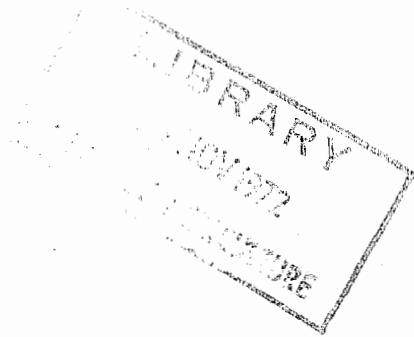


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DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

# Agronomy Branch Report



AGRONOMY BRANCH ANNUAL REPORT,

1971-72

**Report No.**

PASTURE RESEARCH SECTION

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PASTURE RESEARCH SECTION

1. SECTION ACTIVITIES:

1.1 Pasture Research

There has been an increasing trend towards increased pasture productivity in South Australia, but the process has been slow and often uncertain.

Recent work carried out by the Section indicates that in the high rainfall areas, areas receiving 20" or more per annum, applications of fertiliser nitrogen could dramatically increase pasture productivity and as these areas disproportionately contribute to the total productivity in South Australia, immediate gain could be enormous.

These areas currently produce in the vicinity of 10,000 kilograms per hectare of dried pasture herbage when farmed in the conventional manner with pastures of subterranean clover plus volunteer annual species. Studies made in the Section have indicated that during the 7-8 month period of plant growth, light, temperature and rainfall are not limiting growth. There is sufficient light to produce 25,000 kilograms per hectare and recent work has indicated that levels approaching this can be achieved by the application of adequate amounts of fertiliser nitrogen.

Studies aimed at developing approved practices for seed multiplication and processing has continued, particularly with the adapted grass cultivars, Currie cocksfoot, Medea perennial ryegrass and Demeter tall fescue. There have been two developments in this field. Firstly, the seed yielding capacity has been examined for a number of European, North American and New Zealand cultivars of herbage and lawn grasses and legumes to accommodate increasing overseas interest in using South Australia for seed build up for these markets during the northern hemisphere winter. Secondly, the charcoal band herbicide technique has been examined for establishing weed free seed crops.

Pasture establishment research is developing with the commissioning of a new glasshouse financed by the Meat Research Trust Fund. Detailed studies of the nutrition of pasture seedlings under an array of fertiliser treatments will be possible. The development of ideas from the glasshouse into field practice will in future be greatly assisted by the recent development and commissioning of a versatile self-propelled

sowing machine. This machine is capable of sowing at a wide range of rates and mixtures through a range of devices in a wide range of combinations.

Evaluation of new herbage plant cultivars under grazing is being examined on Kangaroo Island Research Centre. There *Medea* perennial ryegrass and Siro 1146 hybrid phalaris (*P. tuberosa* x *P. arundinacea*) are being compared with Victorian perennial ryegrass (the standard sown perennial), Wimmera rye (the standard sown annual), and a pasture consisting of subterranean clover plus other volunteer annuals.

The plant introduction activities are centred at the Northfield Research Laboratories with the field station at Parafield, a northern suburb of Adelaide.

The Parafield Plant Introduction Centre now enjoys the reputation of maintaining one of the leading medic "gene pools" in the world and there is a continuing world wide demand by research workers for material.

With the increasing need to develop alternate crops to supplement falling farm incomes in South Australia from wheat and wool, the future role of the plant introduction work has been under review during the year and it is hoped that in the near future the work can be broadened to deal with introductions of a wide range of other material such as oil seed crops, grain legumes and pulse crops.

The major activity conducted by the group during 1971-72 has been the continuance of the classification programme of the annual species of Medicago.

The final testing and release of a new cultivar of lucerne, viz. Paravivo, has seen the culmination of eight years of intensive sampling of trials to compare seasonal production and persistence.

Sward trials were established to compare the seasonal herbage production, seed production, subsequent regeneration and winter production of fifty lines of Medicago rugosa with existing commercial cultivars in two environments.

Small swards of an extremely early flowering genotype of M. truncatula were established in comparison with commercial cultivars on private farms on Upper Eyre Peninsula.

Seed supplies of 165 lines of annual legumes were increased in the field whilst 103 lines of more valuable material were grown in the glasshouse and shadehouse.

A pilot trial to establish the tolerance or resistance of many annual legumes to the fungus disease, Kabatiella caulivora, was sown on Kangaroo Island.

The grass garden at the Parafield Plant Introduction Centre was fumigated and resown with 136 lines of legumes, grasses and fodder plants of economic and student value.

### 1.3 Plant Breeding

In addition to the general introduction programmes specific breeding programmes of annual Medicago species, particularly M. truncatula, lucerne, perennial ryegrass and tall fescue, are being undertaken.

During the year the legume breeding work has been modified to cope with major new factors in the environment, sitona weevil (Sitona humeralis) and clover leaf scorch (Kabatiella caulivora).

Sitona weevil has during the past year been quite devastating on medic pastures of South Australia. A major attack is now being made on many aspects related to developing control systems for sitona weevil. Some aspects of this work are reported in the section of this report dealing with entomology. Efforts are being made by plant breeders to identify resistance to the adult with a view to breeding adapted plants with as much resistance as possible. Worthwhile levels of non-acceptance have been identified in some lines of Medicago rugosa and a suggestion of some resistance in a number of lines of lucerne.

Clover scorch is causing increased concern to farmers on Kangaroo Island and other areas of high rainfall, particularly where the dominant variety of subterranean clover in the pasture is Yarloop. The very large collection of annual legumes assembled over the years by the plant introduction group are now proving of great value in the search for resistant lines which could be of use as herbage plant cultivars to replace the susceptible Yarloop. Work is proceeding both in the glasshouse and in the field on Kangaroo Island in conjunction with the Research Centres Branch.

## 2. PASTURE RESEARCH:

### 2.1 Seasonal Availability of Soil Nitrogen on a Solonized Solonetz Soil at Kybybolite - P. Cocks

Regular sampling of soil for available nitrogen at weekly intervals has indicated that relatively high levels of available nitrogen occur at the commencement of the wet season, but rapidly diminish. Therefore very low levels of soil nitrogen are available for the majority of the growing period of pastures.

Application of ammonium sulphate to a pasture consisting of barley grass, cape-weed and Mt. Barker subterranean clover indicates that a potential yield of 22,300 kilograms per hectare can be achieved as compared with 12,300 kilograms per hectare for the pasture receiving no nitrogen fertiliser.

Potential yield was calculated from a series of response trials established every month and cut for yields six weeks after the application of nitrogen.

With application of nitrogen up to 100 kilograms per hectare per annum all the nitrogen applied could be accounted for in the tops of the pasture. At higher rates of application, available soil nitrogen increased significantly and at extreme levels where a total of 600 kilograms per hectare were applied during the season, ammonia nitrogen was detected as deep as one foot in the soil.

Over all rates of nitrogen applied, the majority could be accounted for in the tops or as soil nitrogen (mostly ammonium, but a small percentage of nitrate).

### 2.2 The Influence of Temperature and Density on the Growth of Communities of Mt. Barker Subterranean Clover - P. Cocks

The influence of temperature on the growth of high and low density communities of subterranean clover was studied in a growth chamber at four temperatures, ranging from 12°C day/7°C night to 27°C day/22°C night.

The response to temperature depended on leaf area index (LAI). When LAI was low (0.2) growth rate increased with increasing temperature to a maximum at 22°C day/17°C night. However, when LAI was 3 the growth rate was not influenced by temperature within the range tested. At a still higher LAI (5.5) the response in growth became negative with increasing

temperature. Communities at the highest temperature grew at only half the rate of those at the lower temperature.

Although LAI in grazed pastures has not been measured, dry matter levels in winter are known and these suggest that LAI is normally above 1. If this is so these investigations indicate that pasture growth is seldom limited by low temperatures in winter.

### 2.3 Sward Evaluation of Lucerne Selections - E.D. Higgs, I.D. Kaehne

Cultivars of lucerne in use in Australia are being compared with a number of introductions selected by Dr. G. Leach formerly of the Waite Institute. Trials have been established in the high rainfall zone in the Lower South East on deep sand, a rendzina, and a well drained soil developed on limestone. At Turretfield Research Centre (18" rainfall) a further trial has been established on a red-brown earth soil.

After allowing a year for establishment, systematic cutting for yield for two years is being carried out. This will be followed by a period of rotational grazing to evaluate the persistence of lines.

All varieties have expressed characteristic growth rhythms on all sites sampled. Broadly these characteristics are:- extreme winter dormancy followed by active growth late in the spring (e.g. Rhizoma); less extreme winter dormancy followed by active growth early in the spring (Du Puits); slight winter dormancy followed by moderate spring growth (e.g. Hunter River), and active autumn and early winter growth followed by relatively poor spring and early summer growth (Siro Peruvian).

The best total yields generally have been only marginally superior to Hunter River.

### 2.4 Studies on the Optimum Harvest Time for Tall Fescue (Festuca arundinacea) Cultivar Demeter - E.D. Higgs & K.G. Boyce

A further experiment was conducted during 1971-72 on a commercial crop of tall fescue grown under irrigation near Naracoorte. Twenty harvests were made from 7th December, the date at which seed shattering was first apparent, until 2nd January, 1972.

Shattered seed was collected in tins at daily intervals.

Moisture content of the hand stripped seed was determined on a 10% sub-sample of the yield sample.

Yield of seed increased steadily from 7th December until 20th December. A sharp decline in yield occurred during the remaining period of sampling.

Average seed size of the harvested seed increased throughout the period of sampling as did the average size of shattered seed.

Germination tests completed (1 replicate only to date) indicate that there is little change during maturation, all tests exceeding 90%.

Germination tests on the shattered seed indicate that early shattered seed is of poor germination.

The moisture content at the point of maximum seed yield was about 48% on a wet basis.

#### 2.5 Studies on the Relative Seed Yield of Local and Foreign Herbage and Lawn Cultivars - E.D. Higgs, W.O. Coleman, J. Simons, M. Jongebloed

Forty-two cultivars were compared in two trials under irrigation in the Naracoorte district. The trials were established during June, 1971.

Results indicate that the majority of lawn seed varieties fail to produce seed in the year of establishment, and that very poor seed yields are produced in the year of establishment by red clover, all cultivars of cocksfoot, and white clover. Several cultivars of Phalaris tuberosa produced intermediate yields while all varieties of annual, Italian and perennial ryegrass produced yields approaching the best conceivable yields for these cultivars. These trials will be continued for several seasons.

#### 2.6 Development of a Research Self-propelled Pasture Establishment and Harvesting Machine - D.A. Saunders

Difficulties in rapidly re-establishing pastures is thought to be a major reason for the low level of pasture resowing undertaken by farmers in the high rainfall pasture zone of South Australia (20-40"). An experimental sowing machine in which standard commercial components of a number of leading drill manufacturers can be rapidly re-arranged in any desired combination has been built and tested.



The machine incorporates herbicide application equipment and can also apply several fertilisers simultaneously if so desired.

When fully developed it will also be capable of harvesting plots by means of a flail, reciprocating or cylinder mower as required.

The machine is transportable on a four wheel trailer towed by a heavy duty utility truck.

A field test to examine the capabilities of the machine was conducted in the winter of 1971. Further developments have taken place so that now this machine is capable of sowing comprehensive pasture establishment experiments at high speed. A wide array of establishment techniques can now be easily incorporated within one experiment.

#### 2.7 Investigations into the Charcoal Herbicide Establishment Technique - D.A. Saunders

The use of a band of activated charcoal to protect a row of seed from an application of the herbicide diuron (which controls all seedling weeds) was developed in Oregon and is now widely used to establish grass seed crops. The advantage of the technique is that the population of unwanted plants in a newly sown crop can be reduced to a level where the total removal of remaining weeds and other crop species is feasible using a spot spray technique. This allows grass seeds completely free of weed seeds and other crop seed to be produced within the first year from an autumn sowing.

Using the experimental sowing machine with a double disc opener followed by a rubber press wheel the feasibility of using this technique has been shown for a number of herbage and lawn grass cultivars. This was demonstrated in a series of experiments conducted at the Northfield Research Centre and on farmers' properties near Naracoorte.

#### 2.8 Laboratory Evaluation of a Range of Activated Charcoals - D.A. Saunders

There is a great array of activated charcoal available commercially. The price varies over a very wide range. The evaluation of charcoal in the field is time consuming and expensive, so a reliable laboratory technique is needed to reduce the cost of establishing the efficacy of a particular activated charcoal for adsorbing the herbicide, diuron.

A series of diuron formulations were shaken with a series of activated charcoals, the free diuron was then estimated using adsorption by ultra violet light.

These preliminary investigations indicate that good correlation can be obtained between field performance of a charcoal and its capacity to adsorb diuron in the laboratory.

## 2.9 Studies on the Efficiency of Fertiliser Feeding Stars - D.A. Saunders, D.J. Reuter

The evenness and accuracy of feed of superphosphate attained by three different makes of fertiliser stars was examined. Indications are that all fertiliser stars have a high degree of variability of output. This is due to changes in the rate of feed as the individual teeth move across the outlet. The order of variability is such that on light sandy soils toxic rates of fertiliser could be applied at the peak rate of feed, while insufficient amounts for maximum plant growth are applied at the lowest rate of feed. Where seed and fertiliser are placed in intimate contact it is conceivable that much of the poor establishment of pasture plants is due to uneven fertiliser feeding. With all stars examined the higher the speed of rotation the less variability in fertiliser feed rate. It is concluded that if there is a choice between low and high capacity stars to attain the desired overall rate of fertiliser, that the low capacity stars rotating at high speed will provide the best possible result.

## 2.10 Evaluation of Five Pasture Types in Terms of Liveweight Changes and Wool Production - P.R. Gibson

In many areas of South Australia existing pastures consist of sown subterranean clover plus volunteer annual species consisting of a variety of grasses and broad leaf plants. For many years there has been controversy as to whether further progress can be made in pasture productivity by the inclusion of a perennial grass cultivar. While many perennial grass cultivars have been recommended few have been subjected to critical assessment as far as animal performance on pasture containing them is concerned.

A trial was established on Kangaroo Island during the autumn of 1970 to compare an existing pasture of subterranean clover plus volunteer annuals with several sown grasses. Cultivars were Victorian and Medea perennial ryegrass, Siro 1146 hybrid phalaris and Wimmera annual ryegrass. The trial has been stocked since the beginning of 1971 with Merino wethers. Liveweights have been recorded at intervals which are more

frequent when bodyweights decline to critical levels. Pasture productivity and composition are being measured throughout the year. Animal production is measured both by bodyweight and seasonal wool production.

No conclusive results are available at this early stage of the experiment. To date animal production in the sown pastures has not substantially exceeded that on the pre-existing pasture over the twelve month period. Victorian perennial ryegrass and hybrid phalaris however, were both able to make considerable green growth during the summer of 1971-72, which was particularly wet in what is normally a well defined Mediterranean-type climate. This should significantly result in increased animal productivity during this period.

The trial will be continued for several more years.

2.11 Screening Annual Legumes for Resistance to Clover Scorch Caused by the Fungus *Kabatella caulivora* -  
E.J. Crawford, P. Beale, A. Dubé, J. Johnston

Subterranean clover dominant pastures, particularly on Kangaroo Island and to a lesser degree in the high rainfall districts of the Adelaide Hills and South East, have been seriously and increasingly affected by clover scorch in recent years. Glasshouse and field screening of the widest possible range of annual legume species and lines is being undertaken as rapidly as possible using stocks of seed from the comprehensive gene pool assiduously built up over the past decade or so.

To date there are few indications of immunity or substantial resistance to the disease in Trifolium species. Probably the best that can be hoped for will be a degree of tolerance although a large range of material remains to be investigated.

3. PLANT INTRODUCTION:

3.1 Indexing of Introduced Plants - E.J. Crawford

An index is maintained of seeds introduced into South Australia. This covers a very wide range of species, but particularly those which have been found most valuable in South Australia such as annual and perennial Medicago species, annual Trifolium species, particularly T. subterraneum.

Viable seed supplies of most introductions have been maintained for use in further evaluating introductions, for use in breeding programmes and for screening for particular problem diseases or pests and for exchange with other scientific institutions.

The index is maintained in close collaboration with C.S.I.R.O. Division of Plant Industry and the majority of introductions are also indexed under the CPI index. The total number of indexed lines is now 7,507.

### 3.2 Classification of Annual Species of Medicago - E.J. Crawford

The largest possible number of lines of annual Medicago are being progressively classified using 36 morphological and 22 agronomic characters. A total of 586 lines of medics were dealt with in the year under review. The total classified is now over 2,800 made up of about 2,000 introduced lines from which an additional 725 morphologically different lines have been isolated.

Within the 586 lines tested this year, 362 selections were made on varying morphological or agronomic characteristics. The most complex group was the M. polymorpha group with 293 selections. In the complete M. polymorpha group, 24% of the lines were of the sub-species brevispina, by far the majority originating from Chile.

Early flowering was also a feature of the Chilean material. Of the 343 lines from the main M. polymorpha group, 151 flowered earlier than Jemalong barrel medic, and of these 69 originated from Chile. Of these 69 lines, 35 also flowered earlier than Cyprus barrel medic.

Of the 73 main M. truncatula lines grown, only 15 were earlier flowering than Jemalong whilst 5 were earlier than Cyprus barrel medic.

Most M. intertexta lines were late flowering, only 9 of the 56 grown being earlier than Jemalong. However, all were very productive relative to Jemalong.

Of the 40 M. littoralis lines grown, only 5 were earlier flowering than Harbinger and none were as productive as Harbinger.

The remaining species with lesser entries showed little of outstanding promise, M. disciformis and M. praecox lines being substantially inferior to Jemalong.

Tests to compare changes in seed coat permeability were conducted on all lines with sufficient pod material over the summer-autumn period.

This data along with the 55,000 morphological and agronomic recordings made during the growing season is being prepared for computer storage and sorting and will be available to interested plant breeders and agronomists.

### 3.3 Sward Trial Evaluation of the M. rugosa Group - E.J. Crawford

Two trials were established to compare the relative establishment, seasonal herbage production, seed production, regeneration and subsequent winter production of 50 lines of M. rugosa with that of Paragosa gama medic, Borong and Jemalong barrel medics, one semi-commercialised line of M. polymorpha and Clare subterranean clover. These trials were established on:-

- \* A red brown earth at Parafield Plant Introduction Centre
- \* A self-mulching grey clay loam at Turretfield Research Centre.

Interim results are as follows:-

#### 3.3.1 Establishment

Establishment, although variable, was quite good. At Parafield, one M. rugosa accession established significantly better than the mean of the experiment whilst at Turretfield, four established better at the 5% level.

#### 3.3.2 Annual dry matter production

One sample was taken at the maximum growth stage in November. At Parafield, a selection, M. polymorpha emanating from near Maitland, was the only line to significantly exceed the mean yield of the experiment whilst at Turretfield six M. rugosa accessions exceeded the mean at the 5% level.

Of these six, four originated from Greece, one from Israel and one from Portugal.

#### 3.3.3 Seed production

Yields determined, but not analysed to date.

Natural regeneration and seasonal herbage production will be measured on both sites in 1972.

3.4 Final Testing & Release of Paravivo Lucerne -  
E.J. Crawford

In 1965 and 1966 trials were established at Parafield to compare the seasonal production and persistence of a selected line of lucerne with that exhibited by the winter growing cultivar, African. The line had been selected to maintain the good seedling vigour and good winter production characteristics of African.

In subsequent years the latter two characteristics were shown to be as good as or better than African. By 1970 the selection exhibited the ability to persist better than African (35.2 compared with 22.1 plants per M<sup>2</sup> respectively), and was ultimately registered under the cultivar name, Paravivo, in March, 1971.

Percentage Dry Matter Yield Relative to Hunter River  
(5 year mean)

Cultivar	Autumn	Winter	Spring	Summer
Paravivo	14.3	38.3	15.1	24.3
African	-7.6	0.9	-8.6	18.5

The absolute 5 year mean dry matter production of Paravivo was 6,350 kilograms per hectare or 84% of the total production, whilst that of African was 5,200 kilograms per hectare (75%) and Hunter River 5,220 kilograms per hectare (74%).

3.5 Pilot Trials with an Early Genotype of Medicago truncatula - E.J. Crawford

Extending the limits of annual medics in low rainfall areas is controlled by adequate seed production associated with which is earliness of flowering.

The remaining four species, although grown in previous years, contained lines not previously grown, viz. recent introductions, and selections made from the previous years' lines. These included:-

<u>M. littoralis</u>	40 lines
<u>M. rugosa</u>	9 lines
<u>M. tornata</u>	18 lines
<u>M. truncatula</u>	73 lines

The annual medic collection has revealed one line of M. truncatula which flowers within 9-10 weeks of germination in the Parafield environment.

Small pilot trials comparing this accession with Cyprus or Jemalong barrel medic and Harbinger strand medic have been established in low rainfall areas of Upper Eyre Peninsula.

Interim results are as follows:-

At the four sites established in 1971 the early flowering accession was more vigorous and seeded more prolifically than the controls. However, because of the degree of impermeability of the seed, natural regeneration was inferior in 1972. Further sowings are planned.

### 3.6 Over Summer Hard Seed Changes in Annual Medicago - E.J. Crawford

Each year whenever there are adequate supplies of seed pods from the introduction rows the progressive changes in seed coat permeability are recorded from December until the onset of the autumn rains, usually in May. The majority of medic seed produced at Parafield Plant Introduction Centre approaches 100% impermeable seed soon after maturation and generally does not decline below 90% at the time of the commencement of the autumn rains. Many lines remain close to 100% throughout this period.

In an attempt to find which of the pods produce the permeable seed and which seed within the pod is permeable, flowers produced at various times during the flowering period were labelled and their pods afterwards examined. The results indicate that the most rapid increase in permeable seed occurred from pods which matured rapidly and were set towards the end of flowering. The proximal seed in pods contributed by far the majority of the permeable seeds with successively distant seeds contributing less and less, those more than four from the proximal seed rarely germinated.

#### 4. PLANT BREEDING:

##### 4.1 Annual Medicago Breeding - M.J. Mathison

Improvements are being sought in winter herbage yield, seed and burr yield, re-establishment and wide adaptability to important wheat belt environments. During the year under review, assessments are being made at sites selected as representative of the great majority of wheat belt environments of South Australia. About 250 introduced lines of M. truncatula, 50 lines of M. rugosa and 50 bulked F3 hybrid populations of M. truncatula are being assessed. This study of M. rugosa complements the plant introduction investigation at Parafield and Turretfield. A total of about 6,000 small swards of these lines was established during 1971. Useful variability is indicated in each of the attributes considered important. In particular, a source of material for greatly improved re-establishment has now been detected.

##### 4.2 Screening Annual Medicago Species for Resistance to Adult Sitona humeralis - M.J. Mathison

The annual medic breeding programme was conceived prior to the discovery of Sitona humeralis in South Australia. This insect has rapidly built up to be a major pest of annual and perennial Medicago. A systematic search of the entire Medicago collection is now being undertaken in an endeavour to find material resistant to the adult sitona. It is realised that resistance is an essential attribute to good performance of a selection.

Large numbers of adult sitona are allowed to feed on recently germinated seedlings of Medicago, and plants which are less attractive to sitona are identified. Only a fraction of the total available Medicago lines have been examined to date. No significant resistance has been found yet in Medicago truncatula, but it appears to be present in some lines of M. rugosa and some lines of M. scutellata.

##### 4.3 Studies in the Effect of Fluctuating Temperatures on Changes of Hard Seed of Medic Cultivars - M.J. Mathison

The effectiveness of fluctuating temperatures (a treatment of one month of daily 15°C to 60°C fluctuations) as a means of transforming water impermeable seed coats of annual medics into permeable ones has been examined by several Australian investigators.



Claims that fluctuating temperatures greatly reduce the percentage of impermeable seed have not been upheld by these trials.

It has been demonstrated that the discrepancies are due to the different techniques used. When fluctuating temperatures have reduced the percentage of impermeable seed the seed was derived from commercial samples by fractionation.

These trials used seed gently removed from the pod. Under these circumstances fluctuating temperatures had little effect on seed coat permeability.

It is therefore concluded that the results reported from interstate were the result of threshing the seed and not fluctuating temperatures.

#### 4.4 Breeding of Lucerne - I.D. Kaehne

##### 4.4.1 Lucerne introduction programme

The lucerne collection programme has expanded during 1971-72 to include 957 introductions from 38 countries representing 16 species of perennial Medicago. From this material approximately 500 lines have been passed through quarantine for use in attaining the various objectives of the lucerne breeding programme.

##### 4.4.2 Selections of lucerne for adaptation to waterlogged and poorly drained soils

Populations of lucerne having a reputation for flooding tolerance have been crossed with high yielding varieties adapted to South Australia in preparation for multiplication and comparative trials of parents and hybrids.

##### 4.4.3 Selection of lucerne for persistence under continuous grazing

Selected introductions representing 45 geographic populations of perennial Medicago have been crossed with high yielding hay type lucernes in preparation for multiplication to compare the 45 groups with hay lucernes and their hybrids under continuous grazing.

##### 4.4.4 Selection of lucerne for higher yield and persistence

Introductions which have strong expression of yield, persistence, disease resistance and seed yield, are

being multiplied and hybridised in preparation for multiplication and comparative sward trials with commercial varieties in a range of environments.

#### 4.5 Screening Lucerne Cultivars for Waterlogging Tolerance - I.D. Kaehne

Eight varieties of lucerne were grown in pots in the glasshouse in three soils; a Rendzina, a solonized solonetz and an ironstone gravel. They were then subjected to waterlogging for varying periods by placing the pots in a water bath which brought the free water level in the pots to slightly above soil surface.

All varieties survived ten days of this treatment. Pots subjected to twenty days of waterlogging caused the death of all Demnat and African plants and some Hunter River plants.

Forty days of treatment resulted in death of the remaining Hunter River plants and all plants of Du Puit. Two introductions from Russia, "Rhizoma" and "Narangansett" survived 40 days of inundation suggesting that there are possibilities for breeding for waterlogging tolerance.

#### 4.6 Studies on the Resistance of Lucerne to Sitona Weevil Feeding - I.D. Kaehne

Twenty-four varieties of lucerne (17 introductions and 7 Australian varieties), were subjected to feeding by adult sitona weevils. Three plants, one each from the three varieties Kanza, Rhizoma and Hunter River, were partially tolerant to feeding. This work will be continued.

#### 4.7 Perennial Grass Breeding Programme - G. Lawton

This programme was initiated to exploit the genetic variation within the species Lolium perenne L. (perennial ryegrass) and Festuca arundinaceae (tall fescue) in the hope of increasing pasture productivity in the higher rainfall and irrigated areas of the State, particularly in situations to which lucerne is poorly adapted because of winter wetness.

##### 4.7.1 General objectives

- \* Yield potential assessment of Festuca arundinacea introductions

- \* Hybridisation between and within the two basic sources of material of tall fescue, i.e. Mediterranean origin and north European and U.S.A. origins; to develop a variety whose seasonal growth pattern more closely matches the requirements of the grazing animal, with special emphasis on winter productivity and responsiveness to summer rains
- \* Forage yield assessment of Lolium perenne introductions to evaluate material for use as direct introductions, or as potential parents in a breeding programme.

A comprehensive collection of local and overseas lines of both species has been made. Through the co-operation of the C.S.I.R.O. Department of Plant Industry, it has been possible to obtain over 180 seed samples of natural ecotypes of tall fescue which were collected in the past from important Mediterranean and European areas. Also about 20 commercial cultivars of tall fescue and 80 of perennial ryegrass have been obtained in response to personal requests made to overseas breeders. These lines are now being grown at Northfield Research Laboratories for seed production to enable small swards to be established in appropriate areas of South Australia during 1973.

##### 5. PUBLICATIONS:

- Beale, P.E. & Crawford, E.J. - "Preliminary Investigations with Several Annual Trifolium Species on Kangaroo Island". South Australia Journal of Experimental Agriculture and Animal Husbandry.
- Higgs, E.D. (1971) - "Investigations into Seed Production, Marketing and Other Matters in Europe and the U.S.A." Agronomy Branch Report No. 34.
- Higgs, E.D. (1971) - Report on the Annual Meeting of the O.E.C.D. Certification Schemes held in Paris, 29th March -1st April, 1971 and the subsequent visits to the seed certification facilities at Versailles, France and Cambridge, England. Report submitted to the Co-ordinating Committee for Seed Certification and received at meeting of Committee held 25th-27th October, 1971, 16 pp., 8 appendices.

Cocks, P.S. & Donald, C.M. - "The Germination and Establishment of Two Annual Pasture Grasses (Hordeum leporinum, Link and Lolium rigidum Bard)". Australian Journal of Agricultural Research.

Mathison, M.J. - "Seed Coat Permeability in Wild and Domesticated Annual Medicago". Master of Agricultural Science thesis, University of Adelaide, June, 1972.

PLANT PATHOLOGY SECTION

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PLANT PATHOLOGY SECTION

1. ACTIVITIES OF THE SECTION:

During August, 1971, Dr. Banyer, who had directed the plant pathology research and services within the Agronomy Branch, resigned. Dr. Dubé was appointed as Section Leader in the following October and he has had the difficult task of re-organising the Section with almost entirely new staff.

Increased emphasis has been given to the work of this Section, particularly in view of the clover leaf scorch (Kabatiella caulivora) problem which threatens the productivity of legume based pastures over large areas of the State. At the beginning of 1972, Miss Johnsson was appointed to the staff to work on this problem.

Mrs. Rix also joined the Section during the year to assist with the laboratory and field work.

The Section has instituted discussion groups which are held at monthly intervals and are designed to exchange information with other research officers in the Department and at the Waite Agricultural Research Institute.

Other developments in the Section have been the establishment of a reprint collection, an herbarium and a culture collection of all the economic agronomic diseases in South Australia. These collections are being made with the aim of making the Plant Pathology Section a useful resource centre for information on agronomic plant pathology.

The Section has continued to enjoy the excellent laboratory facilities rented from the Waite Agricultural Research Institute. The close association of the Section with the staff of the Plant Pathology Department of the Institute has been most valuable in this formative year.

2. RESEARCH:

2.1 Rust of Skeleton Weed (Puccinia chondrillina) -  
A. Dubé

Studies on the over summer survival of the rust spores were commenced during January, 1972 at Karoonda and Parilla. The viability of spores on old infected stems decreased from 44% in January to 17% in March. However, the unusually high rainfall in February produced a new emergence of rosettes;

the first infection of which was observed at Parilla in early March. During April it was observed, by the development of rust pustules on newly emerged rosettes, that the rust had spread widely throughout the Mallee areas. Studies of the over summer survival of the rust will therefore be continued in the 1972-73 summer. Studies will also be made, under South Australian winter field conditions, of the time required from infection to first pustule formation. This information will allow some estimation of the rate of generation development of the rust in South Australia, and help to complete our knowledge on its biology.

## 2.2 Cereal Cyst Nematode on Barley (*Heterodera avenae*) - A. Dubé

In 1970, 500 barley varieties were tested in the field for resistance to cereal cyst nematode; of these varieties 20 were chosen for further testing.

In 1971 these varieties were tested at three sites, Urania, Mt. Hope and Crystal Brook. Assessment was made by counting the number of cysts in a 500 gram sample in the row of the particular variety. From this field assessment and also because of their origin, four varieties have been chosen to be exhaustively tested in the laboratory for resistance. These tests will possibly allow determination of the mechanisms of resistance.

Studies on the effect of rotations of different cereals on the population of cereal cyst nematode in the soil, were assessed again by cyst counts. The results showed that the cyst population was probably dependent upon the particular crop growing that season rather than what was sown in the season before. A resistant barley had fewer cysts per 500 gram of soil than Clipper, but the number of cysts in a particular treatment was simply a reflection of the susceptibility of the crop sown, e.g. barley had fewer cysts than wheat which had fewer cysts than oats.

## 2.3 Leaf Scald of Barley (*Rhynchosporium secalis*) - A. Mayfield

This project, on one of the most important leaf pathogens of barley in South Australia, commenced in 1971. There are two main sections of the project. They are:-

- \* The assessment of the effect of leaf scald on the yield and quality of barley. This is a field experiment in which disease levels will be controlled by the use of different fungicide spray programmes, and disease levels will be linked with yields. In 1973 this experiment will be extended to form a basis for field surveys on the economic importance of barley leaf diseases in South Australia.
- \* The relative importance of sources of primary inoculum in the infection of a barley crop.

Studies on the ability of R. secalis to survive over summer commenced in December, 1971. Infected barley and barley grass were placed in the field at six sites (Aldinga, Arthurton, Karoonda, Cleve, Parndana and the Waite Agricultural Research Institute). Samples were taken every three weeks for seven months and then at three-monthly intervals. The ability of the fungus to sporulate has decreased but after seven months in the field it is still capable of infecting barley seedlings. Laboratory and field experiments will be conducted to determine the factors which reduce the amount of fungus surviving over summer.

#### 2.4 Clover Leaf Scorch (Kabatiella caulivora) - Miss Johnsson

Prior to Miss Johnsson joining the Section, Mr. Mayfield supervised a survey of Kabatiella on Kangaroo Island. The survey was conducted by the staff at the Department of Agriculture Research Station at Parndana. Forty properties were chosen at random, of these 39 had Kabatiella. Little information was gleaned from farmers on the effects of cultural practices on disease severity, because of the inadequate records kept by many of them.

The research project Miss Johnsson has commenced is in its early stages, however a literature review has been completed. In January, 1972 Kabatiella was isolated from 6 week old Trifolium subterraneum cv. Yarloop plants from Kangaroo Island. This isolate has been shown to be pathogenic on Yarloop grown in growth cabinets. The fungus has been successfully grown in liquid culture and under these conditions it sporulates profusely. These cultures have been used for inoculation of plants for (1) the accumulation of infected plant debris for survival studies, and (2) resistance screening experiments.

An experiment for screening a collection of Trifoliums and other legumes was completed successfully. Of



375 lines, 146 were susceptible to the Kangaroo Island isolate. The remaining 229 lines will be rechecked for resistance in another experiment. Screening of other Trifolium collections will be carried out in future, as an attempt to find genetic resistance that could be used in future plant breeding programmes. Studies on the epidemiology of the disease in the field will be conducted in September and October of 1972. Ground surveys will be supplemented by aerial and satellite photographs. Studies on the over summer survival of the organism will be initiated in December, 1972.

2.5 Annual Ryegrass Toxicity (a combination of a nematode (Anguina sp.) and a bacterium (Corynebacterium ap.) - A. Dubé

The Plant Pathology Section was involved in assessing the results of the survey prepared by A. Michelmore (District Agricultural Adviser) and Mr. P. Price (post-graduate student). Little useful information was obtained from the survey because of the inadequate records kept by most farmers. However, from this survey and Mr. Price's research we were able to design a field experiment to test the effects of the various cultural practices on the ryegrass toxicity. The management practices being assessed were hard grazing, long fallow, use of herbicides, e.g. paraquat, and burning in late spring; all these practices being attempts to prevent seed head formation on the Wimmera ryegrass. Seed head formation is essential for the development of the nematode galls. These practices are an attempt to markedly reduce the nematode population and hence the transmission of the bacterium is also reduced or prevented.

2.6 Bunt of Wheat (Tilletia foetida) and Covered Smut of Barley and Oats (Ustilago hordei) - A. Dubé & P. Chu

2.6.1 Field experiments

These are being done in association with the Cereal Section. The experiments on the control of fungicides of bunt of wheat, and smut of barley and oats are designed to determine dosage response curves. The description of these curves will allow this Section to recommend the cheapest and safest level of fungicide the farmer can use. After a visit to Mr. L. Jones, Senior Plant Pathologist at the Victorian Wheat Research Institute, it was decided that he would screen all bunticides of wheat. The S.A. Department of Agriculture would screen all smuticides for the control of Ustilago hordei on barley.

## 2.6.2 Laboratory experiments

There have been two main sections of work.

- \* In vitro testing of bunticides and smuticides. A method of rapidly "in vitro" testing the efficacy of bunticides and smuticides has been used to test all the most promising fungicides. Further testing will be done on some fungicides to determine their modes of action.
- \* The determination of the effects of new fungicides on different South Australian isolates of Ustilago hordei. The Australian Barley Board in South Australia has supplied the Section with 44 samples taken from smutted loads of barley, which were rejected by the Board. The distribution of the farms from which the smutted barley came was not confined to any particular area in the State, it was State-wide. Unfortunately none of the isolates germinated so no testing could be done this year.

## 3. SERVICES:

### 3.1 Disease Identification

Ninety-two specimens were identified during the year 1971-72. Some new recordings were made for diseases on particular hosts in South Australia. Sclerotinia sclerotiorum, a soft rot of stems, was observed on lupins from the south east of South Australia. Leptosphaeria naamani, "spring dead spot" of turf, was identified on a specimen from the Holdfast Bowling Club green. A rust, Uromyces anthyllidis, was identified on Medicago minima from Parafield.

### 3.2 Bunt and Smut Testing

Seven samples of bunt (Tilletia foetida) were forwarded to the laboratory for hexachlorbenzene resistance testing; no resistance was detected. Fourteen bunt viability tests were conducted for Alf Hannaford & Co. to assist with their experimentation on bunticides. Attempts to freeze dry spores as a method of storing and retaining bunt spores at a high viability failed.

### 3.3 Extension Services

Replies were prepared for the following topics:-

- \* From the Australian Wheat Board, "the problems of feeding bunted cereal to livestock".

- \* From P. Fairbrother (District Agricultural Adviser) on (1) "the percentage sclerotes in lupin seed and its effect on livestock", and (2) "the grazing of Demeter fescue infected with ergot Claviceps purpurea".
- \* From T. Davidson on "the grass hosts of Gaumanomyces graminis".

#### 3.4 Quarantine

Seed of Trifolium fragiferum were tested in an attempt to find hyphae of "black patch" disease. Two samples of perennial ryegrass were tested for "blind seed" disease (Gloeotinia temulenta). A reply was made to a request by the Chief Quarantine Officer in South Australia on the position of outbreaks of bacterial wilt in Victoria and the susceptibility of Hunter River lucerne to this disease. Cultures of rhizobia for Sulla (Hedysarum coronarium) were also tested for effective nodulation and the absence of pathogens.

#### 4. VISITORS:

The following are the people who visited the Section:-

Mr. N. Gryll (Virologist, C.S.I.R.O. Division of Plant Industry)  
Dr. R. Boyd (Plant Breeder, Western Australian Institute of Agriculture),  
Mr. T. Kellock (Plant Pathologist, Victorian Department of Agriculture),  
Miss B. Hollingdale (Plant Breeder, Wheat Research Institute, Wagga).

#### 5. CONFERENCES:

In March Dr. Dubé attended the ad hoc meeting of Plant pathologists in Canberra called by the Department of Primary Industry. This meeting considered the efficacy of replacement fungicides for hexachlorbenzene and organomercurial compounds as cereal seed dressings. In May Dr. Dubé and Mr. Heard visited Mr. L. Jones, Senior Plant Pathologist at the Victorian Wheat Research Institute, to discuss the integration of research programmes on bunticides and smuticides.

The Section was represented at two Agricultural Bureau Conferences, one at Blyth and the other at the Murray Lands West Conference. The papers presented were on "Haydie" and "The Replacement of Organomercurial Seed Dressings". A prepared reply was made for the Yorke Peninsula Conference on "do the new pickles control loose smut". At the annual Agronomy Branch Conference Miss Johnsson gave a paper on

"Kabatiella". During this conference the Branch visited the Waite Institute and inspected a display of agronomic diseases prepared by this Section.

6. PUBLICATIONS:

- Banyer, R.J. & Fisher, J.M. (1971) - "Seasonal Variation in Hatching of Eggs of Heterodera avenae". Nematologica 17: 225-236.
- Banyer, R.J. & Fisher, J.M. (1971) - "Effect of Temperature on Hatching of Eggs of Heterodera avenae". Nematologica 17: 519-534.
- Banyer, R.J. & Fisher, J.M. (1972) - "Motility in Relation to hatching of eggs of Heterodera avenae". Nematologica 18: 18-24.

SEED PRODUCTION SECTION

SECTION LEADER:

Mr. D.C. Ragless

EXTENSION OFFICERS:

Naracoorte Office:

Mr. W.O. Coleman, R.D.A.

Mr. M.C. Jongebloed

Mr. I. Simons

Adelaide Office:

Mr. T.R. Usher, R.D.A.

Mr. G.E. Cooper

ASSISTANT:

Mrs. D.E. Rattray

SEED PRODUCTION SECTION

1. SECTION ACTIVITIES:

This group provides a technical advisory service to growers, harvesters, processors and marketers of herbage seeds.

To enable meaningful, up to date advice to be given, it is necessary for the group to research scientific literature, conduct fact finding surveys and field trials and employ routine laboratory testing.

Development and implementation of scientifically sound, commercially practicable certification schemes for producing and identifying herbage, vegetable and fodder seeds of high genetic quality, is also an important facet of the work of this Section.

The services provided by this Section go beyond the boundaries of South Australia. A yield prospect reporting service on behalf of overseas firms multiplying seed in South Australia is provided. Certification of fodder seeds is undertaken in South Australia on behalf of the British Certification Scheme and the Section participates in the O.E.C.D. and E.E.C. International Certification Schemes.

2. RESEARCH:

2.1 Kale - Time of Sowing, Seeding Rate, Row Spacing and N Interactions - M.C. Jongebloed

To determine the latest date that Stabil cultivar of kale could be sown to obtain high seed yields, a trial was laid down near Naracoorte with six sowing times spread over five months. Also incorporated to investigate probable interactions were three row widths, four seeding rates and three rates of nitrogen fertiliser.

Results indicate 2-3 lbs. of seed in 7" rows should be sown by the end of January for top yields. Good yields may be obtained with sowings up until the end of February provided ample nitrogen fertiliser is applied.

## 2.2 The Long Term Effects of Lucerne Scarification - D.C. Ragless

Much lucerne seed is scarified following harvest to reduce hardseededness. This project is designed to determine long term effects of commercial scarification on lucerne seed germination.

## 2.3 Seed Sampling Methods - D.C. Ragless

Few, if any, commercial pasture seed lines or batches are homogenous. Thus variability poses problems in obtaining representative samples. This project is designed to establish accuracy of various sampling techniques for known variabilities.

## 2.4 Effects of Moisture Content at Harvest on the Variability of Phalaris tuberosa - D.C. Ragless

Low viability of much commercially available Phalaris seed has been considered to be due to seed being harvested at too high a moisture content.

This project will determine the correlation (if any) between moisture content at harvest and germination of commercially harvested Phalaris tuberosa.

## 2.5 The Practicability of an Automatic System of Sample Collection for Seed Certification Schemes - D.C. Ragless

Pasture seed sampling by hand is time consuming and can be influenced by subjective assessments by the person sampling. Automatic sampling by machine should be time saving, reliable, accurate and less costly. However, most automatic designs are either very costly or poorly designed and inaccurate.

This project is investigating the use and accuracy of a low cost, simple automatic sampler suitable for unattended use in seed certification schemes.

## 2.6 Identification of Cultivars of Pasture Species by Morphological Differences - T.R. Usher

Documentation of the identifying characters of annual legumes by means of colour photography is the main aim of this programme. A secondary aim is to determine the optimum stage

of growth, in different seasons, for development of marker characters of various annual legume cultivars.

2.7 Development of New Certification Procedures -  
D.C. Ragless

The need to include additional herbage, vegetable and fodder crop cultivars in certification schemes necessitated a programme to develop new procedures to cater for these crops. Schemes designed to fulfil local domestic needs and those of O.E.C.D. and E.E.C. International Schemes have been developed and implemented.

2.8 Geranium Control (*Erodium* spp.) in Pastures  
at Kybybolite - W.O. Coleman

Field demonstrations have been laid down showing the applicability of herbicides, grazing management and pasture resowing to aid control of geranium (*Erodium* spp.) in pastures.

2.9 Weed Control, Purple Clover (*T. purpureum*) -  
M.C. Jongebloed

Six post-emergent herbicides are being tested at different dose rates in a seed crop near Mt. Gambier to test effects upon seed yields of the crop and effectiveness of control of unwanted plant growth.

2.10 Weed Control in Du Puits Lucerne (*M. sativa*) -  
W.O. Coleman

A new herbicide is under test for control of sorrel (*Rumex* spp.) in a lucerne seed crop near Naracoorte and to test its effect upon seed yields.

2.11 Weed Control in Shaftal Clover (*T. resupinatum*) -  
W.O. Coleman

Four post-emergent herbicides were applied at various dose rates to plots in two commercial crops in the South East to test effects on seed yields and effectiveness of weed control.

3. EXTENSION:

The Seed Production Section has continued to give a highly specialised technical extension service to the small seed industry in South Australia.



Not only have officers serviced the growers with general agronomic advice and market trends, but harvesters and processors, merchants and overseas consumers have also been involved in the extension programmes. For example, seed processors have been given technical advice on sampling, seed separation and scarification, while merchants have been assisted with quality, identification and packaging problems.

A summary of the extension activities of the Section has been listed below.

### 3.1 Field Days

The following four field days were organised during 1971-72:-

- \* Charcoal banding (Naracoorte)
- \* Pasture deterioration (Kybybolite)
- \* Skeleton weed (Naracoorte)
- \* Herbicides for Maral Shaftal (Keppoch)

### 3.2 Agricultural Bureau Conferences & Meetings

Nine meetings were attended.

### 3.3 Mass Media

T.V. programmes	2
Radio talks	6
Press releases	12

### 3.4 Industry Conferences

During the year under review officers from the Section participated in conferences held by the Seed Industry Association, the Seed Merchants' Association, the Seed Co-operative and the South Australian Seed Growers' Association.

### 3.5 Property Visits

Two hundred and eighty-three properties were visited to give extension advice as distinct from the regulatory services associated with seed certification procedures which are listed below.

Thirty-six visits were made to seed firms on general extension work.

4. REGULATORY INSPECTIONS:

The seed certification scheme requires high standards to be set both in the paddocks growing the seed and in the processing plants and the laboratory after the seed is harvested. To maintain these necessary standards, officers make regular field inspections for noxious weeds and to ensure genetic purity. Machinery is also inspected and bags of seed sealed and samples taken.

Details of the inspections made during 1971-72 have been outlined in the following table:-

Inspection	Farms	Merchants' Seed Warehouse
Seed certification	887	32
Weeds Act	1	1
Seeds Act	1	2
Orange International Certificates, sampling, sealing	2	23
Lucerne cube inspection	-	1

5. DIAGNOSTIC SERVICES:

With help from specialists within other sections of the Branch, seed production officers have continued to provide the industry with a weed, insect, disease and seed identification service which is essential for efficient seed production. The extent of this service has been tabled below.

Service	No. of Specimens
Weed identification	70
Insect identification	42
Disease identification	27
Seed identification	25
Total	164

6. STAFF:

During the year there were no staff changes within the Section. This has enabled the Section to work productively and maintain a high standard.

In-service training continued. Officers within the Section attended 13 training schools, mostly associated with learning new extension methods and farm management practices. All members of the Section also attended special field training courses on O.E.C.D. methods.

Mr. Ragless was invited to lecture at the "International Training School on Seed Certification and Improvement" which was organised by the Federal Government in Melbourne.

7. PUBLICATIONS:

The following extension articles and special reports were published during 1971-72:-

"Sunflower Seed Production", special bulletin.

"Harvesting of Temperate Pasture Species", paper published by Mr. D.C. Ragless for the International Seed Certification and Improvement Course, Melbourne.

"Noxious Weeds in Pasture Seeds", paper published by Mr. D.C. Ragless in the proceedings of the third meeting of the noxious weeds committees of Victoria, New South Wales and South Australia.

"Multiplication of Seed for Export", Agronomy Branch Conference, D.C. Ragless.

"Report on the Use of Basic Seed", paper prepared for the Seed Certification Advisory Committee by D.C. Ragless.

"Rules for the Production of Certified Seed", special bulletin, Department of Agriculture.

"Seasonal Seed Report", Agronomy Branch Report No. 26.

"Survey of the Hunter River Cultivar of Lucerne to Determine the Practicability of its Australian Certification as a Local Cultivar", paper prepared by D.C. Ragless for the Seed Certification Co-ordinating Committee.

"Annual Seed Certification Statistical Report".

"Individual Grower Performance Report".

Throughout the year the Section has continued to issue the monthly newsletter to the Seed Industry.

WEED SCIENCE SECTION

SECTION LEADER:

Mr. G.B. Baldwin, B.Sc., R.D.A.

RESEARCH OFFICERS:

Mr. M.J. Catt, B.Sc.

Mr. L.T. Jacobs, R.D.A., Dip. For. (Canberra)

EXTENSION OFFICERS:

Mr. J.A. Dickinson, N.D.A. (U.K.), M.R.A.C.

Mr. J.M. O'Neil, R.D.A.

Mr. K.R. Smith, W.D.A.

Two vacant positions

REGULATORY OFFICERS:

Mr. C.R. Alcock, R.D.A., H.D.D.

Mr. S.J. Garrick

Mr. A.W. Lewis

ASSISTANTS:

Mr. D.C. Carter

Mr. L.B. Hoff

WEED SCIENCE SECTION

1. SECTION ACTIVITIES:

During the period under review the Weed Science Section has gradually rebuilt its strength after the resignation of five field officers over a period of eighteen months, which left the Section without any representation at country centres. Technical services have therefore been greatly curtailed but it has been possible to keep essential work going by calling upon regulatory officers and field assistants to do work normally the responsibility of extension staff.

The Weed Science Section provides a weed information service involving plant identification and weed control information to the general public and the agricultural community.

It is also responsible for the surveying, recording and mapping of noxious weed infestations within the State.

Information on the identification of individual weeds and their control, and on the use of herbicides is continually being produced, up-dated and distributed to interested parties. The regular publications such as "Herbicide Recommendations" and the "Cereal Weed Spraying Chart" have been maintained.

Officers also lecture at Agricultural Bureau conferences, field days, Bureau meetings and Rural Youth meetings.

The Weed Science Section provides a weed control liaison service to 97 district councils, 22 city councils and 18 town councils in South Australia. Associated with this work is the control of subsidy claims for the salaries of local government weeds officers and for weed control on unoccupied Crown lands and half roadsides adjoining.

The Section is responsible for providing an inspection service at stock markets for Noogoora burr, and for inspecting areas for noxious weeds outside of local government areas. The Section spray unit is used in some of these areas.

The Section is also responsible for supervising the control of African daisy in the National Park areas of the Adelaide Hills.

Increasing attention has been given to the registration of herbicides in conjunction with the Technical Committee on Agricultural Chemicals. This work is endeavouring to ensure the safe use of these agricultural chemicals.

The research group has gradually diminished in strength from five research officers to three as industry funds have become more restricted during the past two years. The skeleton weed research work which was co-ordinated throughout southern Australia by the Technical Sub-committee on Skeleton Weed Research for a period of eleven years has been finalised in the current year, except for the continued support being given to the biological control programme. The cereal weed control programme has also been finalised.

Three research officers are currently attached to the Weed Science Section. One of these is responsible for weeds research in agronomic crops, the specific perennial weeds, skeleton weed and silver leaf nightshade.

Another is responsible for research into the factors influencing the germination of weed seeds, pasture weed control and weed control research into seed crops.

The third is concentrating on the control of Eucalypt growth and long term residual control of vegetation for bush-fire prevention.

There is a need for an extra officer to research the control of proclaimed weeds, and additional laboratory and field staff to support the group. This need will become more evident when the weeds glasshouse complex is completed in August, 1973, if it is to be used to the best advantage.

## 2. EXTENSION:

### 2.1 Identification & Information Service

Some 800 personal enquiries involving weed identification and control were handled by Head Office staff (3 per day). Three hundred and fifty letters were despatched to persons enquiring by mail. There is no record of the large number of telephone enquiries received.

Enquiries of all types average approximately 10 per day.

## 2.2 Mapping & Surveying

Considerable time was spent by officers of the group preparing to map noxious weed infestations, using a computer. Programming the machine and coding the various areas of South Australia has been completed. If this system is successful it will be the first time the technique has been used in Australia as an aid to weed control extension programmes.

## 2.3 Bureau Meetings, Conferences & Field Days

During the year under review Weed Science Section officers addressed 23 Agricultural Bureaux and conferences and organised 7 field days. Two special radio talks were also given.

The main themes discussed in these mass media programmes were the biological control of skeleton weed, cereal weed control, soursob control and "off-target" damage by 2,4-D to sensitive crops such as tomatoes and vines.

Nine special press releases were also issued during the year.

## 2.4 Off-target Damage Programme

Officers of the Section were involved in farm visits and meetings during May and June, 1972, in the South East of the State to emphasise the dangers of "off-target" damage and publicise the alternative, low volatile herbicide recommendations issued by the Department.

## 2.5 Displays

The first of a series of Schedule I noxious weeds went on display at the S.A. Museum in June, 1972. This was organised by Museum staff in co-operation with the Weed Science Section.

## 3. REGULATORY SERVICES:

### 3.1 Liaison with Local Government

During 1971-72, despite serious staff shortages, the Section was able to service local government authorities with 58 visits to train and co-ordinate the work of their inspectors and attend 18 council meetings to help with policy decisions. Eight other special meetings to assist weed



control boards and to deal with specific weed problems were also held.

It is also important to note that the Section serviced farmer organisations at an increasing level during the year. Sixteen meetings were held with noxious weed sub-committees of the United Farmers & Graziers and the Stock-owners' Association and other similar organisations.

### 3.2 Subsidies

Eighty-four councils made claims for subsidies during 1971-72 for weed control on unoccupied Crown land and half roadsides adjoining. Payments made to councils totalled \$45,600.

This was a reduction of \$3,100 from the previous year due to a cut back in Government monies available for this work.

Seventy councils, employing 52 approved weed control officers, received salary subsidy payments totalling \$59,800. This amount was payed during 1971-72 but relates to the work done by these officers in the financial year 1970-71.

### 3.3 Inspection Services - Noxious Weeds

During 1971-72, forty-three stock market inspections were made to check for livestock carrying Noogoora burr and other serious weeds.

One hundred and fifty horses bound for Western Australia were also inspected on behalf of that Government.

Additional details of the market inspections are included below:-

Yelta market (Victoria)	10
Abattoirs market (S.A.)	32
Paringa market (S.A.)	<u>1</u>
	<u>43</u>

A total of 367,000 sheep and 27,000 cattle passed through these markets; no Noogoora burr infested stock were found. Negotiations to have the Victorian authorities share the inspection service with South Australia for the Yelta market have begun.

### 3.3.1 Areas outside of local government

- \* Northern - Three inspections of Yadlamalka Station were made during the year for Noogoora burr. Scattered plants were removed by the owner.

An inspection of northern areas known to contain Mesquite was made.

- \* North eastern - The yearly inspection of the north eastern properties and known outbreaks of Noogoora burr was completed in March, 1972.

### 3.4 Weeds Section Spray Unit

A modern four-wheel drive spray unit is operated by the Section to deal with serious infestations of weeds which cannot be efficiently dealt with by local government or which occur in pastoral areas outside of local government areas.

A total of eight man weeks was spent on the following projects:-

- \* Four man weeks were spent spraying 50 miles of the Nundroo stock route for saffron thistle and horehound.
- \* Two man weeks were spent treating noxious weeds on roadsides outside of the District Council areas of Kimba and Franklin Harbour.
- \* One man week was spent spraying salvation jane near the S.A.-Victorian border at Paringa.
- \* One man week was spent treating mesquite in the northern area.

### 3.5 African Daisy - Adelaide Hills

During October to December, 1971, Weed Science Section staff supervised the contract spraying of the Cleland National Park and organised the use of 10 prisoners from the Adelaide Gaol who hand pulled African daisy in the National Park areas.

The total expenditure on this work was approximately \$7,300.

### 3.6 Conferences

The following three important conferences dealing with regulatory aspects of weed control were held during the year:-

- \* The fourth Local Government Weed Control Officers' Conference. This biennial Conference was held in April, 1972. Ninety-eight council representatives attended.
- \* A conference of New South Wales, Victorian and South Australian noxious weeds committees met in Mt. Gambier in April, 1972.
- \* The Section organised the South Eastern Regional Weeds Officers' Conference.

### 3.7 Registration & Clearances of Herbicides

The work involved to maintain a high standard of safety for the use of herbicides has continued as a high priority function of the Section during the year. Sixty-four new herbicide labels and 12 amended labels were examined for approval under the South Australian Agricultural Chemicals Act. Eight clearances were also assessed for new herbicides under the requirements of the Federal Technical Committee for Agricultural Chemicals.

### 3.8 Weeds Act, 1956-1969

Major alterations were made to the principal regulations of the Weeds Act on the 10th March, 1972. Officers of the Section drafted these prior to their approval by the Crown Law Department and prepared two detailed reports for consideration by the Parliamentary Committee for Subordinate Legislation.

The new regulations involved re-scheduling 15 noxious weeds, mainly to enable control measures to be carried out in newly infested areas.

## 4. WEEDS RESEARCH:

### 4.1 Soursob Research (Oxalis pes-caprae) - M.J. Catt

Excellent progress has been made with the research into the chemical control of soursob over the last three years. In 1971-72 trials were conducted at six sites with two herbicides. These have shown that oxadiazon and diuron

give significant control of O. pes-caprae and substantial yield increases. Oxadiazon (17,623 RP) is still in the development process and as such is not commercially available. Diuron however, is in the process of obtaining registration for use in cereal crops in South Australia after receiving a clearance from the Technical Committee on Agricultural Chemicals. Indications are that this herbicide will be well received by farmers for early post-emergent weed control. A bulletin has been prepared summarising the research and giving new recommendations.

#### 4.2 Silver-leaf Nightshade (Solanum eleagnifolium) - M.J. Catt

Trials concluded over the last three year period have shown no economic broad acre treatment for this serious noxious weed. Spot spray treatment with Tordon 50-D(R) is the only effective method of control.

#### 4.3 Biological Control of Skeleton Weed (Chondrilla juncea) - M.J. Catt

Experimental releases of the skeleton weed rust, Puccinia chondrillina, a gall midge, Cystiphora schmidtii, and a gall mite, Aceria chondrillae, were made in the Murray Mallee in conjunction with C.S.I.R.O. Division of Entomology. The organisms have been introduced from Europe by C.S.I.R.O. Early indications are that the three predators will have a serious effect on skeleton weed populations in the area.

#### 4.4 Scented Woolly Salvia (Salvia lanigera) - P.M. Kloot

##### 4.4.1 Herbicide trials

Low rates of amine MCPA have been shown to selectively control this weed in Murray Mallee annual medic pastures. Treatments will have to be continued for several years to deplete the seed reserves. A bulletin summarising these recommendations has been printed.

##### 4.4.2 Germination studies

Laboratory studies indicate that a highly specialised germination process is present in scented woolly salvia. Advantage is taken of light falls of rain by the extrusion of a gel which holds water around the germinating seed. Field studies have shown that seed reserves appear to be exhausted after three years.

#### 4.5 Pheasant's Eye (Adonis spp.) - P.M. Kloot

Taxonomic and ecological studies continue. Effective chemical control has been obtained with bromoxynil at low rates. Studies of medic tolerance to low rates of brominil are being made.

#### 4.6 African Daisy (Senecio pterophorus) - P.M. Kloot

Germination experiments and control investigations are being conducted, the latter in conjunction with the Woods and Forests Department.

#### 4.7 Amsinckia (Amsinckia spp.) - P.M. Kloot

Assessments of current control procedures and investigation of newer herbicides are commencing.

#### 4.8 Pasture Seed Crops

This work has now been completed and published. In the year under review, new herbicides for use in lucerne and seed crops were studied. A number of registrations have followed from this work.

It is anticipated that further work on pasture seed crops will be commenced soon.

#### 4.9 Research Glasshouse

Plans have been approved for the construction of the weeds research glasshouse complex at a cost of \$42,000.

Funds were made available from the Australian Meat Research Committee and the State Government to finance this facility.

It is anticipated that this unit will be completed in August, 1973.

#### 4.10 Weeds Research (Bushfire Protection)

Two officers are working in this specialised field. Their work currently includes projects on:-

- \* Phalaris control on roadsides
- \* Eucalypt regrowth control

- \* Fire fuel investigations for prescribed burning
- \* Fire intensity and African dairy density.

## 5. STAFF TRAINING:

During the year three officers have received additional training in taxonomic botany by attending the course conducted by the Botanic Garden and three officers in the Section are currently receiving general training as technologist by attending the Weed Control Training Course, conducted by the Department of Further Education.

During September, 1971, Mr. M.J. Catt spent two weeks on study leave in Victoria and New South Wales mainly to learn glasshouse techniques for weed science.

## 6. PUBLICATIONS:

During 1971-72 twenty-seven new extension publications were issued by the Weed Science Section.

### 6.1 Bulletins

- \* Prickly Pear Problems in S.A.
- \* Soursob Control
- \* Cereal Weed Spraying Chart

### 6.2 Coloured plates with control details

- \* Matricaria
- \* African Feather Grass

### 6.3 Weed control notes & other publications

- \* "A Key to the Identification of Rumex species in S.A."
- \* "How Can Farm Dams & Water Storages be Kept Weed Free?"
- \* "Recommendations for Weed Control Near Vineyards"
- \* "The Potential of African Daisy to Invade Farmlands"
- \* "The Biological Control of Skeleton Weed"
- \* Yellow Burr Weed
- \* Perennial Thistle

- \* St. John's Wort
- \* Khaki Weed
- \* Fennel
- \* Winged Sea Lavender
- \* Cape Weed
- \* Caltrop
- \* Cape Tulip
- \* Soursob
- \* Neoban<sup>(R)</sup>
- \* GM 23<sup>(R)</sup>

6.4 Prepared Bureau Replies which are Available as Handout Extension Material

- \* The Control of Rumex species
- \* Sheep's Sorrel
- \* Apple of Sodom
- \* Ice Plant
- \* Spray-Seed

6.5 Research Publications

- Kloot, P.M. (1971) - Weed Research in Australia, 1954-1970. J. Aust. Inst. Agric. Sci. 37: 233-235.
- Kloot, P.M. & Dawes, J.H. (1972) - The Use of Herbicides for Weed Control in Pasture Seed Crops - Part I - Legumes. S.A. Dept. Agric. Agronomy Branch Report No. 28.
- Kloot, P.M. & Dawes, J.H. (1972) - The Use of Herbicides for Weed Control in Pasture Seed Crops - Part II - Grasses. Ibid. No. 29
- Tideman, A.F. (1972) - The Distribution and Weediness of African Daisy in South Africa. S.A. Dept. Agric. Agron. Branch Report No. 37.
- Wood, R.T.M. (1972) - Cereal Responses to Nitrogen Fertilisers and Herbicide Treatments on Skeleton Weed Infested Land in the Murray Mallee Region of South Australia. Ibid. No. 31.

- Wood, R.T.M. (1972) - Investigations into the Use of Herbicides as Aids to Pasture Establishment on Skeleton Weed Land in the Murray Mallee. Ibid No. 32.
- Wood, R.T.M. (1972) - Pasture Establishment and Pasture Competition Experiments on Soils Infested with Skeleton Weed in the Murray Mallee of S.A. Ibid No. 33.