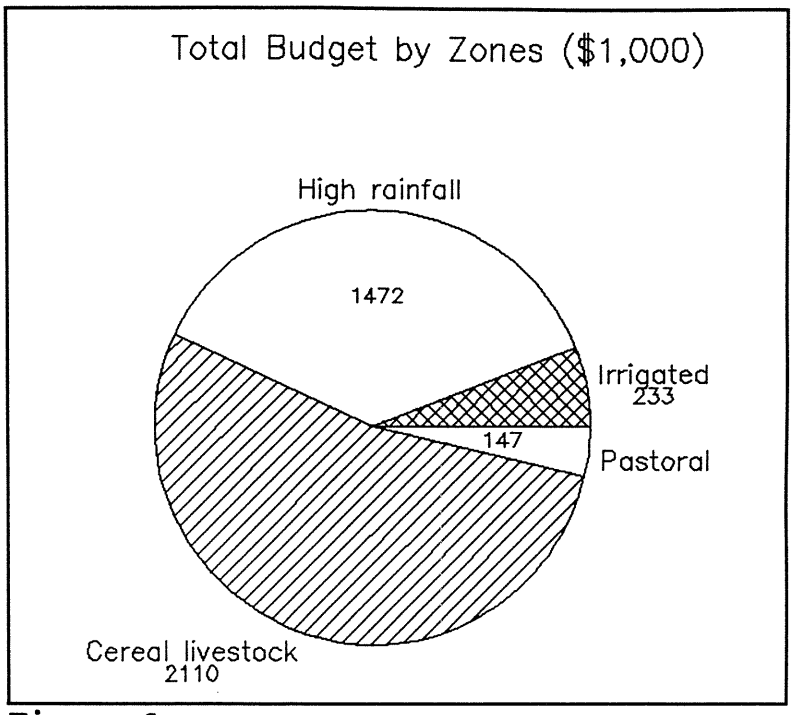


Figure 1

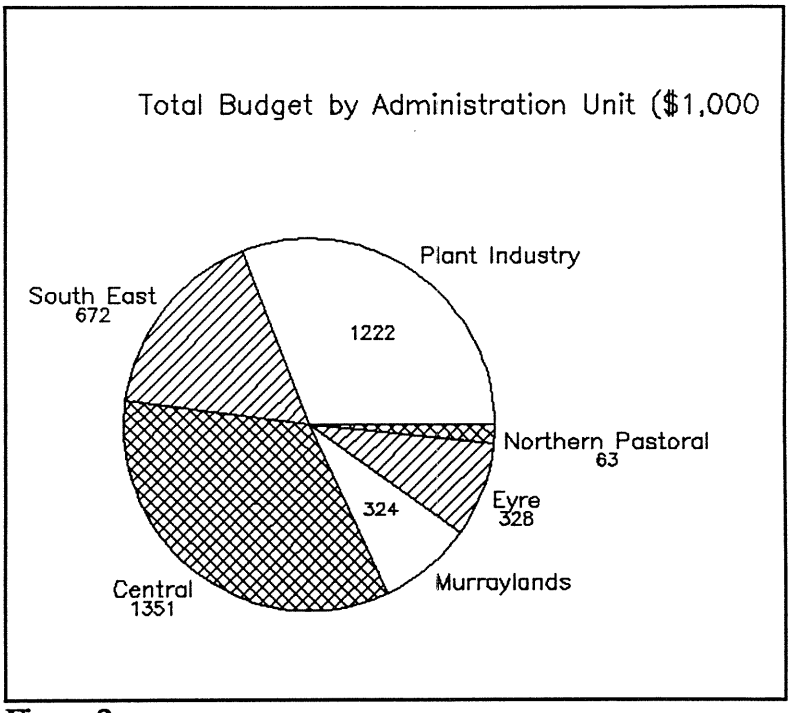


Figure 2

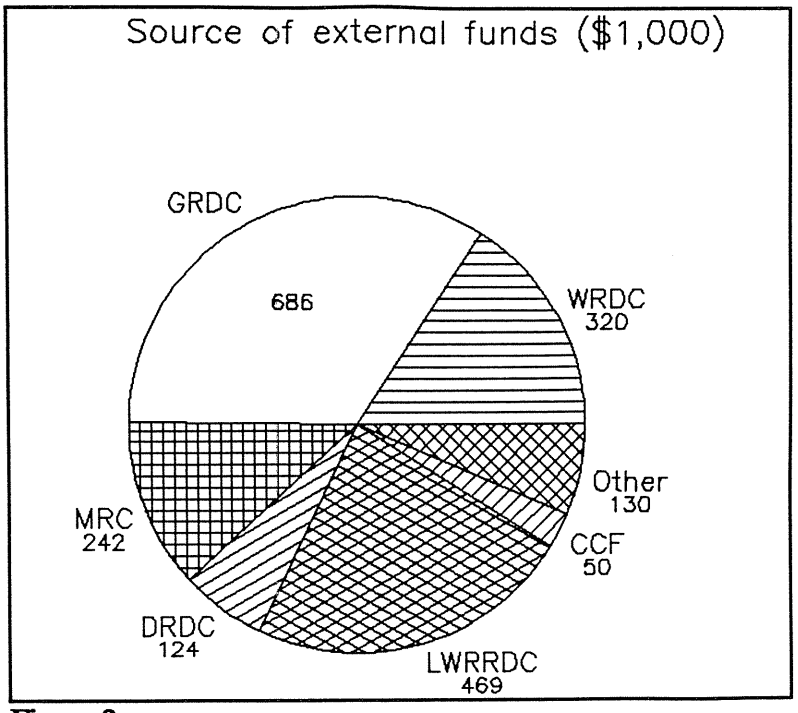


Figure 3

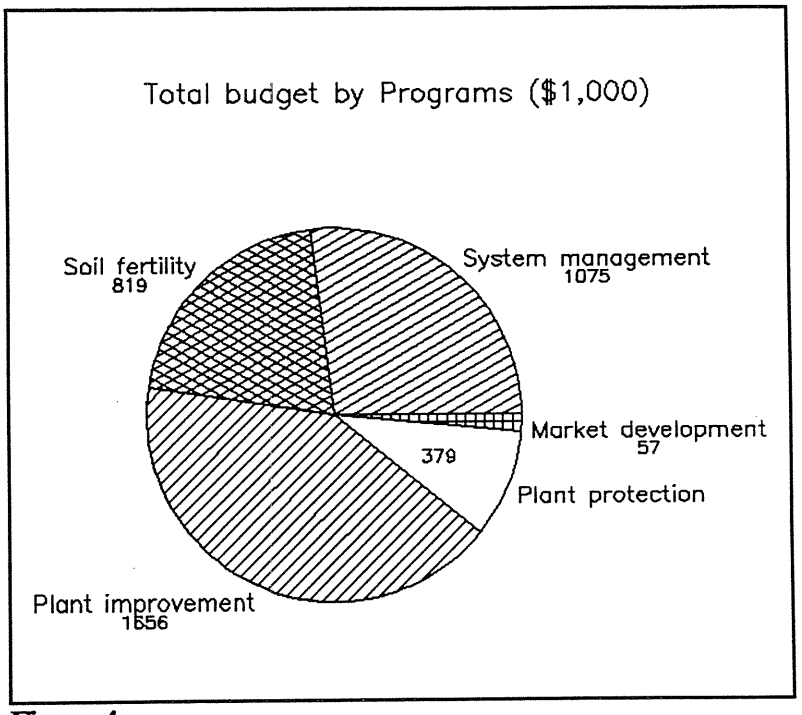


Figure 4

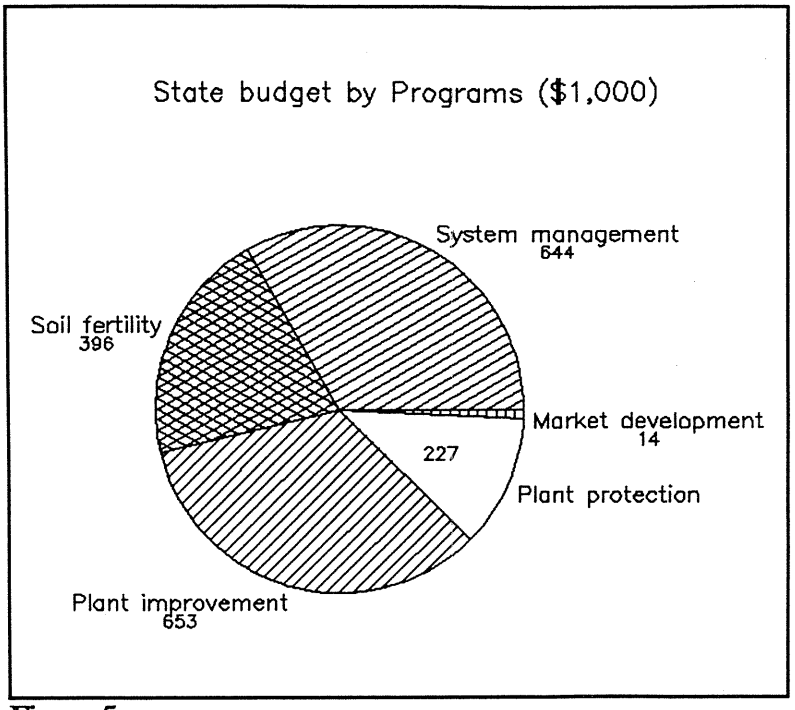


Figure 5

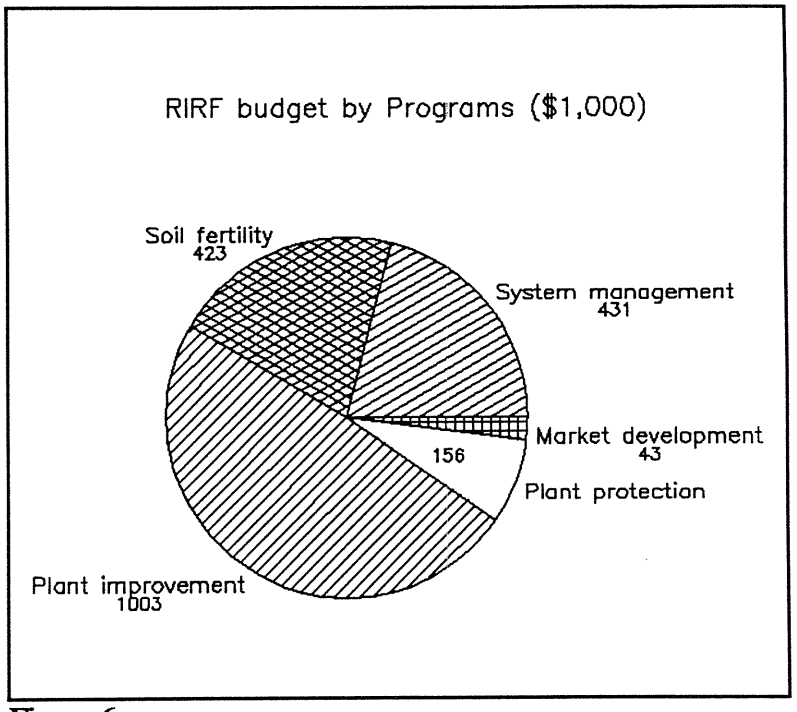


Figure 6

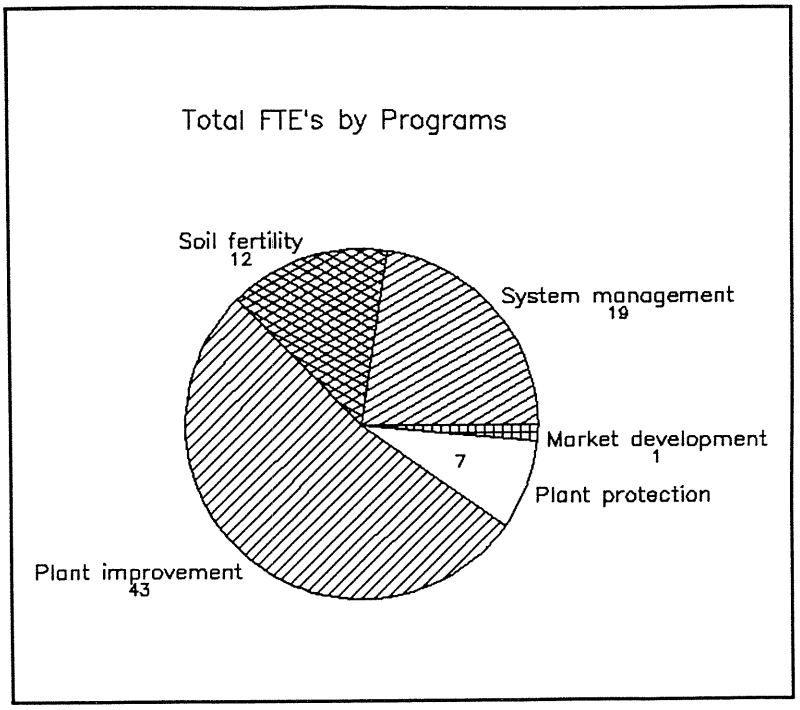


Figure 7

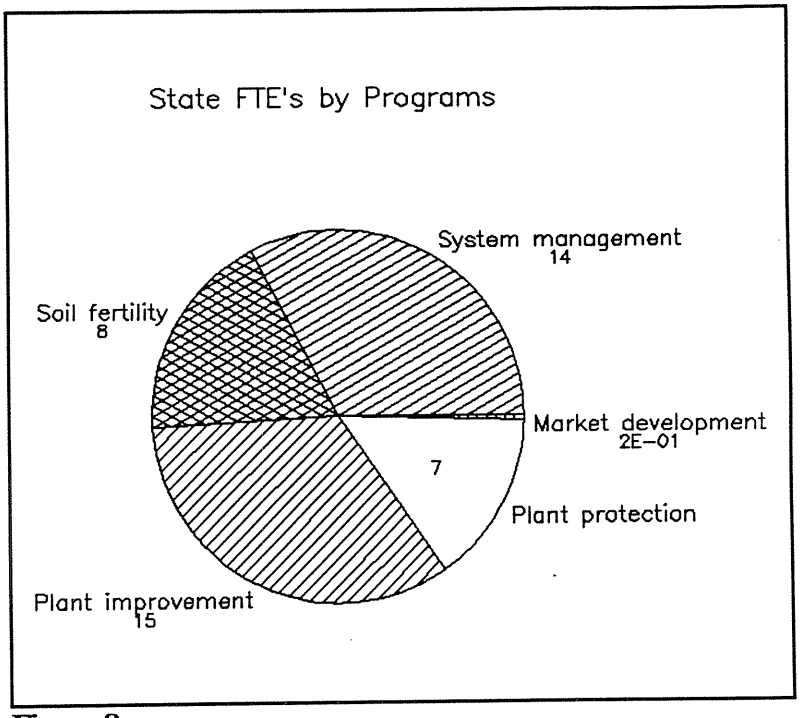


Figure 8

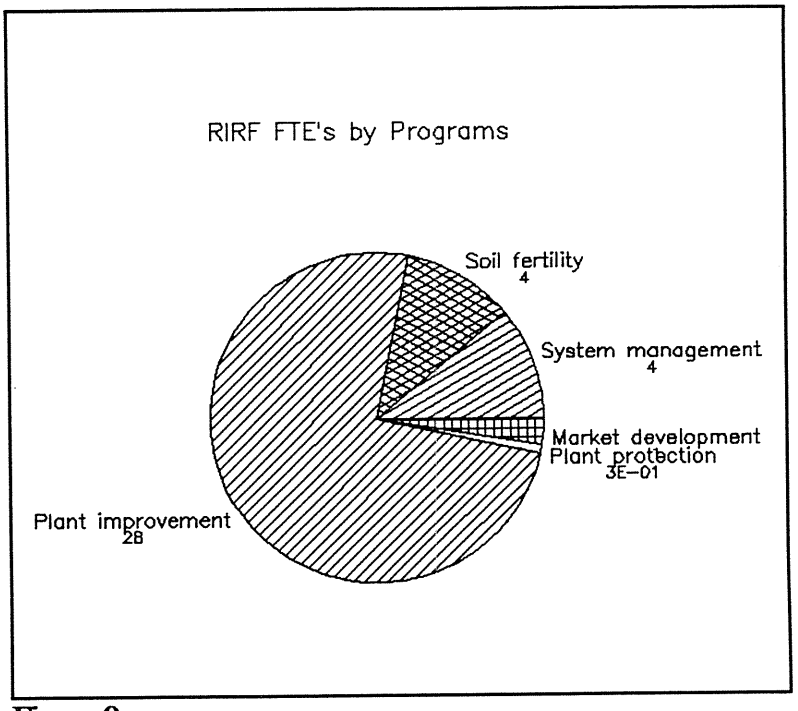

RIRF FTE's by Programs
Soil fertility
4
System management
4
Market development
Plant protection
3E-01
Plant improvement
28

Figure 9

PART C: STRATEGIC PLAN

The Strategic Plan for Pastures and Forages consists of six parts; one for each management programme. The barriers are addressed in their relevant programmes and have been given major emphasis to reflect the method by which the commodity review was approached.

In each section of the plan a structure has been established to facilitate a management review of resource distribution and identification of resource deficiency and the need for resource re-allocation or restructuring.

1. MANAGEMENT AND POLICY

Barrier 1: Lack of government funding for basic staff resources within the department is restricting the overall pasture research effort, the availability of well experienced pasture agronomists for extension purposes and the ability of the department to supply services.

Outcome Sought: Ensure that a framework of staff appropriately qualified to solve problems associated with the pasture based industries in South Australia is put in place.

The committee recognises that an increase in State funded resources is unlikely. Each technical programme therefore was reviewed using the following criteria.

(a) Given current State resources are there ways to improve efficiency?
(b) Is there a need for revision of the management structure?
(c) Is there any deficiency in particular disciplinary skills?
(d) What would be the effect of reduced state resources ie. staff?
(e) What should be the commodity committee's future role and structure?
(f) The role of the commodity committee in project review.

2. PROGRAMME 1. FARMING SYSTEMS AND MANAGEMENT.

Introduction

Seven barriers have been grouped under Programme 1. They are:

Barrier 2:	Need for transfer of sound technological advice
Barrier 4:	Lack of rigorous financial evaluation in ley farming
Barrier 5:	Lack of appropriate management of legumes in ley farming
Barrier 8:	Lack of critical technical information for managers
Barrier 10:	Limited information on alternative management systems
Barrier 12:	Degradation in the pastoral zone
Barrier 14:	Lack of management of legumes in permanent pastures

While each Barrier was initially devised with a specific problem and outcome in mind there is considerable overlap between the seven barriers listed above. In developing the Strategic Plan addressing Programme 1 it was decided that the barriers may not be the most efficient framework for programme development. Consequently, a framework based on desired outcomes and strategies to achieve those outcomes has been developed.

Three guiding principles were used to construct the resultant Strategic Plan. They are:

(a) **Pasture research and extension must be integrated into whole-farm management systems.**

(b) **Research and extension activities should be integrated where possible.**

(c) **There should be a strong on-farm emphasis to all research and extension activity.**

These principles are represented diagrammatically in Figure 10. The link between research and extension, and the on-farm focus on clearly illustrated. The majority, but not all activities in Programme 1 have an on-farm focus and are represented in the top circle of Figure 10.

The Strategic Plan for Programme 1 : Farming Systems and Management is detailed below.

SUB PROGRAMME 1.1

To develop and validate technical and economic information related to pasture management necessary to optimise sustainable animal and crop production.

Outcomes desired:

1.1 Develop a rigorous means of evaluating economic returns of pasture management options in terms of both livestock and crop production.

1.2 Define critical levels of key ecological parameters for sustainable farming systems.

1.3 Define pasture management practices which produce reliable and productive pastures.

1.4 Develop livestock grazing systems which integrate forage crops, fodder conservation, and alternative feed sources with pastures.

Strategies (to achieve outcome):

. Review existing data on biological and technical relationships, and interactions between and within cereal-livestock zones of SA, and within high rainfall areas.

. Review and evaluate simulation and decision-support models that may account for interactions between enterprises and the economic effects of different management practices; eg. MIDAS, GRAZPLAN, UDDER, and RANGEPACK.

. Modify, develop and validate such models for use in the:

- high rainfall, permanent pasture zone
- cereal-livestock zone
- pastoral zone

. Commit staff and resources to regular and periodic monitoring of past monitoring sites (eg. Wegener, Adams, Crosby).

- Survey farmers and advisers to determine successful pasture management strategies and reasons for their success or failure.

Sub Programme 1.2

To increase farmer awareness and adoption of recommended pasture management practices.

Outcomes desired:

2.1 Find out why farmers are not adopting new or existing pasture technology.

2.2 Construct new programmes for transfer of technology to farmers.

Strategies (to achieve outcomes):

- Collate technical information into a pastures management handbook for SA.

- Review and analyse past surveys of farmer attitudes, and district needs analyses undertaken by district offices:

  eg. Harrison Report
  Pasture Research Review
  Research Centres Review
  Ruminant Research Review

Also review any surveys undertaken by Advisory Board of Agriculture, UFS, SADA, Agricultural Councils.

- Ascertain/seek out farmer and district adviser attitudes to:

  - Adoption of new technology in relation to pastures, cereal and livestock management.

  - Benefits and costs of pastures to farming systems. Benefits of legumes.

  - Improving cereal and livestock productivity.

- Identify deficiencies/gaps in knowledge:

  - selection of rotation sequences
  - optimum stocking rate and grazing management
  - feed year planning, fodder conservation, feedlotting
  - managing pasture legume seed reserves

- Utilise farmer groups such as Bureaux, Landcare, and special purpose groups such as pasture monitoring groups to promote and validate pasture technology.

- Once attitudes and constraints are known, construct programmes to improve productivity and efficiency of cereal and livestock production.

2.1 EXISTING PROJECTS WITHIN THE PROPOSED STRATEGIC PLAN FRAMEWORK

Existing projects are listed under desired outcomes in Table 5. Where a project addressed more than one outcome than the project has been listed under the outcome it most closely addresses. The following points have been drawn from the information presented in Table 5.

Features of the current program

(a) There are no projects currently addressing Outcome 1.1 (methods of economic analyses).

(b) Within Programme 1 there is relatively little industry funded research or extension. The ratio of State:RIRF funds within Programme 1 is 61:39 compared to 48:52 for the overall Pasture and Forage Commodity Programme. One exception is the support from the National Soil Conservation Programme which accounts for most of the industry funds under Outcome 1.2 (define sustainable farming systems).

(c) Thirteen of the 32 projects currently listed in Programme 1 have a total budget of less than $10,000. The situation is even worse under Outcome 1.3 where 9 out of 12 projects have a budget less than $10,000, and only one project receives industry funding.

(d) There is currently only one project receiving substantial industry support for predominantly extension activities.

Table 5: Existing projects addressing recommended outcomes under Programme 1

CODE	TITLE	SUPERVISOR	BUDGET		
			State	RIRF	Total
Outcome 1.1 Develop a rigorous means of evaluating economic returns of pasture management options in terms of both livestock and crop production.					
-	No projects	--	0	0	0
Outcome 1.2 Define critical levels of key ecological parameters for sustainable farming systems.					
8	High rainfall acid soils	Kealey	40000	56000	96000
14	Marginal land soil mgt.	Kennewell	10000	69000	79000
30	Farm planning on sands	Wurst	0	6500	6500
42	Murraylands farm mgt.	Heinjus	38000	50000	88000
44	Chowilla floodplain rehab.	Bone	38400	42300	807000
TOTAL			126400	23800	350200
Outcome 1.3 Define pasture management practices which produce reliable and productive pastures.					
10	Renovation of Yarloop	Little	8000	0	8000
11	Grass cont. vs lamb qual.	Little	1000	0	1000
13	Medic agronomy	Little	200	0	200
19	Saltbush management	Hunt	28000	0	28000
23	Grass control in pasture	Wurst	1800	0	1800
31	Inc. past. prod./utilis.	Fairbrother	27230	0	27230
38	Pasture estab./mgt.	Prance	1360	0	1360
56	Pasture establish. research	Mathison	7800	0	7800
61	Pasture establishment	Bellotti	20000	7500	27500
64	Grass control in pasture	Davidson	2100	0	2100
74	Medic establishment	McCord	6000	0	6000
75	Crop-pasture demonstration	McCord	4500	0	4500
TOTAL			107990	7500	115490
Outcome 1.4 Develop livestock grazing systems which integrate forage crops, fodder conservation, and alternative feed sources with pastures.					
20	Semi-arid woodlands	Hunt	35000	0	35000
36	Fodder produ. and quality	Dillon	15000	0	15000
37	Dairy focus groups	Prance	40000	0	40000
41	Increasing milk yields	Scown	80000	0	80000
47	Milk from ryegrass	Valentine	31000	35400	66400
78	Pasture eff. in anim. prod.	Mowatt	29000	0	29000
85	Breeding forage oats	Barr	24000	40000	64000
TOTAL			254000	75400	329400
Outcome 2.1 Find out why farmers are not adopting new (or exiting) pasture technology.					
16	Pasture monitoring	Hannay	4000	0	4000
22	Cereal zone pasture ext.	Bellotti	47000	70000	117000
TOTAL			51000	70000	121000
Outcome 2.2 Construct new programmes for transfer of technology to farmers.					
7	U.S.E. pasture development	Stanley	10000	0	10000
15	RBE conservation farming	Woodard	15000	8080	23080
26	Upper EP extension	Wurst	6500	0	6500
27	Upper EP group develop.	Wurst	3600	0	3600
52	RBE conservation farming	Bock	23000	0	23000
66	Pasture advisory/reg.	Fulwood	12000	0	12000
TOTAL			70100	8080	78180
GRAND TOTAL			609490	384780	994270

Initiatives required to implement the Strategic Plan

The following initiatives address the points listed above.

(a) Analytical tools/methods to allow economic analysis of pastures within multi-enterprise production systems (eg. farms) are desperately needed. Pasture technology must be promoted in unequivocal and persuasive economic terms. The absence of sound economic justification is currently a major constraint to adoption of pasture technology.

A suitable tool for the above task appears to be the MIDAS model developed in WA. However, the implementation and validation of MIDAS under SA conditions would require a major commitment on behalf of the Department. This work should not proceed unless the necessary staff and resources are committed.

(b) A concerted approach to RIRFs is needed to redress the current lack of industry funding of Programme 1 activities. Given that competition for industry funds will increase, it is imperative that the Department set its own priorities by limiting the number of projects submitted to the various funds. To achieve a more balanced research portfolio it will be necessary to reduce the level of industry funding in other areas.

(c) The large number of small projects indicates that some aggregation of smaller projects may be worthwhile. This is particularly evident under Outcome 1.3.

(d) High priority should be given to RIRF submissions addressing Outcome 1.3 and Outcome 2.2. Submissions in these areas should be actively encouraged by the pasture commodity group and preference should be given to these projects during the internal refereeing process.

PRINCIPLES TO FOLLOW IN
IMPLEMENTING STRATEGIES

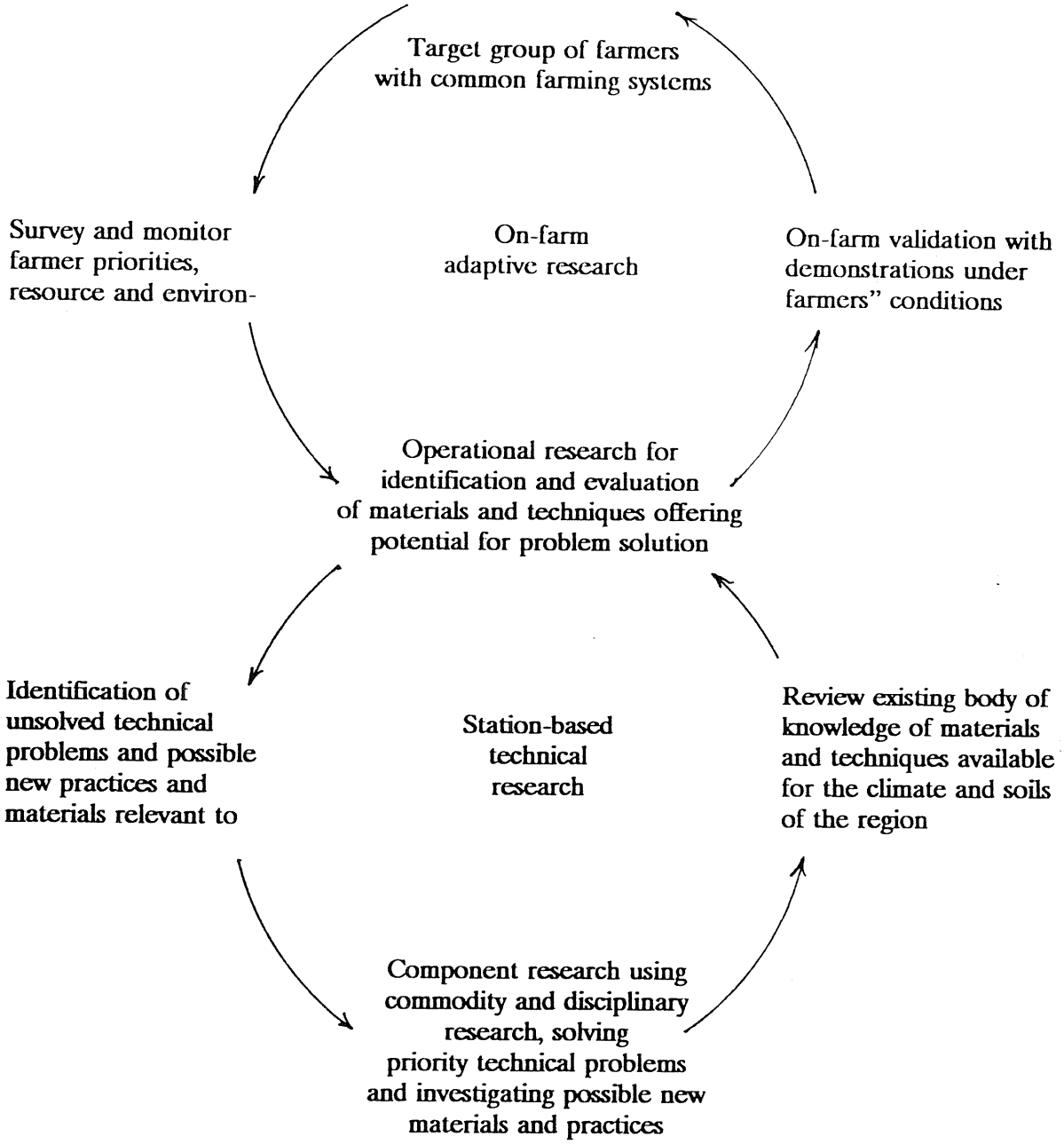


Figure 10:
(adapted from Collinson 1982)

3. PROGRAM 2: SOIL MANAGEMENT AND PLANT NUTRITION

3.1 *BARRIER 3: Low and declining levels of soil fertility and poor soil structure are limiting pasture productivity and threatening the economic viability of agriculture.*

Outcomes sought:

(a) Definition of the current fertility status of SA soils in terms of organic carbon, P, K, N, S, pH, trace elements and structure. From this identify areas where soil macro-and micro-nutrient deficiencies restrict pasture growth and provide corrective recommendations.

(b) Define the effects of various components of ley farming on soil fertility (organic matter, nutrient status, aggregate stability, etc.) and identify those components which will maintain soil fertility and farm viability.

Current objectives:

(a) To report to farmers in the Coomandook, Frayville and Monarto districts by December 1992 on the need for zinc and manganese for pastures in cropping rotations.

(b) By June 1993, produce reports and broadcasts for farmers in Upper Eyre Peninsula and the Murray mallee recommending soil management for stabilising deep sands while maintaining forage productivity.

(c) By June 1991 provide written recommendations to landholders in the Adelaide Hills and Fleurieu Peninsula on land management practices for varying pasture land classes.

(d) To report to farmers in the Streaky Bay District by June 1991 on the need for copper, zinc and manganese for grassy, medic pastures.

Current resources:

(a) Projects: four

Supervisors: Davidson (M), Foley (E), Butler (C), and Holden (E).

(b) Staff: state: 2.15 FTE RIRF: 0.1 FTE

(c) Estimated finances 1990-91:
State: $104,000 RIRF: $100,000

3.2 *BARRIER 7: An incomplete definition and detection of nutrient deficiencies and toxicities, limit the potential for nitrogen fixation and efficient nutrient management in pastures.*

Outcomes sought:

Improvements in returns from grazing through more efficient use of macro and micro-nutrient fertilisers and improved nitrogen fixation.

Current objectives:

(a) By June 1991 produce a data base for farmers and advisers which contains soil and plant analysis data for Fleurieu Peninsula, including changes with time.

(b) By December 1993, produce scientific reports, field days and fertiliser formulations for manufacturers and farmers, which define more efficient phosphorus fertilisers for acid soils receiving varying rainfall.

(c) By June 1993, produce reports and new releases for farmers in the cereal/livestock zone, defining the residual effectiveness of zinc fertilisers in pasture and crop production.

(d) To report to the scientific and farming communities by June 1991 on the criteria for detecting copper and zinc deficiencies and the critical needs of these trace elements in high-rainfall-zone, sub-clover pastures.

Current resources:

(a) Projects: four

Supervisors: Prance (C), Lewis (S), Hannam (P) and McFarlane (S).

(b) Staff state: 3.8 FTE RIRF: 1 FTE

(c) Estimated finances 1990-91:
State: $174,000 RIRF: $70,000

Strategic Plan for Barriers 3 and 7:

The Department of Agriculture, various commercial companies, CSIRO and Universities provide research work and advice in respect to soil fertility and plant production. The Department also provides a soil and plant analysis service.

The Department's strategy should continue to be directed at maintaining or improving the chemical fertility of soils. The targets which can contribute most to this strategy are:

(a) increasing the use by landowners of soil and plant tests to determine the nutrient status of pastures.

(b) Providing advice and recommendations on efficient fertiliser inputs.

(c) increasing the content of legumes in pastures.

Project objectives which will assist in achieving these goals are, in order of priority:

- To report to fertiliser manufacturers and graziers by June, 1996 on the suitability of a variety of rock phosphate products as sources of phosphorus for varying soil and climatic conditions.

- To produce reports for fertiliser manufacturers by June 1995 on sources of low solubility potassium fertilisers for high rainfall zone pastures.

- Report and extend to graziers in the Southern Mount Lofty Ranges by June 1996, on the need for P, K, and S fertilisers and the rate at which phosphorus should be applied.

- To report and recommend to the scientific and farming communities by June 1994, on practices which maintain healthy levels of Se (for animals) in sub-clover based pastures.

- By June 1996 report to graziers on the nutritive value of pelletised poultry manure for pastures and define its residual effects on soils and plants.

3.3 ***BARRIER 11: Increasing areas of chronicle and acutely salt affected land is resulting in declines in yield and loss of productive land.***

Outcome sought:

(a) The identification, development and adoption of salt tolerant pasture plants.

(b) Identify the causes of salinization and develop countermeasures.

Current objectives:

(a) By June 1999, produce reports, field days and news releases to Kangaroo Island farmers which recommend trees and shrubs for planting on saline grazing land.

(b) To report farmers in the Cooke Plains area on the suitability of various legumes for saline soils by June 1992.

Current resources:

(a) Projects: two

Supervisors: Dohle (C) and Davidson (M)

(b) Staff: state: 0.17 FTE RIRF: Nil

(c) Estimated finances 1990-91:
State: $7,700 RIRF: Nil

Strategic Plan for Barrier 11:

The Department of Agriculture plays the leading role in providing advice and remedial action in respect to dryland salinity. The Departments of Mines and Energy, Environment and Planning, Engineering and Water Supply and Woods and Forests, together with the CSIRO and Waite Agricultural Research Institute contribute alone and through representation on the State Dryland Salinity Committee.

Target: To control and reverse the spread of dryland salinity in South Australia. Objectives for future projects identified for this strategy are:

- **To provide reports, field days and new releases to landholders by December 1997, which recommend the best management options for high priority salinity areas of South Australia.**

- **By December 1994, produce written reports to landholders in the Angus-Bremmer catchment area recommending pasture and soil management practices which will limit salinisation of Angus-Bremmer water.**

3.4 ***BARRIER 13: Increasing areas of land are suffering from soil acidity, to a degree that both pasture productivity and nitrogen fixation are reduced.***

Outcomes sought:

To arrest the effects of declining soil pH on pasture, animal and crop productivity through farmers applying efficient liming practices and adopting acid tolerant plant cultivars.

Current objectives:

(a) To produce written reports and broadcasts for fertiliser manufacturers, distributors and farmers by June 1993, which identify areas in the Central Region affected by soil acidity and which recommend corrective measures.

(b) To produce technical papers for advisers and the scientific community by June 1993, which define the distribution of soil acidity in Central SA, and quantify the effects of lime amendments on pasture growth and soil chemistry.

Current resources:

(a) Projects: two

Supervisors: McLean (C), Dyson (C).

(b) Staff:
State: 1.35 FTE RIRF: 2 FTE

(c) Estimated finances 1990-91:
State: $153,000 RIRF: $99,000

Strategic Plan for Barrier 13:

The Department of Agriculture and CSIRO Division of Soils have defined the distribution of induced soil acidity in South Australia. The Department is responsible for providing advice and recommendations to landowners on efficient corrective measures.

Future Departmental work will focus on halting the decline in soil pH by developing lime requirement recommendations and encouraging the efficient use of lime products. Research should be continued to define the effects of lime amendments on the availability of plant nutrients, and on plant health.

The Department of Agriculture's strategy for arresting the rate of soil acidification and ameliorating acidic soils should include consideration of the following projects which pertain to pastures and forage crops:

(a) Developing and exploiting species and cultivars with tolerance to soil acidity.

(b) developing and exploiting strains of Rhizobium adapted to acid conditions.

4. PROGRAM 3: PASTURE AND FORAGE GENETIC IMPROVEMENT

BARRIER 9: There is a lack of easily managed, well adapted, persistent pasture cultivars (both for existing and evolving farming systems) and/or suitable rhizobial strains for pasture legume cultivars.

Outcome:

To breed, select and ensure the commercial adoption of easily managed, well adapted, persistent pasture cultivars and/or suitable rhizobial strains for pasture legume cultivars.

General Comments:

(a) Barrier 9 is a comprehensive summary of deficiencies in current pasture species which are common to the three arable farming zones of the sate: the cereal livestock zone, the high rainfall zone, and irrigated pastures.

(b) The deficiencies are:

(i) Many cultivars require MANAGEMENT SYSTEMS which are too costly to achieve maximum biological productivity, or are perceived as incompatible with other requirements/operations in farming systems, or have not been suitably demonstrated by experimentation.

(ii) WELL-ADAPTED cultivars are still lacking for many soil types and climatic regions of the state.

(iii) PERSISTENCE of perennial and self-regenerating annual species/cultivars is required in all farming zones to support stability of systems and increase efficiency.

(iv) RHIZOBIOLOGICAL RESEARCH seems inadequate for a state in which the farming systems are so dependent upon biologically fixed nitrogen.

4.1 General Strategic Objectives

The General Strategy for genetic improvement of pasture and forage which evolved from meetings of the Commodity Group and researchers involved in genetic improvement is presented in the accompanying flow diagram.

The major components of the process arising from Barrier 9 and the flow diagram are:

(a) An improvement programme must be developed or re-evaluated within an economic and physical analysis of the farming system it addresses so that its economic benefits and impact can be measured. This objective obviously

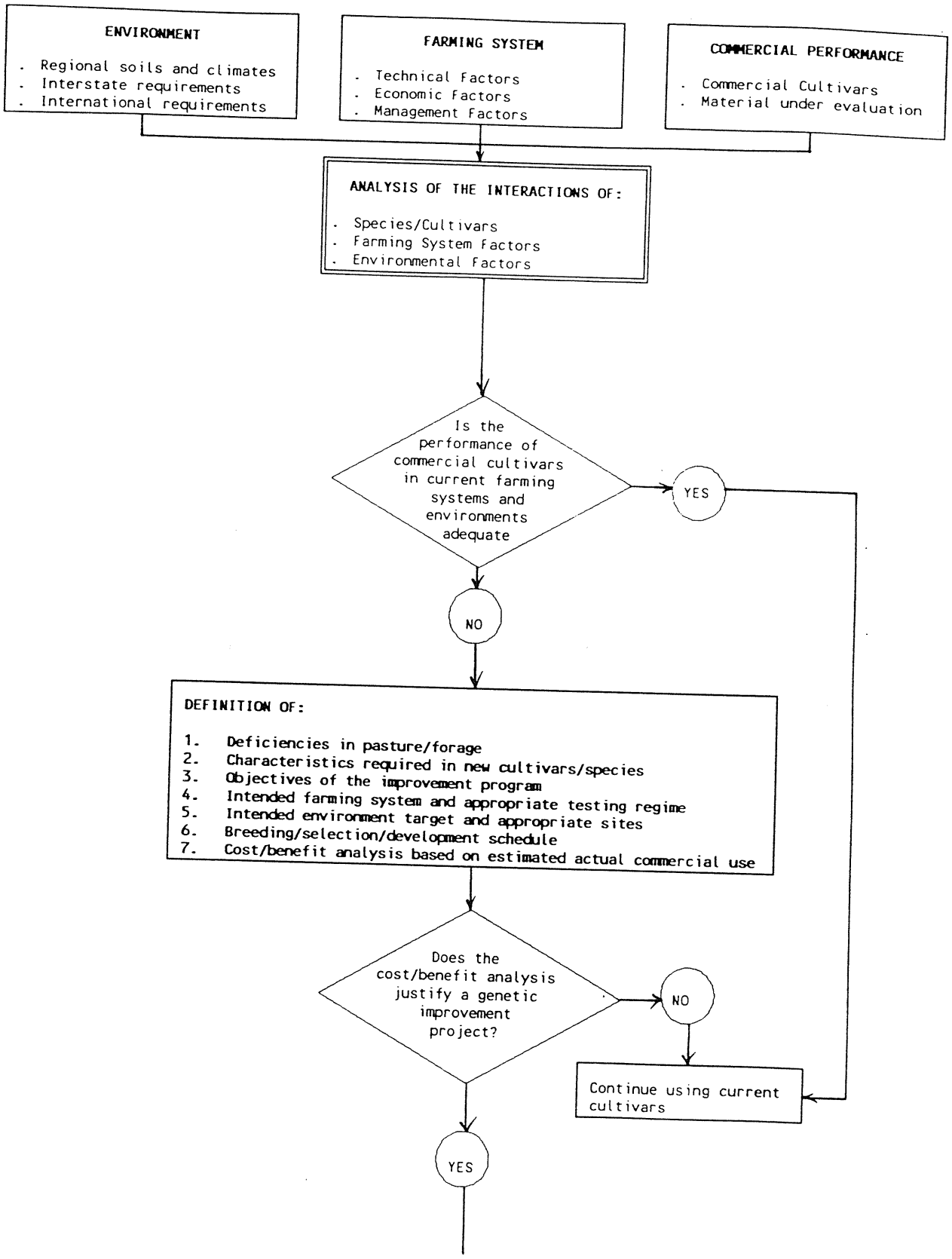
implies that the economic benefit of any new cultivar must be established for its intended farming system. This may require greater emphasis upon selection/breeding in the intended system of use.

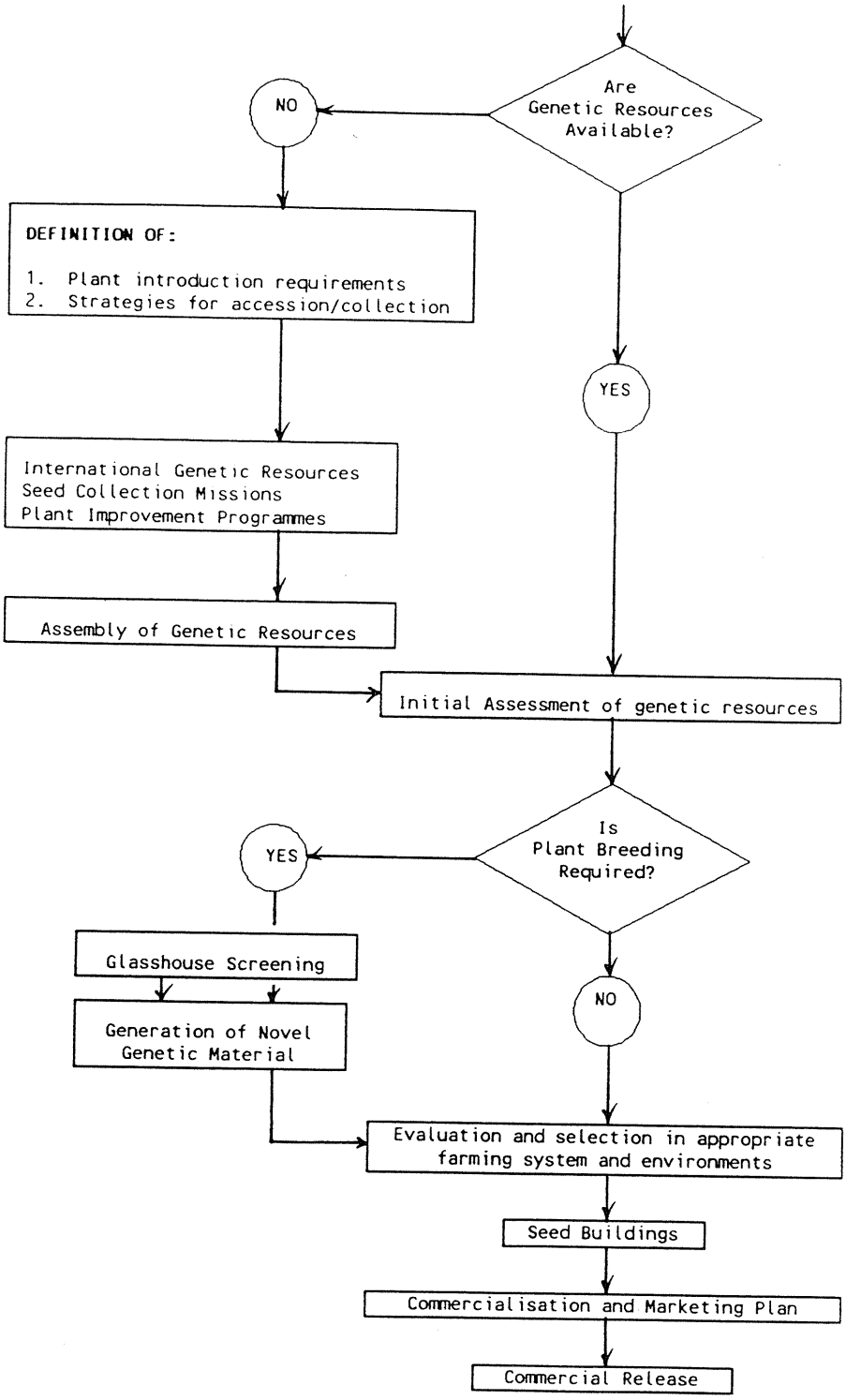
(b) Emphasis must be given to the measurement and achievement of persistence within farming systems.

(c) Rhizobiological limitations upon production must be addressed.

(d) The implications for plant improvement in the Strategic Plans of Programs 1, 2, 4 and 5 must be addressed.

GENETIC STRATEGY FOR PASTURE AND FORAGE GENETIC IMPROVEMENT




Are
Genetic Resources
Available?
NO
YES
DEFINITION OF:
1. Plant introduction requirements
2. Strategies for accession/collection
International Genetic Resources
Seed Collection Missions
Plant Improvement Programmes
Assembly of Genetic Resources
Initial Assessment of genetic resources
Is
Plant Breeding
Required?
YES
NO
Glasshouse Screening
Generation of Novel
Genetic Material
Evaluation and selection in appropriate
farming system and environments
Seed Buildings
Commercialisation and Marketing Plan
Commercial Release

4.2 REGIONAL OBJECTIVES

Cereal Livestock Zone

(a) **Genetic Resources Unit**

Outcomes:

(i) The improvement of pastures and forages by providing or assisting in the acquisition of genetic resources of species with potential in the cereal livestock zone.

(ii) To maintain the Australian Medicago Genetic Resource Centre.

(iii) To maintain the status of the Department as a participant in national and international germplasm storage and exchange.

Current Projects: (*Code No. in Table 6)

(i) (6)* Plant Introduction Centre

(ii) (16) Evaluation of medic introductions

(iii) (33) Maintenance of Australian Medicago Genetic Resource Centre.

Associated Projects with a direct input from the Genetic Resources Unit are (see Table 6) 1, 15, 26, 32, 8, 17 and the development of cold-tolerant medic export markets (see Marketing Programme).

Current Resources (for servicing the 10 projects above)

(i) Staff: State 5.60 FTE; RIRF 2.4 FTE

(ii) Estimated finances 1990-91:

State $193,000
RIRF $ 73,000

(b) **Medic Breeding and Evaluation Unit**

Outcomes:

(i) Develop medic cultivars which have superior performance in farming systems in the cereal-livestock zone.

(ii) Breed medics for the National Annual Medic Improvement Program.

Current Projects:

(i) (1) Medic Breeding

(ii) (15) Agronomic Evaluation of Medics

There is a component of medic breeding and evaluation in projects 26, 32, 70, 17 (Table 6).

Current Resources:

Staff: State 1.50 FTE; RIRF 7.00 FTE

Estimated Finances 1990-91:

State: $ 61,400
RIRF: $248,000

(c) **Subclover Improvement**

Outcomes:

(i) Improved subterranean clover cultivars for the cereal livestock zone.

(ii) Cultivars of *T. Brachycalycinum* (bred in collaboration with the National Subclover Improvement Program breeding centre, Perth) especially better adapted to lower rainfall cropping zones than current cultivars.

Current Project:

(i) (12) National Subclover Improvement Programme

There is a component of subclover evaluation in project 26 (see Table 6).

Current Resources:

Staff: State: 1.20 FTE; RIRF 2.00 FTE

Estimated Finances 1990-91:

State: $44,000
RIRF: $74,000

(d) **Lucerne Breeding and Evaluation**

Outcomes:

(i) Lucerne cultivars with greater persistence and grazing tolerance than existing cultivars.

(ii) Lucernes with greater tolerance to salinity.

Current Projects:

The lucerne breeding programme conduct experiments in the cereal livestock, high-rainfall and irrigated zones. Two of the six testing zones in the state and the Mid-North (Marrabel and Clare) and Upper South East (Culburra). These would use about one quarter of total resources. The projects are listed in the High Rainfall and Irrigated Zones in Table 6 (Codes 5 and 19).

Current Resources (for Cereal-Livestock zone only):

Staff: State: 0.10 FTE; RIRF 1.25 FTE

Estimated Finances 1990-91:

State: $ 8,000
RIRF: $59,000

(e) **Annual Ryegrass Improvement**

Outcomes:

(i) Annual ryegrass with resistance to *Anquina* (gall nematode)

(ii) Resistant cultivars and appropriate management strategies.

Current Project:

(i) (34) Annual ryegrass toxicity "resistance" breeding.

Current Resources:

Staff: State: 0.80 FTE; RIRF 3.50 FTE

Estimated Finances 1990-91:

State: $ 34,000
RIRF: $100,000

(f) **Regional Evaluation Projects**

Outcomes:

The commercialisation of pasture legumes adapted to:

(i) The handsetting red-brown earth soils.
(ii) The cereal-livestock belt of Eyre Peninsula.
(iii) The lower rainfall area of the zone.

Current Projects:

(i) (26) Solution of pasture legumes for low rainfall
(ii) (32) Identification of pasture legumes/Eyre Peninsula
(iii) (70) Medic variety evaluation/Murray Mallee
(iv) (77) Pasture Evaluation (Lock)

Current Resources:

Staff: State: 0.81 FTE; RIRF 3.0 FTE

Estimated Finances 1990-91:

State: $ 13,300
RIRF: $120,100

In addition to these projects the development of cold-tolerant medics for export conducts experiments to assess seed production (see Program 5). That project involves 0.20 State FTE, 1.0 RIRF FTE and costs the state $19,000 and RIRF $53,000.

(g) **Rhizobiology**

Outcome:

To provide highly effective rhizobia strains for legumes in the cereal-livestock zone.

Current Projects:

None.

Field assessment of strains provided by WADA and CSIRO is conducted as part of projects 4, subclover improvements; 15, agronomic evaluation of medics and 5, lucerne breeding.

Current Resources:

Staff: Nil
Resources: Nil

(h) **Submissions for 1991-92 Funding**

Four submissions for RIRF funding were prepared for the cereal-livestock zone for 1991 funding (See Table 7).

(i) **Suggestions for Future Research**

In the staff survey five suggestions were received (See Table 7).

(i) (99) Rhizobiological research.

This area is directly addressed in Barrier 9 and has a high priority.

(ii) (101) Investigations of the non-nodulation of medics in mallee soils.

(iii) (118) Evaluation of sulla (*Hedysarum*).

(iv) (119) Collection of naturalized medics.

(v) (120) Identification of persistent pasture legumes.

4.3 HIGH RAINFALL AND IRRIGATED ZONE

(a) Annual Legume Improvement

Outcomes:

(i) The improvement of annual pasture based farm productivity in the farming systems of the zone by developing and identifying improved cultivars.

(ii) Extension of the area of use of annual legumes by identifying and developing species and cultivars for niches currently unsatisfactorily supplied with annual pasture legumes.

(iii) Identify useful cultivars by participation in national and international legume improvement programmes.

Current Projects:

(i) (4) National subclover improvement programme (in part).
(ii) (8) Pasture legumes for high rainfall zones.
(iii) (17) High rainfall pasture research (in part).
(iv) (56) Subclovers for low phosphorous soils.

Associated projects with a direct impact are the Genetic Resources Unit (6) and the National Subterranean Clover Improvement Programme (4).

Current Resources:

(i) Staff:

(ii) Estimated finances 1990-91:

State $108,200
RIRF $ 48,500

(b) Perennial Legume Improvement

Outcomes:

(i) Identification, development and commercialization of cultivars which improve productivity and pasture quality in perennial pastures in farming systems of the zone.

(ii) Extension of the use of perennial legumes with riches where they are currently unsatisfactory but would improve farm productivity.

Current Projects:

(i) (5) Lucerne breeding for high rainfall zones.
(ii) (36) Selection of lucerne for resistance to *Stagonospora* and tolerance to salinity.
(iii) (19) Breeding nematode resistant lucerne.
(iv) (17) High Rainfall Pasture Research (in part).

(v) (73) National White Clover Improvement Programme.

Current Resources:

(i) Staff:

(ii) Estimated Finances 1990-91:

State: $ 45,000
RIRF: $149,500

(c) **Rhizobiology**

Outcomes:

(i) Providing highly effective rhizobial strains for legumes in the zone.

Current Project:

(i) (21) Pasture Rhizobiology

Current Resources:

(i) Staff:

(ii) Estimated Finances 1990-91:

State: $50,500
RIRF: $31,100

(d) **Perennial Grass Improvement**

Outcomes:

(i) Identification, development and commercialization of cultivars which improve productivity and pasture quality in perennial pastures in farming systems of the zone.

Outcomes:

(i) (2) Dryland perennial grasses for the high rainfall zone.

(ii) (17) High rainfall pasture research (in part).

(e) **Pasture Composition Dynamics**

Outcome:

(i) Greater stability and productivity of pastures by identifying, developing and promoting the most table production and economic association of species and cultivars for pastures in the high rainfall and irrigated pastures.

Current Projects:

(i) (17) High Rainfall Pasture Research (in part).
(ii) (78) Dairy Pastures - Clare area.

Note that these projects are the genetic component of the High Rainfall component of Technical Programme 1: Farming Systems and Farm Management.

4.4 PASTORAL ZONE

(a) Improvement of Browse Shrub

Outcome:

To retard desertification by identifying shrubs more tolerant to grazing.

Current Project:

(i) (72) Saltbush selection for grazing tolerance.

Current Resources:

(i) Staff:

(ii) Estimated Finances

State: $3,000
RIRF: $Nil

Table 6 : Projects in Technical Program 3: Pasture and Forage Genetic Improvement

Current Projects		Cereal Livestock			
Code	Title	State	Industry	Total	Supervisor
1	Medic Breeding	50400	168000	218400	Lake
4	Nat. Subclover Imp. Pro.	44000	94000	138000	Bellotti
6	Plant Information	125000	0	125000	Auricht
15	Agronomic Evltn. of Medics	11000	80000	91000	Howie
16	Evaluation of Medics	18000	73000	91000	Auricht
26	Seln. Pasture Low R/Fall	3000	74500	77500	Crosby
32	pasture Legumes/E.P.	5000	45600	50600	Saunders
33	Aust. Medicago Gen. Res. Cen.	50000	0	50000	Auricht
34	Argt/Nematode Res. Ann. Rg.	34000	15000	49000	McKay
70	Medic Var. Evaluation/ML	3100	0	3100	McCord
77	Pasture Evaluation (Lock)	2200	0	2200	Lewis
82	Lucerne Variety Demo. Minni	1200	0	1200	Wurst
		High Rainfall			
Code	Title	State	Indust	Total	Supervisor
2	Dryland Grass/High Rainfl	81000	103000	184000	Flower
5	Lucerne Breeding H.R.F.	14000	124000	138000	Kaehne
8	Pasture Legumes/High Rfal	86000	32000	118000	Craig
17	High RF Pasture Research	40000	50000	90000	Mitchell
21	Pasture Rhizobium	50500	31100	81600	Ballard
36	Lucerne Stagonos/Salt	9000	35000	44000	Kaehne
56	Subclovers for Low Phos.	8200	0	8200	Little
73	Nat. White Clover Imp. P.	3000	0	3000	Mitchell
75	Dairy Pastures/Clare	2500	0	2500	Clark
		Irrigated			
Code	Title	State	Indust	Total	Supervisor
19	Lucerne Nematode Resistance	9000	78000	87000	Kaehne
		Pastoral			
Code	Title	State	Indust	Total	Supervisor
72	Saltbush Seltn for Grzng	3000	0	3000	Wurst

Table 7 : Submitted Proposals (1991-92) and suggested Research relevant to Genetic Improvement

CODE	TITLE	SUPERVISOR
Cereal - Livestock		
Submissions		
98	Pasture legumes for low-rainfall	Crosby
107	Breeding vetch	Kaehne
116	Collection Mission - Balkans	Auricht
117	Genetic Resource Centre - store	Auricht
Suggestions		
99	Rhizobiological research	Crosby
101	Investigate non-nodulation/medics	Saunders
118	Sulla evaluation	Auricht
119	Collection of naturalized medics	Auricht
120	Identify persistent past. legumes	Bellotti
High Rainfall		
Submissions		
92	Acid-tolerant rhizobia/lucerne	Ballard
104	Pasture legumes for high rainfall	Craig
108	Breeding root rot resistant lucerne	Kaehne
Suggestions		
94	Pastures specific for horses	Mathison
112	Interspecific crosses/lucerne x medic	Kaehne
Irrigation		
Suggestion		
122	Selection of ryegrass under grazing	Scown
Pastoral		
Submission		
121	Selection of saltbush under grazing	Hunt

5. PROGRAMME 4: PLANT PROTECTION

Barrier: There is a need to research and promote alternative methods of pest, disease and weed control.

Outcomes:

(a) Develop cost-effective pest, disease and weed control strategies which integrate a range of tactics/practices.

(b) Develop integrated weed control strategies so that unnecessary reliance on herbicides is avoided, thus minimising chemical use and the buildup of herbicide resistance.

(c) Develop integrated weed, pest, and disease strategies which reduce dependence on chemicals and thereby reduce pesticide residues and risks to the environment.

5.1 General Information

Weeds, pests and diseases are three key factors responsible for poor pasture production and persistence and hence lower livestock and crop root returns.

The use of chemicals to control weeds, pests and diseases has developed to such a high degree of sophistication in modern Australian farming that the use of chemicals is arguably the most considered factor in cereal-livestock farming and in some farming systems using pastures and forages in high rainfall and irrigated zones. Consideration must be given to the choice of product, its cost, its efficacy, the risks to crops, pastures and livestock and implications for farm management in both the short and long term. The development of effective chemicals has probably led to an over-reliance upon them.

The strong environmentalist movement in politics also places regulatory demands upon the farmer.

Markets are becoming more discriminating in relation to residues in agricultural products. The concerns about pollution and effects of chemicals upon human health which are held by the community are also often and strongly held by many farmers and their families.

Therefore a strategic plan is needed in which reliance on chemicals can be minimised. 'Organic' pasture management could be a goal. When a chemical is used its cost effectiveness must be maximised.

5.2 Strategic Plan

The strategic plan for Plant Protection will be considered in three parts: weeds, pests and diseases.

5.2.1 Weed Control

(a) Current Projects

The current projects are listed in Table 8.

Weeds research is almost entirely conducted by the Department with state resources. In addition there is non-government research in chemical evaluation.

(b) Strategic plan for weed control research and extension

(i) Effectiveness of weed control

Currently in the cereal-livestock zone pastures constitute "weak links" within rotations/farming systems which permit weed build-up and the consequent increased need for chemical control in subsequent crops.

Production losses caused by weeds need to be measured to provide farmers with criteria or guidelines on the need to treat (economic thresholds).

Table 8 : Projects in Plant Protection, 1990-91

SURVEY CODE	TITLE	RESOURCES			
		Staff		Estimated finances ($)	
		State	RIRF	State	RIRF
	Weeds:				
39	Medic herbicide tolerance	.05	-	3,000	-
40	Barley Grass Control	.15		6,300	-
41	Silver Grass Control	.05		2,100	-
46	General weed control	.90	.30	53,000	-
47	Cultivar herbicide	.15		7,000	-
53	tolerance	1.00		42,000	-
54	Pasture weed control	.05		4,000	-
55	(CE)	.90		40,000	-
56	Pasture weed control (EP)	.50		27,000	-
	Pasture weed control (SE)				
	Pasture weed control (ML)				
	Pests:				
43	Invertebrate pests in	.30		15,000	65,400
44	medics	.30		17,000	27,00
	White snail control				
	Diseases:				
49	Seedborne medic diseases	1.05		3,000	18,400
	General:				
51	Buff plate spray boom	1.20		8,000	45,000

In high rainfall and irrigated pastures weeds often reflect non-persistent/ill-adapted cultivars of sown pastures and/or poor fertilizer and grazing management.

Weed control programmes need to be developed which include the integration of control tactics, damage assessment data and practical techniques to assess pest and weed densities.

Therefore research is needed to establish the effectiveness of alternative methods to chemicals for weed control, including grazing, mechanical topping, hay making, burning, sowing competitive plants (oats, vetch, annual rye grass) and rotations.

The nature and scope of this research needs to be determined by and performed in conjunction with detailed monitoring of farming systems which incorporate effective, sustainable and integrated weed control programmes.

A practical method of assessing nutritive loss caused by weeds in pasture should be developed, together with estimates of reduction in carrying capacity so that an economically based decision making model for control of weeds in pasture could be built.

(ii) **Herbicide Screening**

The current programme of screening herbicides for use in pastures needs to be systematised and developed to cover sub-clovers, medics, vetches and other species, soil reaction and two rainfall zones, viz. less than 375 mm and greater than 500 mm. Particular attention needs to be directed to control of capeweed and other "production" weeds which affect pasture establishment, production and persistence of improved species.

Assessment of weed control and pasture legume tolerance to herbicides needs to be by quantitative analysis. Tolerance should be assessed by herbage and seed yields.

Greater research input is needed to assess the potential of herbicides for selective control of certain broadleaved weeds for which no alternative control is apparently effective.

Herbicide/cultivar combinations which enable control of broadleaved weeds, particularly in legumes pastures, for example, glyphosate resistance in medics and subclover should be developed.

(iii) **Herbicide Resistance in Weeds**

Collaborate with W.A.R.I. to develop strategies which integrate management practices to avert herbicide resistance.

An economic evaluation of strategies designed to control development of herbicide resistance should be conducted.

Extension publications on practical strategies to avoid herbicide resistance are needed.

A state-wide co-ordinated programme involving Department of Agriculture, W.A.R.I., Industry and farmers to avoid herbicide resistance should be planned.

(iv) **Avoidance of weed-like behaviour of useful species in farming systems**

Breed and select from *L. rigidum* and other grass species, cultivars which have resistance to diseases affecting cereal crops and to A.R.G.T.

Ensure that competing and contaminating pasture forage and grain legumes can be eliminated from cereal crops effectively by herbicides. (Note that this aim may conflict with attempts to control broadleaved weeds in legume stands.)

(v) **Development of an expert system/data bank**

Develop an expert system to assist farmers make decisions on herbicide selection.

5.2.2 Pest Control

(a) **Current Projects**

The current projects in pest control in pastures are listed in Table 8.

In addition, the medic, lucerne and subterranean clover breeding programmes have as a major objective selection for resistance and tolerance to pests.

(b) **Strategic plan for pest control**

(i) **Breeding for pest resistance/tolerance**

Continue current breeding programmes to improve the resistance/tolerance of pasture legumes to pests, in particular redlegged earthmite, lucerne flea, Sitona weevil, aphids, Heliothus and seed wasp. Pest-resistant pasture cultivars are the most likely tactic to provide low-cost control of pasture pests.

Research alternative species of legumes which have resistance to important pasture pests in South Australia and which can be adapted as pasture plants within current or evolving farming systems.

(ii) **Integrated Pest Management and Economic Thresholds**

A control programme which integrates tactics viz. chemicals, rotations, grazing, biological control, plant resistance and damage assessment data is most likely to succeed in the long-term.

Monitor progress on biological control of RLEM and lucerne flea in Western Australia.

Assess pasture pest damage and develop economic thresholds by a multi-disciplinary team approach involving entomology, livestock, plant physiology, agronomy statistics and economics.

Use the damage assessment data to help define research and extension priorities.

Use the damage assessment data to develop practical techniques to assist farmers in decision making on pest control.

Damage assessment techniques should be demonstrated to farmers as part of the programme.

Assess damage to pasture from wingless grasshopper

5.2.3 Disease Control

(a) Current Projects

The current project is listed in Table 8.

In addition, there is a major programme conducted for disease resistance in lucerne (fungal and nematode pathogens) and some emphasis is given to disease resistance in medic, subclover, perennial clover, other annual clover and grass improvement projects conducted by the Department.

(b) Strategic Plan for Disease Control

Provide a plant pathology input into legume improvement programmes to optimise use of known disease resistance.

Continue intensive selection for resistance to fungal and nematode diseases of lucerne foliage and root tissue.

Survey disease incidence and damage to annual medic and sub clover pastures to determine research and plant breeding priorities.

Expand upon the limited disease screening which currently occurs within the National Medic Breeding Programme.

Survey, collect and identify nematode species which affect legume pastures and forages, determine resistance to those nematodes; and incorporate sources of resistance if they can be identified into existing breeding programmes.

Establish the degree of infection and strains of alfalfa mosaic virus involved within Australia's lucerne and medic stands.

6. PROGRAMME 5: MARKET DEVELOPMENT

Barriers: A market development program is necessary to address barriers 15, 16 and 17 which relate to problems including:

(a) a lack of a formal management infrastructure in the development, multiplication and commercialisation of pasture cultivars;

(b) a lack of a global perspective in identifying potential markets for pasture cultivars; and

(c) high export freight costs and a lack of regulation and maintenance of quality standards for export.

Overall Direction

(a) There is a need for a greater integration and involvement of seed breeders, foundation seed multipliers and marketeers in all aspects of pasture cultivar development. This would ensure that the correct technical infrastructure is developed to enable successful promotion and adoption of suitable cultivars.

(b) There is an opportunity for the Department of Agriculture to generate and facilitate export income from pasture seed and fodder products.

Objectives

(a) To establish a management infrastructure for pasture cultivar development that involves representatives from breeding, seed services and industry to coordinate all activities from cultivar development, quality control, propagation, promotion and commerce.

(b) To review the role of the Herbage Plant Liaison Committee.

(c) To promote a global perspective and an entrepreneurial approach within the Department in all activities in pasture cultivar development and marketing.

(d) To facilitate industry attempts to develop export markets for fodder products, establish and oversee quality standards for export, and assist in freight negotiations.

Current Resources

Projects :	Export of Cold Tolerant Medics
Staff :	Research Officer - 0.2 FTE State, 1.0 FTE RIRF
Finance :	$14400 State, $43000 RIRF

PART D: RECOMMENDATIONS

1. RECOMMENDATIONS

The major conclusions from the analysis of each technical programme and the consequent recommendations were:

1.1 Programme 1 : Farming Systems and Farm Management

(a) The pasture survey indicated that many relatively small projects or minor proportions of time of individual staff members were suggesting a predominantly reactive current programme. There is some indication that these inputs are not closely co-ordinated within the programme or with other Technical Programmes.

(b) A revised management structure is detailed in the Technical Programme's strategic plan. This can be achieved by:

(i) new Job Specifications for two staff:

(ii) dedication of staff to the two major projects: cereal-livestock and high rainfall.

(iii) emphasis on each zone state-wide, particularly for dedicated staff.

1.2 Programme 2: Soil Management and Plant Nutrition

(a) There is a high risk in this programme because of the limited time resources available from highly trained scientists in the disciplines of soil science and plant nutrition with experience in project management.

(b) There is a need to nominate an officer to have a state-wide role in planning and management of plant nutrition projects for pastures and forage.

(c) Departmental management should permit a formal input from specialists in plant sciences into projects in land care and soil resource management to ensure effective liaison and co-ordinate project development. This is particularly required in projects in salinity management.

1.3 Programme 3: Pasture and Forage Genetic Improvement

(a) There is a need to nominate a State-wide manager for existing projects and the coordination of project development in this area.

(b) The high ratio of industry to state resources has attenuated state-funded professional staff. The loss of any state-funded staff, particularly senior staff, would severely affect the structure of this programme and its capacity to continue its current portfolio of projects.

(c) A rhizobiologist is required to develop research projects and manage an extension programme in inoculation and nitrogen fixation.

(d) Support in Pasture Pathology and Nematology is required for a diagnostic service and disease resistance breeding programmes, particularly for pasture legumes (see Programme 4).

1.4 Programme 4: Plant Protection

The strategies in resource management required in this programme are most clearly presented under discipline headings: weeds, diseases and pests.

(a) Weeds

(i) One senior scientist is required to be allocated full-time to weed control in pastures and forages state-wide in the cereal-livestock zone with specific directions to concentrate upon herbicide management and manipulation in the farming systems of that zone.

Comment: Weeds are arguably the major limiting factor to proper utilization of pasture ley systems. Weed buildings in 'pasture' phases affects the whole system and research/extension/industry funding seems to have a disproportionately low recognition of weed related problems compared with farmers who devote considerable time, effort and cost to weed control.

(ii) In the high rainfall permanent pasture and irrigated zones the current allocation of resources should be retained and integrated into the high rainfall pasture projects for Programme 1: Farming Systems and Farm Management. At present the ecology of weeds is critical and should be integrated with chemical control systems.

Note: It is appropriate to state a general response to criticism of the use of herbicides at this point in the development of the Strategic Plan.

If control of weeds can be concentrated at the point of the greatest likelihood of seed buildup which, in the absence of quantitative data, would probably be the 'pasture' phase of current farming, then there would probably be less reliance on herbicide elsewhere in following years thereby probably reducing the average use of herbicide per year. This objective will only be achieved if pastures contain more competitive aggressive species (such as vetches, vigorous medics and alternative clovers) managed in ways to minimize weed establishment and encourage competition. This obviously implies integration with Programmes 1, 2 and 3.

(b) Diseases

Disease control is currently limited to Programme 3 which has a major strategic objective to minimize disease incidence by plant breeding, although the option exists to use fungicides in cost-effective situations for disease control.

A state resource in Pasture and Forage Pathology is urgently required to provide a diagnostic service and focus for management, initiation and evaluation of plant breeding for disease resistance in pastures forages and also probably assist in grain legume breeding.

1.5 Pests

Pest control is partly linked to Programme 3 which has strategic objectives to find and incorporate sources of pests resistance into agronomically acceptable cultivars.

In addition, there is a need to reallocate existing resources to analyse 'on farm' observations and opinions on the economic importance of various pests (eg. Sitona weevil and Heliothus moth) and for entomologists to participate in such a review (and in some cases a re-analysis) with agronomists and plant breeders to define projects to respond to the most economically significant pests of high concern to industry.

1.6 Programme 5: Market Development

(a) A formal structure is required to manage the development of projects involved in product development by the Department. The present dispersed and ad hoc management is not consistent with sound business management practice. A formal structure should fit the realignment of resources which will be required if the Department is reorganized into business units.

(b) The Department must continue to monitor the costs, risks and opportunities in fodder export.

1.7 The Ongoing Role of the Pasture Forage Commodity Group

The group recommends:

(a) That the former Pasture Research Management Committee continue its functions and, <u>in addition</u>, involve extension officers and an economist.

The former committee consisted of:

(i)	Dr Ian Kaehne	Research/Div. Plant Ind.
(ii)	Dr Bill Bellotti	Research/Cereal-Livestock
(iii)	Mr Ron Ellis	Research/South East
(iv)	Mr Brian Bartsch (on proxy)	Research/Adelaide Hills

In addition the groups recommends representatives for:

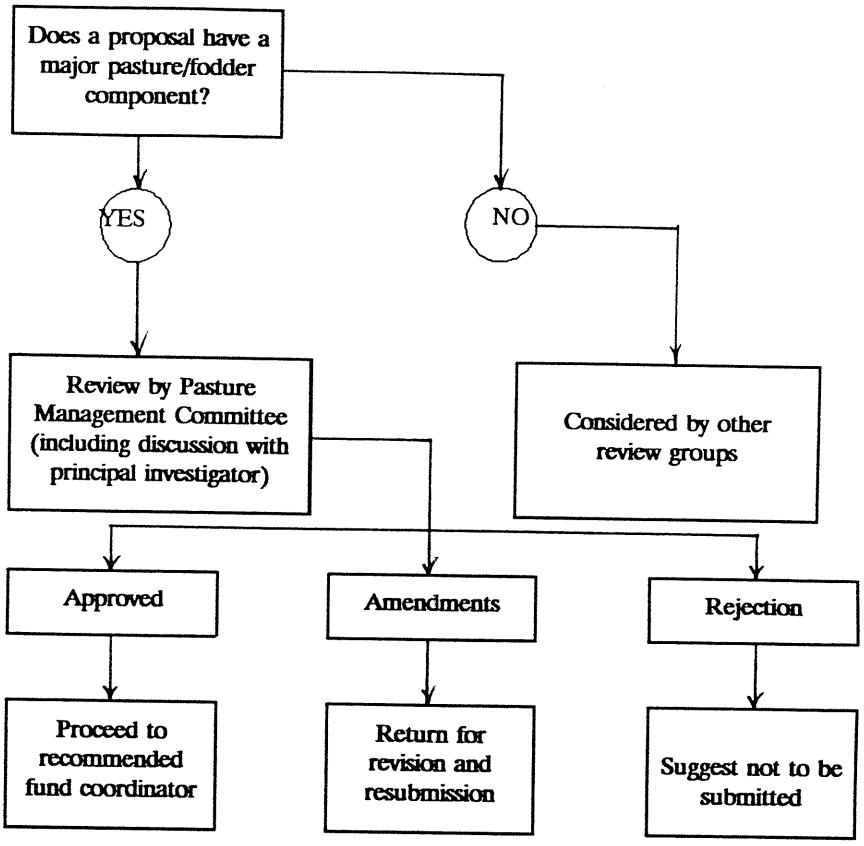
(v) Extension/Cereal Livestock
(vi) Extension/High Rainfall/Irrigation
(vii) Economics

If Messrs Holden, Prance and Presser continue their involvement, the committee would be identical to the commodity group except for the addition of Bartsch (or his proxy) and the latter three representatives would be involved.

(c) **That the Pasture Commodity Committee review all submissions for funding in pasture and fodder research and extension.**

The Committee will also initiate and support proposals (as the Northfield-Turretfield groups has done).

A proposed mechanisms is:



(d) **That the Pasture Commodity Committee maintain a register/data base of all pasture related activities in the Department.**

The Committee recommend that the data base generated by the commodity review be annually updated to assist management.

(e) **That the Pasture Commodity Committee initiate a strategic plan to ensure that sufficient young scientists are trained to support corporate objectives.**