

DEPARTMENT OF AGRICULTURE AND FISHERIES, SOUTH AUSTRALIA

Agronomy Branch Report

ANNUAL REPORT 1975 - 76



REPORT NO. 74

PLANT BREEDING SECTION

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* Resigned January, 1976.

PLANT BREEDING SECTION

Further progress has been made this year in selecting annual medics and lucernes resistant to damage by sitona weevil adults, and in field experiments associated with the lucerne breeding programmes. The appointment of two field assistants to positions newly created during 1975-76, greatly helped this work.

From the thousands of annual medics examined for resistance to damage by sitona weevil adults, about 30 different types have shown some degree of resistance. Work is proceeding to more clearly characterise the resistance of each type, to transfer and improve the degree of resistance in agriculturally important species, and to evaluate the resistant medics for their suitability to South Australian farming. In lucerne, quite low levels of resistance were found in a few of the thousands of plants examined. Repeated crossbreeding and selecting has produced improved levels of resistance, and more populations with a greater percentage of resistant plants. Attempts are being made to further improve these characteristics to give a really worthwhile degree of resistance.

LUCERNE SELECTION. As with the sitona resistance programmes much initial selecting of lucerne plants is done under artificial conditions, such as in glasshouses, where particularly important conditions can be controlled. Lucerne plants resistant to stem nematode and with waterlogging tolerance have been found in this way but subsequently will need to be checked in natural field conditions. In fact, the first field experiment to check out waterlogging tolerance has been completed. Indications are that some of the plants tolerant to waterlogging in pots in glasshouse tests are tolerant in the field, and that some of the progeny from inter-crossing different types have better field tolerance than the parents.

Lucerne plants resistant to continuous grazing and lucerne plants with high yields have been bred and selected in field experiments at Northfield. The next stage in each case will be to inter-breed the selected plants to produce a population for testing as the basis of a new improved cultivar.

GRASS BREEDING. The research officer position previously allocated for perennial grass breeding, has been transferred to the Crop Agronomy Section for grain legume investigations. The perennial grass breeding programme with tall fescue is now being maintained on a modest scale by the pooled staff resources of the Plant Breeding Section. At present a collection of European, American and Mediterranean tall fescues is being compared in field plots with summer irrigation in the Adelaide Hills. Comparisons are being made for seasonal productivity with Demeter tall fescue and other perennial grass cultivars important to South Australia. Attempts will be made to re-combine the seasonal productivity peaks of several tall fescues into a single cultivar with high productivity in all seasons.

MEDIC SELECTION. As a result of continuing studies of hundreds of introduced annual medics grown at five key sites in the South Australian wheat belt, many plants have been selected as potentially valuable for agriculture or for breeding to improve on existing cultivars. One group of plants of the species *Medicago tornata* seems very much more suited to sandy soils than the present annual medic cultivars. In 1975, further field experiments were started with about 16 of these *M. tornata* introductions with a view to selecting one or more new improved cultivars for sandy soils. The late start to the growing seasons in 1975 and 1976 on some of the sandy soils used, is making testing conditions less favourable than desired for rapid progress. However, it will probably help ensure that the introductions finally chosen are those best suited to the variable types of seasons occurring in sandy soil areas.

FUNDING. The annual medic breeding programme is largely funded by the South Australian Wheat Research Committee and the Australian Wheat Research Council. Council also supports the sitona weevil resistance programme. The lucerne breeding programmes are funded mainly by the Australian Wool Corporation. During 1975-76 these breeding programmes were reviewed by the respective industry research funding organisations and have been given continued financial support.

In both the lucerne and annual medic breeding programmes many seed samples were collected overseas in 1974 by Messrs. Mathison and Kaehne. Many of these have been grown in quarantine glasshouses at Northfield and under quarantine at the Parafield Plant Introduction Centre during 1975-76 to build up sufficient seed for various

evaluation tests. It was possible to test numerous annual medics for resistance to feeding by sitona weevil adults by using a few leaves picked from the plants. Already three medics collected from North Africa have been identified as showing some resistance to feeding and potential value to agriculture. One of these may eventually more than repay the cost of the seed collecting expeditions.

Conferences and Training Schools

- "Selection for Waterlogging Tolerance in Lucerne" – M.Ag.Sc. thesis University of Adelaide – I.D. Kaehne.
- In-service Communications Course – C.S. Morner and K. Sutherland.
- Bacterial Wilt of Lucerne Conference by Victorian Department of Agriculture, Melbourne – I.D. Kaehne.
- Monarto Staff Relocation Committee – I.D. Kaehne.

Major Research Projects

- Breeding new cultivars of annual medics for the Australian wheat belt.
- Sward testing of annual medic hybrids and introductions to select breeding lines and potential cultivars.
- Seed coat permeability studies in annual *Medicagos*.
- Selecting and breeding annual *Medicagos* resistant to adult sitona weevils.
- Lucerne introduction and quarantine programme.
- Lucerne selection for high yield and persistence under irrigated and dryland conditions.
- Lucerne selection for adaption to waterlogged and poorly drained conditions.
- Selection of lucerne for persistence under continuous grazing.
- Lucerne selection for resistance to stem nematode.
- Lucerne selection for resistance to adult sitona weevil damage.
- Evaluating seasonal productivity to tall fescue introductions for selection and breeding.
- Maintenance of herbage plant seed collection (in collaboration with Plant Introduction and Pasture Seed Physiology Sections).

PLANT INTRODUCTION SECTION

SECTION LEADER:

E.J. Crawford, R.D.A.

LABORATORY ASSISTANT:

(Mrs.) M.S. Schubert (part-time)

PARAFIELD PLANT INTRODUCTION CENTRE:

B.G. Nankivell, R.D.A.

P.L. Blesing

L.K. Ramsay

S.H. Kelly

K.S. Roberts

W.R. Porter

PLANT INTRODUCTION SECTION

Increased liaison with World Bank authorities and with F.A.O. leaders conducting projects in developing countries, particularly North Africa and the Middle East, strengthened the bonds previously established between the Section and leaders of the various international organisations. This solidarity should lead to further plant exploration and genetic conservation, especially of annual legumes so widespread within the Mediterranean regions, and specifically of annual species of *Medicago* for which this Department is the custodian of the world collection.

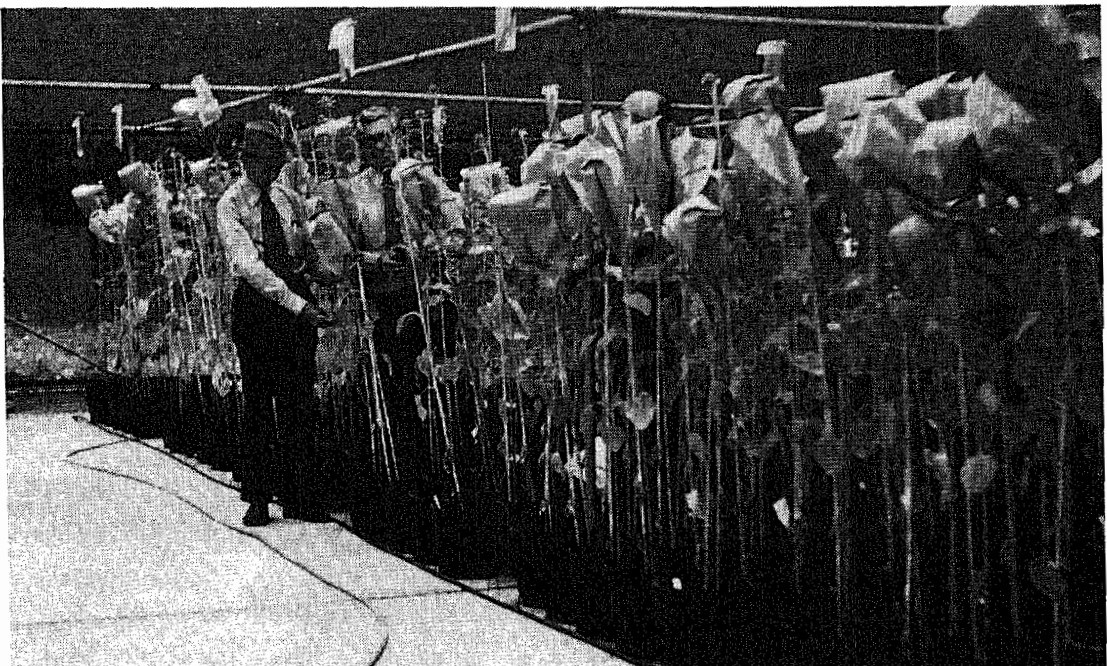
ASSESSMENTS AND TRIALS. At the Parafield Plant Introduction Centre, the agronomic assessment of 569 new herbage plant introductions received from 22 countries, has emphasised the value of Algeria, Morocco and Greece as sources of plants with good seedling vigour (34 per cent of entries), and Morocco in particular, for subsequent winter production (20 per cent of entries). Only 13 lines flowered earlier than the well known cultivar, Cyprus.

A sward trial incorporating 48 of the possible 52 annual sub-species of *Medicago*, highlighted the value of the existing cultivars in the Parafield environment and also demonstrated the potential of other subspecies not currently represented by commercial cultivars. This was most marked in terms of winter herbage and ultimately relative seed production. Moreover, this trial answered questions often asked by international visitors regarding how the non-commercialised species, commonly occurring in their homelands, perform relative to Australia's commercial cultivars.

SEASONAL AFFECTS. Rainfall during the growing season in 1975 was about average at the Parafield Plant Introduction Centre. However, paucity of April/June rain together with frosts during a very dry June, retarded early winter growth. The dry first half of the season was offset by above average October falls which ensured high seed yields in most species.

In the five sward trials conducted in northern parts of the cereal belt of the State, delayed rainfall also affected winter production. But again seed yields were enhanced by good October rains giving yields as high as 1500 kg/ha in the later districts. In the shorter growing season districts of Upper Eyre Peninsula, both herbage and seed production were adversely affected by the lack of winter rainfall.

However, in most instances, seed yields were adequate to ensure satisfactory regeneration in 1976 where sufficient rain has fallen. Unfortunately, many districts are experiencing a similar start to the growing season as was the case in 1975.



Rex Krause (right) discussing sunflower with a visitor to the Parafield Plant Introduction Centre.

Major Research Projects

- Classification of new herbage plant introductions.
- Sward evaluation of Ghor barrel medic (*Medicago truncatula*) at three regional centres.
- Sward evaluation of four selected lines of *M. rugosa* at two regional centres.
- Sward evaluation of four lines of *Trifolium subterraneum* spp. *brachycalycinum* at two regional centres.
- Sward evaluation and relative adaption of 930 genotypes of 14 annual leguminous genera to a hard setting sandy red-brown earth soil.
- Demonstration and agronomic evaluation of 171 genotypes of 48 annual subspecies of the genus *Medicago*.
- Extension of the annual *Medicago* gene pool.
- Quarantine and seed production of 32 lines of sunflower, (*Helianthus annuus*).

PLANT PATHOLOGY SECTION

SECTION LEADER:

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RESEARCH OFFICERS:

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FIELD ASSISTANT:

R. Short, O.N.D., D.B.S.

PLANT PATHOLOGY SECTION

The Plant Pathology Section over the past few years has been engaged in the development of two collaborative research programmes. Although these are only part of the research conducted by the Section, they will be discussed in detail because they have reached interesting stages of development.

The barley leaf scald is a collaborative research programme between the Plant Pathology Section, Waite Agricultural Research Institute and the Western Australian Institute of Agriculture. The programme was designed to:-

- Identify races of the scald fungus
- Study mechanisms of resistance
- Identify sources of resistance of incorporation into commercial barley cultivars
- Assess yield losses caused by the pathogen
- Study management of the disease, e.g. by crop rotation.

We have been fortunate to appoint to the Section, Dr. S.M. Ali who was the Western Australian collaborator on this project. This will mean that the final part of the programme will be completed in South Australia. The 14 different combinations of resistance incorporated into Clipper barley will be field tested during 1977-78.

RUST. The national rust prevention programme has been an important step forward in the control of rust in wheat in South Australia. It is expected that the losses sustained in 1973 and 1974, estimated at \$80M, will not re-occur. The Plant Pathology Section's part in the programme is to survey the State for stem rust. The survey involves the State-wide collection of rusted cereals and grass hosts. As well as a State survey by the Section, farmers and technologists are encouraged to participate. Those who collect samples are provided with a strain identification as well as a summary of the surveys and its implications. The results of the 1974-75 survey based on 421 samples showed that Halberd was susceptible to 80 per cent of all strains. Gabo and varieties with Gabo resistance were susceptible to all strains. New strains were recorded on Condor, Oxley and Egret, which were not previously known to exist in South Australia. No strains were recorded on Kite, Eagle, Gatcher, Gamut or Timgalen. Other important attributes of strain identification are the assessment of resistance of the current varieties, and also for breeders to incorporate the best form of rust resistance available in their most promising lines.

The field management research project on annual ryegrass toxicity has been completed. The results show that attempts to stop head formation of ryegrass also controlled the number of disease inducing organisms in the pasture of the following years. This means that burning, fallowing and hard grazing followed by a cereal crop will reduce these organisms.

Smuticide research has shown that there are several chemicals which show promise for commercial use. Their disease control is better than Ceresan and Hexabunt which have been banned. An advantage of most of these promising chemicals is that they move within the plant. One chemical, a non-systemic, is a liquid which will provide farmers with an alternative to the usual dust formulations.

EELWORM. Studies on cereal eelworm continued. The oat variety West was compared with Swan, Avon and Early Kherson. Swan and Avon were the least efficient in multiplying the eelworm and Early Kherson was one of the most efficient. West oats was close to the efficiency of Early Kherson in allowing multiplication of eelworm on the roots. This finding is of concern as the majority of South Australian farmers grow Swan or Avon which has probably been checking eelworm populations. A switch to West could lead to an aggravation of the cereal eelworm problem.

This growing season, the emphasis on cereal eelworm research is on chemical control. Studies have commenced on the use of a liquid fumigant and a granular chemical which will control eelworm at several sites in the cereal belt. These studies are an extension of a successful Victorian research programme for which economical returns were gained following eelworm control.

Another interesting project started this year is the chemical control of powdery mildew of barley. This study will involve farmers on Lower Yorke Peninsula and in the Lower

South East, in developing chemical control techniques suitable for their area and problems.

All the projects completed and in progress are of an applied and practical nature and appear to be of considerable value to primary producers.

Current Research Projects

Surveys of wheat stem rust strains in South Australia

Control of powdery mildew of barley with fungicides

The effect of leaf scald on the yield and quality of barley

Development of scald resistant lines of cv. Clipper

Cereal Smuticide assessment

Control of cereal eelworm with nematicides

Annual Ryegrass Toxicity Investigations.

SEED PHYSIOLOGY SECTION

SECTION LEADER:

K.G. Boyce, M.Ag.Sc., Ph.D.

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TECHNICAL OFFICER (LABORATORY):

(Ms.) A.M. Kelly

SEED PHYSIOLOGY SECTION

The work of the Section involves generation of technical information relating to production, processing, storage and utilisation of all types of seeds. Investigations are in progress on herbage, cereal, grain legume, vegetable, flower and turf seeds.

PASTURE PRODUCTION. Agronomic research is in progress at Kybybolite Research Centre to determine the influence of stocking rate, grazing management and nitrogen fertiliser on seed yield and wool production using three perennial grass species. To date, the results have highlighted the overwhelming influence of the length of the grazing season on maximum economic return of both seed and wool. Grazing pressure and fertiliser application, although important, have lesser influence. However, an integrated strategy-system of management appears necessary for maximum economic productivity.

Other field projects include continuation of the evaluation of seed production potential of foreign and local cultivars of herbage grasses and legumes, turf grasses, flowers and vegetables. Studies on harvest technology of perennial grasses are continuing with the development of preferred time and method of harvesting *Phalaris tuberosa*. An improved technique for windrowing phalaris crops before harvest has been researched and incorporated into production technology information available to seed producers. A new method has been developed for pre-harvest management of vegetable seed crops which are prone to loss due to seed shattering from the mature head. A quick-drying glue sprayed onto the crop just prior to harvest, results in significant increases in seed yield and economic returns.

SEED QUALITY. Two seed quality experiments of significance are in progress. Commercial size lots of all the major herbage grasses and legumes are being monitored for quality deterioration in six commercial seed warehouses around the State. The results of this experiment will give seed merchants a guide to the storage life of those seeds. A successful extension project has been carried out in association with Mr. Hogg of the Seed Production Section. This project was aimed at showing seed growers, processors and merchants the need for monitoring of seed moisture levels to prevent seed quality deterioration. The use of moisture meters was introduced, and this instrument is now in service with practically all processors and merchants.

Seed quality in lupins has been investigated. Many samples of seed for sowing have been shown by germination test to be of poor quality. The relationship between laboratory test and field performance is under investigation. Initial indications are that the standard laboratory test is a reasonable guide for predicting seed germination and subsequent establishment in the field.

GERMINATION RESPONSE. In the laboratory and controlled environment units, experiments are in progress to show the germination response of various seeds to temperature as an aid to selection in the plant introduction programme and as a guide for routine seed testing.

In addition the inhibition of germination of the seed of annual *Medicago* species by the presence of wireweed is being investigated. This is a major problem in wireweed infested districts of the mixed cereal farming areas. It appears that a substance which prevents root and shoot elongation of medic seed is washed from wireweed by rain thus upsetting normal germination response.

Conferences, Training Schools and Study Leave

Conferences

- Australian Seed Producers Federation Annual Meeting, Ballarat, Victoria, 23rd-24th September, 1975.
- South Australian Seed Producers Association Annual Meeting, Struan, South Australia, 29th October, 1975.
- South Australian Seedgrowers Co-operative Annual General Meeting, Adelaide, 27th November, 1975.
- Australian Society of Animal Production Biennial Conference, Adelaide, 9th-13th February, 1976.

Committee Meetings

- Seed Industry Association – Australian Seed Producers Federation Consultative Research and Development Group, Melbourne, Victoria, 27th October, 1975.
- Organising Committee meeting for 2nd Australian Seed Research Conference, Canberra, A.C.T., 30th-31st March, 1976.

Interstate Study Tour

- Victorian seed production areas and Victorian Department of Agriculture Seed Research Group, Burnley, Victoria, 22nd-26th September, 1975 – K.G. Boyce.

Training Schools

- Organisational Development and Inter-personal Relations Course, Adelaide, May, 1976 – K.G. Boyce.
- In-service writing school, April, 1976 – C.M.J. Williams.

- Effect of grazing and nitrogen applications on perennial grass seed yield – C.M.J. Williams, K.G. Boyce.
- Time of harvest studies for perennial grass seed crops – K.G. Boyce.
- Evaluation of seed production potential of foreign bred species – K.G. Boyce, C.M.J. Williams.
- Influence of temperature on seed germination – K.G. Boyce.
- Seed quality investigations with lupins – K.G. Boyce, R.M. Kain.
- Harvest studies on vegetable seeds – C.M.J. Williams.
- Phenological development in sown pasture grasses – K.G. Boyce, L. Cook and F. Robinson (latter two from Victorian Department of Agriculture).
- Storage studies with herbage seeds – K.G. Boyce, E.S. Hogg, G.E. Cooper.
- Inhibition of medic seed germination by wireweed – K.G. Boyce, P.M. Kloot.

SEED PRODUCTION SECTION

SECTION LEADER:

D.C. Ragless

SEED PRODUCTION ADVISERS:

Adelaide

G.E. Cooper
C.A. Schubert

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TECHNICAL ASSISTANT:

(Ms.) J. Birrell

SEED PRODUCTION SECTION

Following the 1972 visit by Mr. Ragless to the Mediterranean region, and his report (Agronomy Branch Report No. 46) that the area was an immediate potential market for annual medics and sub. clover seeds, the seed industry began developing markets in North Africa for annual medic seeds.

To supply this market with its requirements, a rapid increase in production, particularly of Jemalong barrel medic, was essential. A programme aimed at increasing production was initiated using mass media, Departmental publications, field days, farmer meetings and individual farmer contacts, to inform growers of:—

- Costs and returns possible from medic seed production
- The potential market
- Proven specialised methods of production.



Pasture seed being loaded for Libya.

It has proved to be an outstanding success. Growers responded to the extent that production increased by 200 per cent in two years and the potential market as seen by Mr. Ragless has become a reality. Export sales of pasture seed to Mediterranean regions have increased from a token amount in 1972 to some \$2M. worth of medic seed in the latest export year.

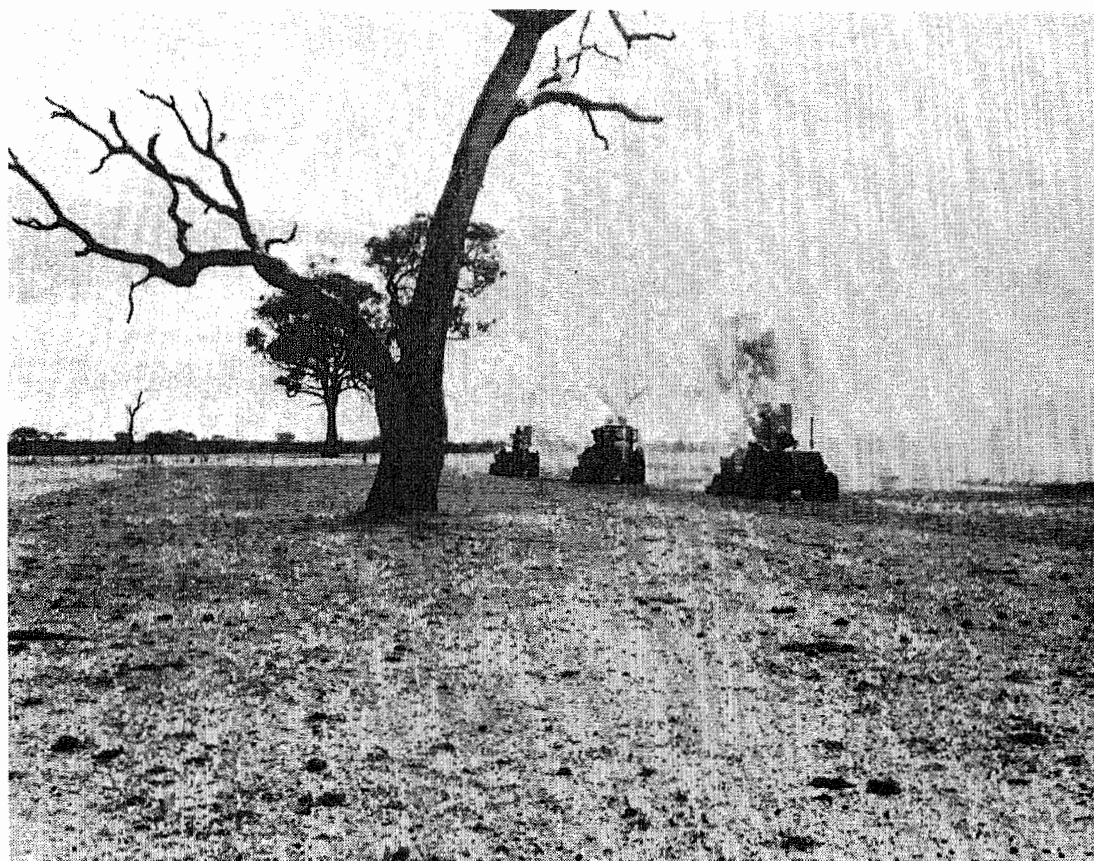
OTHER SEEDS. Other seeds have not been neglected in the Section's efforts to promote production and marketing opportunities. For example, work with Paravivo lucerne has aimed at increasing seed production, reducing the price of seed, improving distribution of seed and, with the help of some of the district agronomists, publicising and demonstrating Paravivo's value.

The Section, in conjunction with the Seedgrowers Co-operative, C.S.I.R.O. and other officers of the Branch has worked to secure inscription in the E.E.C. countries of the Australian cultivar, Demeter. This will enable the development of a potentially large export market to the benefit of growers of Demeter tall fescue seed.

In addition to the Jemalong barrel medic programme, a sales promotion campaign has commenced for seed of annual medics and clovers grown in northern agricultural regions. This is being carried out in association with the seed industry and district agronomists through publicity and demonstrations. Results already reported by seed sale outlets are most encouraging.

Working with Parndana Research Centre, promotional publicity, demonstration plantings and field days have been arranged, together with a pricing policy to enable Trikkala sub. clover seed to sell at a level realistic to both growers and users.

TOTAL PRODUCTION. The total production of certified seed in South Australia for the 1975-76 season was about the same as in each of the previous two seasons. By comparison, production in most other States dropped by from 50 to 70 per cent from the previous year's production. This comparison is mainly a reflection on South Australian marketing methods, but also it indicates the effectiveness of specialised production methods as used in South Australia.



Harvesting sub. clover near Mundulla.

NEW TECHNIQUES. Several new techniques and innovations have been introduced this year to further improve and refine the production, certification and marketing of pasture seeds.

A major limiting factor in the production of annual medic and clover seeds using conventional machinery, is the slowness of the harvesting operation. In conjunction with the Department of Defence at Weapons Research Establishment, an investigational and developmental programme has commenced to try and overcome the problem. All conceivable methods of seed gathering will be considered, then the most promising will be selected and developed to a stage where it could be commercialised. Some of the new systems, such as utilising the electrostatic properties of seed, have possibilities for the future.

The past year has seen several "firsts" in certification and testing, notably:—

- Oat seed certification has been introduced.
- For the first time in ten years a substantial quantity of certified lupin seed was produced.
- Field plots designed to check the effective operation of certification procedures in producing high quality seed are now being used for all categories of seed. Plot testing for 1973-74 has been completed and has indicated an excellent operation of all schemes.
- A new method of labelling of certified seed has been devised. This will cut the cost to the Department by over 50 per cent, cut costs to seed cleaners, enable more streamlined procedures, be more legible, more durable and provide more information.
- Comparative testing of the automatic sampler developed in association with Heathville Pty. Ltd. has continued and indications are that the method is accurate and virtually fool-proof.

When the Waite Agricultural Research Institute relinquished responsibility for maintenance breeding of Currie cocksfoot, the Seed Production Section took over this responsibility. High quality breeder seed was produced this year and is now available to the seed industry throughout Australia for the first time for several years.

A very small quantity of authentic seed of Hannaford barrel medic and Snail medic has been multiplied at Northfield and for the first time supplies of pre-basic seed are now available to make possible (if needed) certification of these cultivars.

LIAISON. At the invitation of the Australian Development Assistance Agency, Mr. Ragless presented lectures in Brisbane and Melbourne to members of the International Training Course on Seed Improvement and Certification. Subsequently, two members of the Course, one from India and one from the Philippines, worked in the Seed Production Section of the Agronomy Branch for a training period of one month.

A bi-monthly newsletter to report industry activities and provide improve liaison between sections of the seed industry and the Department of Agriculture and Fisheries has been commenced and is proving to be highly successful.

Current Projects

Seed for certified crop establishment
Production of certified seed in the South East of South Australia
Seed cleaning costs
Dock weed control in lucernes
Certified perennial grass seed containing dock
Grass weed control in legume herbage seed crops
Pasture seed production costs
Increased annual medic seed production
Seed storage
Promotion of certified seed.

Conferences and Schools

Mr. Ragless attended the following meetings which were held in Sydney concurrently in February, 1976:—

- The Australian Seed Industry Advisory Committee meeting
- The Co-ordinating Committee for Seed Certification meeting
- The Chief Seed Testing and Regulatory Officers meeting.

The Seed Production Section has been represented at all meetings of the Seed Industry Association and many meetings of the Seed Producers Association.

Most officers of the Section attended the annual meeting of the Seedgrowers Co-operative and the Mini-Branch Conference on Cereal and Crop Seed Production.

Messrs. Cooper and Simons attended the In-service training school on Communication held in Adelaide in May.

Mr. Hogg attended the Local Government Weeds Officers Conference in Adelaide in May.

WEED SCIENCE SECTION

SECTION LEADER:

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

SECRETARY, WEEDS ADVISORY COMMITTEE:

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

RESEARCH OFFICERS:

*M.J. Catt, B.Sc., Dip.Bus.Admin.

*P.M. Kloot, M.Ag.Sc.

RESEARCH ASSISTANT:

D. Carter

EXTENSION OFFICERS:

*R.S. Britton, H.D.A.

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

S.J. Garrick

D.I. Murrie, R.D.A. (Hons.)

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

REGULATORY OFFICERS:

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*Temporarily attached to other Sections.

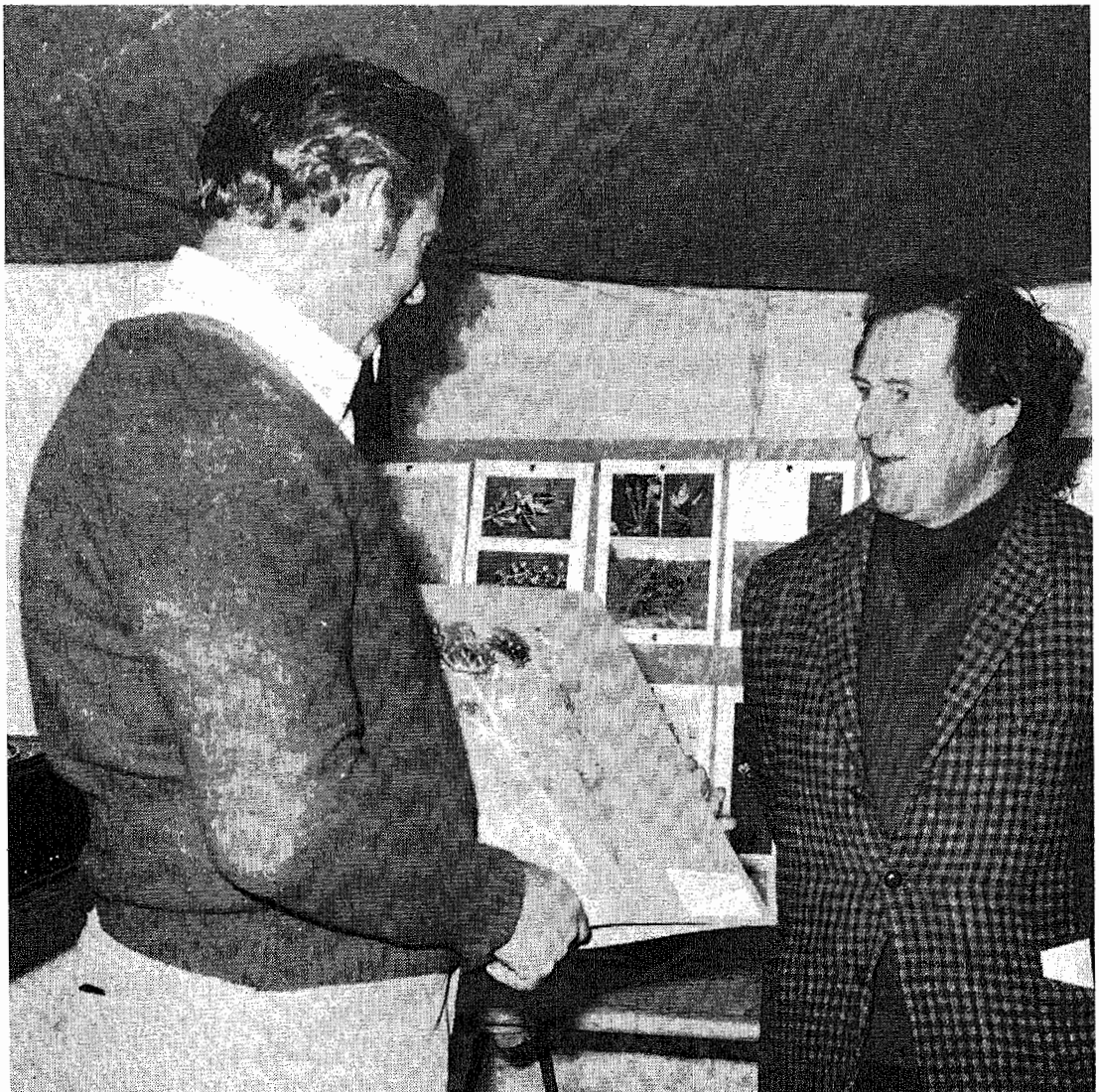
WEED SCIENCE SECTION

The year 1975-76 has been a difficult one for the Weed Science Section extension services. The Senior Agronomist (Weed Science), Mr. Baldwin, is studying in the United Kingdom and has been absent for 10 months. Mr. Smith, the South East Regional Weeds Agronomist, has been studying at Roseworthy Agricultural College since February, 1976. Mr. Britton transferred from the Murray Mallee region to the Northern region to fill a position which had been vacant since March, 1975 which now leaves the Murray Mallee region vacant.

Since February, 1976, Mr. Alcock has been seconded for up to 50 per cent of his time to the Monarto Development Commission to carry out a botanical survey and advise on weed control relevant to intended land use at Monarto. It is expected that this service will continue for a further 12 months at least.

During a private visit to Canada, Mr. Alcock was assisted by the Department in a three week investigation into weed control in that country. His interesting observations are contained in Agronomy Branch Report No. 72.

PEST PLANTS BILL. The most significant development during the year was the final passage through Parliament of the Pest Plants Bill on 18th February, 1976 and its proclamation on 15th April, 1976. This culminated three years of intensive preparation and consultation with local government, primary industries and at Parliamentary level. The Pest Plants Commission has still to be appointed before the new legislation can be enacted.



Weeds Officer Jim Garrick (left) discussing weed problems with visitor to Bute Field Day.

WATER HYACINTH. Following a meeting of the Working Panel on Water Hyacinth at Moree in November, 1975, there are now encouraging signs that this infestation is receiving serious attention not only from the three States concerned, but also from the Commonwealth Government. Major flooding throughout the infested area during the early part of 1975 with the possibility of water hyacinth spread to the westerly river systems, has demonstrated the need for urgent and positive action to be taken. Close surveillance of the Darling and Murray River systems is being maintained since the flooding.

Dr. D.S. Mitchell, a world renowned aquatic weed expert from Rhodesia, assisted the Working Panel in formulating measures to control the Moree water hyacinth infestation. We are also indebted to him for a general assessment of problem water weeds within Australia and their potential threat to our water conservation systems.

The campaign to prevent "off target" herbicide damage to crops within the State has continued. Only isolated damage to tomatoes and vines was reported during this year. On Eyre Peninsula, misuse of soil sterilant type herbicides was noted.

SKELETON WEED. The increasing number of outbreaks of skeleton weed on Yorke and Eyre Peninsulas and in the Mid and Lower North is of particular concern. Previously many councils have done much to contain skeleton weed outbreaks by encouraging landholders to destroy the weed, but it is now apparent that work is declining in some council areas due to an erroneous assumption that containment and eradication can be obtained by biological agents.

Field trials were carried out during the 1975 season to evaluate various herbicides for weed control in field crops, including cereals, lupins, and linseed, however, unpredictable weather conditions, particularly during the winter period made meaningful assessments difficult. The unusually dry start to the 1976 season may again complicate assessments.

Biological control of *Emex* species using the weevil, *Apion antiquum*, is continuing to be assessed. Releases were made at eight new sites throughout the State in addition to the original 1974 releases at Pt. Pirie and Two Wells. Observations and possibly further releases will continue to be made during the coming year.

Field demonstrations using Asulox[®] for the control of bracken fern have been very encouraging. Further work will be carried out using various additives, including urea to induce herbicide application rates and hence cost.



Weeds Officers Grant Baldwin and Arthur Lewis treating mesquite at Wallerberdina Station.

REGULATORY. Generally, regulatory services were inadequate to effectively cover the many aspects involved. It has been difficult to maintain previous services with the current level of personnel resources at some 30 per cent below strength.

Most councils have maintained weed control services but unrest and wait-and-see attitudes are becoming apparent due to the delay in implementation of the new Pest Plants Act.

Government funds "Control of Proclaimed Weeds", totalled \$230,000 and of this amount \$224,000 was distributed to 87 councils as repayment for Crown land works and salary subsidies for 46 weeds officers.

Most weeds officer vacancies with councils are now filled but there are 13 unqualified officers employed and experienced officers continue to seek other work.

Stock inspections, mainly for Noogoora burr, totalled 69, and involved 861,000 sheep and 81,250 cattle. No burr were detected on the cattle but 5,567 sheep (1:50) were infested. Details are as follows:— 7 visits to Yelta, a total of 63,000 sheep inspected and 5,034 (1:12) were burr infested; 61 visits to Gepps Cross, a total of 778,200 sheep inspected and 533 (1:1,500) were burr infested; 1 visit to Peterborough and no burr was found in the 20,000 sheep inspected.

Regulatory patrols outside local government areas reported that of the weed areas inspected, heavy infestations of mesquite, Noogoora and *Opuntia* were found. Treatments were carried out against these weeds. Roadsides, Kimba/Iron Knob, Cowell/Kimba, stock route west of Penong and Paringa to the Victorian border were sprayed for a range of noxious weeds.

Khaki weed was inspected at Arkaroola and reported from Commonwealth Hill station. Mesquite has been reported to be in the far north east region of the State and the spread of boxthorns is causing concern for some pastoralists.

It is intended to investigate these matters and to stimulate more weed control activity in the pastoral areas.

Californian burr is now well entrenched along the Murray River, at least from Mannum to and beyond the Victorian border.

Conferences, Training Schools and Study Leave

- Agronomy Branch Mini-Conference, 30th-31st August, 1975.
- Regional Local Government Weeds Officers' Conference (Eyre Peninsula), November, 1975 — C.R. Alcock, J.A. Dickinson.
- Fifth Australian Weeds Conference, Melbourne, 26th March-2nd April, 1976 — P.M. Kloot, D.I. Murrie.
- Ground Spray Operators' Conference, organised by I.C.I. Aust. Ltd., 29th March, 1976 — R.S. Britton.
- Sixth Local Government Weeds Officers' Conference, Walkerville, 28th-29th April, 1976 — organised by C.R. Alcock and Section officers.

Current Extension Projects

- Biological control of *Emex* spp. — Assessment of State-wide field trials using the insect, *Apion antiquum* (10 sites in all).
- Biological control of skeleton weed — continued assessment of predators.
- Control of bracken fern with the herbicide, Asulam — This will also involve the use of additives, e.g. urea with the object of increasing the effectiveness and lowering costs of treatment.
- Chemical control of bracken fern in established lucerne.

- Weed control in lupins.
- Water hyacinth publicity campaign.
- Brome grass control in cereal crops on Eyre Peninsula.
- Continuing "off target" damage campaign.
- Comparison between I.P.C., Carbetamide and Pronamide in strawberry clover.
- Comparison between I.P.C., Carbetamide and Pronamide in subterranean clover.
- Tolerance of strawberry clover to Asulam.

APPENDIX I

PUBLICATIONS

Agronomy Branch publications for year ending 30th June, 1976 are listed under section headings with authors' names in alphabetical order.

AGRONOMY EXTENSION:

- Fairbrother, P.D., Holden, K.J. and Mowatt, P.J. — "Lupin Growing in S.A." Farmer and Graziers Feature and Special Leaflet.
Marrett, P.L. — Agriculture in S.A. Series — "The Lower South East".
Marrett, P.L. and Mowatt, P.J. — "Sunflowers in the South East". Special Bulletin 17/75.
Webber, G.D. — "The Ley Farming System in S.A.". Special Bulletin 20.75.
Webber, G.D., Cocks, P.S. and Jefferies, B.C. — "Farming Systems in S.A.". Williams, S.G. — "Drainage Comes First in Improving Murray Swamp Pastures". Leaflet No. 3674.

BUSHFIRE PROTECTION SECTION:

- Francis, B.J. — "Monarto Bushfire Control Plan". Special Report and Agronomy Branch Report No. 65.
Francis, B.J. — "Fire Safety with Farm Machinery". Fact Sheet.
Francis, B.J. — "Spontaneous Combustion of Hay". Fact Sheet.
Freak, R.H.T. — "Herbicides for Firebreaks". Fact Sheet.
Green, B.A. — "Bushfires Involve Women". Journal Department of Agriculture and Fisheries, Sth. Aust., Vol. 78, No. 4, November, 1975.

CROP AGRONOMY SECTION:

- Heard, T.G. and Marshall, B.J. — "Cereal Variety Recommendations for 1976". South Australian Department of Agriculture and Fisheries Extension Bulletin 2.75.
Marshall, B.J. — "Better Care in Harvesting Malting Barley". South Australian Department of Agriculture and Fisheries Extension Bulletin 2.76.

ENTOMOLOGY SECTION:

- Summary of Crop and Pasture Pest Recommendations 1976. Extension Bulletin No. 10.76, South Australian Department of Agriculture and Fisheries.
Allen, P.G. (1976) — "Alternative Insecticides for the Control of the Pasture Cockchafer (*Aphodius tasmaniae* Hope) in Pasture". Aust. J. Expt. Agric. An. Husb. (In press).
Allen, P.G. (1976) — "Assessment of Damage to Annual Pastures by the Pasture Cockchafer (*Aphodius tasmaniae* Hope) in South Australia". Submitted to Aust. J. Agric. Res.
Allen, P.G. (1976) — "Sequential Sampling for the Pasture Cockchafer (*Aphodius tasmaniae* Hope) (Coleoptera:Scarabaeidae) in Pastures in South Australia". Agronomy Branch Report No. 71.
Allen, P.G. (1976) — "Summary of the Control of Pests in Turf". Fact Sheet.
Grierson, I.T. and Allen, P.G. (1976) — "Effect of Reduced Tillage on Cereal Curculio (*Desiantha caudata* Pasc.) Damage to Wheat". Submitted to Aust. J. Expt. Agric. An. Husb.
Laughlin, R. and Allen, P.G. (1976) — "The Population of *Culex annulirostris* along the River Murray in South Australia in 1975". Agronomy Branch Report No. 73.

PASTURE UTILISATION SECTION:

- Cocks, P.S. (1975) — "Volunteer Plants in Annual Pastures". Journal of Agriculture, South Australia, 78: 95-9.
Cocks, P.S., Boyce, K.G. and Kloot, P.M. (1976) — "The *Hordeum murinum* Complex in Australia". Aust. J. Bot. (In press).
Gibson, P.R. (1976) — "A Comparison of Annual and Perennial Based Pastures for Liveweight and Wool Production of Sheep Grazing on the Lateritic Podsollic Soils of Kangaroo Island". Proc. Aust. Soc. Anim. Prod. XI, 325-8.

- Gibson, P.R. (1976) — A Comparison of Liveweight Gain and Wool Production from Polwarth Ewe Weaners Grazed at Three Stocking Rates on Three Different Perennial Based Pastures in the Southern Adelaide Hills of South Australia". Proc. Aust. Soc. Anim. Prod. XI, 6p.
- Hawthorne, W.A. and Cocks, P.S. (1976) — "The Growth of Some Perennial Grasses Under Irrigation on a Rendzina Soil in the Lower South East of South Australia". Agricultural Record 3, 8-12.
- Kloot, P.M. (1976) — "The Species of *Adonis* L. Naturalised in Australia". Muelleria (Melbourne). (In press).
- Maschmedt, D.J. and Cocks, P.S. (1976) — "Sulphur-coated Urea Compared with Urea and Ammonium Nitrate as a Source of Nitrogen for Swards of Annual Ryegrass (*Lolium rigidum* Guad.). Agricultural Record, 3, 4-7.
- Smith, M.V. and Gibson, P.R. (1976) — "Simulation as an Aid to Predicting Pasture Resowing Profitability". Proc. Aust. Soc. Anim. Prod. XI, 317-20.

PASTURE BREEDING SECTION:

- Crawford, E.J., Mathison, M.J. and Webber, G.D. (1976) — "Annual Medic Cultivars in South Australia". Submitted for Bulletin, S. Aust. Dept. Agric. and Fisheries.
- Kaehne, I.D. (1976) — "Preliminary Observations on the Performance of Hybrids Between Diverse Morphological Forms of Lucerne". Submitted for Australian Plant Breeding Conference and 3rd S.A.B.R.A.O. Congress, Canberra, 1977.
- Kaehne, I.D. (1976) — "Stem Nematode Resistance in Lucerne". Submitted for Australian Plant Breeding and Genetics Newsletter No. 26.
- Kaehne, I.D. (1976) — "Studies in Waterlogging Tolerance in Lucerne". Thesis submitted to University of Adelaide in partial fulfilment of degree of M.Ag.Sc. 179pp.
- Mathison, M.J. (1976) — "Breeding for Resistance to Sitona Weevil". Seed Industry Newsletter No. 1, South Australian Dept. of Agriculture and Fisheries and South Australian Seed Producers Association 5.
- Mathison, M.J. (1976) — "West European Study Tour and Pasture Legume Seed Collecting in the U.S.S.R., Balkans, North Africa and Lebanon". Submitted for Australian Plant Breeding and Genetics Newsletter No. 26.
- Mathison, M.J. (1976) — "Perennial Grasses, Rust and a Cautionary Tale". Submitted for Australian Plant Breeding and Genetics Newsletter No. 26.
- Mathison, M.J. (1976) — "Sitona Weevil Resistance in Annual *Medicago*". Submitted for Australian Plant Breeding Conference and 3rd S.A.B.R.A.O. Congress, Canberra, 1977.

PLANT INTRODUCTION SECTION:

- Crawford, E.J. (1974) — "Geotropism in *Medicago aculeata* Willd.". Aust. Plt. Breed. and Gen. News. 24/1974*.
- Crawford, E.J. (1975) — "Data Bank and Genetic Conservation in Annual Species of the genus *Medicago* L.". Aust. Plt. Int. Rev. V. 10, No. 3.
- Crawford, E.J. (1975) — "Time of Flowering in Annual Species of the genus *Medicago*". Aust. Plt. Breed. and Gen. News. 25/1975.

PLANT PATHOLOGY SECTION:

- Ali, S.M., Mayfield, A.H., and Clare, B.G. (1976) — "Pathogenicity of Southern Australian Isolates of *Rhynchosporium secalis* on 21 Barley Cultivars". For Proceedings Australian Plant Pathology Society Conference.
- Dube, A.J. (1975) — "Smuticides 1975-76 Treatment Season". South Australian Department of Agriculture. Fact Sheet.
- Dube, A.J. — "Sclerotinia stem rot in Lupins". Journal S.A. Department of Agriculture and Fisheries, Vol. 79 : No. 1.
- Johnsson, J.S. (1975) — "Control of Clover Scorch". S.A. Department of Agriculture. Fact Sheet.
- Mayfield, A.H., Clare, B.G. and Dube, A.J. (1974) — "Survival of *Rhynchosporium secalis* in Barley Leaves". Australian Plant Pathology Society Newsletter 3 (1), 4.
- Mayfield, A.H. (1975) — "Wheat Stem Rust Strains in South Australia, 1973 and 1974". S.A. Department of Agriculture and Fisheries, Leaflet No. 4046.
- Mayfield, A.H., Short, R. (1975) — "Stem Rust Survey". S.A. Department of Agriculture and Fisheries. Fact Sheet.

*Released during 1975.

Mayfield, A.H. — "Barley Leaf Scald". Journal S.A. Department of Agriculture and Fisheries, Vol. 79 : No. 2, autumn 1976.

Mayfield, A.H. (1975) — "Stem Rust Strains in South Australia". Australasian Plant Breeding and Genetics Newsletter 25 : 57-58.

SEED PHYSIOLOGY:

Boyce, K.G., Cole, D.F. and Chilcote, D.O. (1976) — "Effect of Temperature and Dormancy on Germination of Tall Fescue". Crop Science 16: 15-18.

Boyce, K.G. (1975) — "A Guide to Seed Storage and Longevity". S.A. Seed Producers Association Annual Meeting, Struan, 29th September, 1975.

Boyce, K.G. and Coleman, W.O. (1976) — "Harvesting Methods for Seedmaster Phalaris Seed Crops". Aust. Seed Sci. Newsletter 2. (In press).

Boyce, K.G. and Crawford, E.J. (1976) — "Long Term Storage of Annual Pasture Legume Seed". Aust. Seed Sci. Newsletter 2. (In press).

Cocks, P.S., Boyce, K.G. and Kloot, P.M. (1976) — "The *Hordeum murinum* Complex in Australia". Aust. J. Bot. (In press).

Williams, C.M.J. and Ailden, W.G. (1976) — "Economic Returns from Annual Pastures Sown at Different Rates". Proc. Aust. Soc. Anim. Prod. 11: 321-324.

Williams, C.M.J., Geytenbeek, P.E. and Ailden, W.G. (1976) — "Relationships Between Pasture Availability, Milk, Supply, Lamb Intake and Growth". Proc. Aust. Soc. Anim. Prod. 11: 333-336.

Williams, C.M.J., Patterson, A.J. and Simons, I.H. (1976) — "Potential of the Pasture Seed Industry in Temperate Higher Rainfall Areas of Australia". Proc. 1st Nat. Conf. Aust. Inst. Agric. Sci. (In press).

SEED PRODUCTION SECTION:

Coleman, W.O. *et al* — "Interstate Study Tour Report on Pasture Seed Production and Certification". Agronomy Branch Report No. 70.

Coleman, W.O. — "Certification of Lupins". Fact Sheet.

Cooper, G.E. — "Herbage Seed Production 1974-75 Season". Agronomy Branch Report No. 67.

Copper, G.E. — "Seed for Certified Crop Establishment". Fact Sheet.

Dodson, C.M. — "Individual Grower Production 1974-75". Agronomy Bulletin.

Hogg, E.S. — "Seed Cleaning Costs". Fact Sheet.

Hogg, E.S. — "Moisture Limits for Safe Seed Storage". Fact Sheet.

Ragless, D.C. — "How to Get Best Value for Money When Buying Pasture Seeds". Fact Sheet.

Ragless, D.C. — "Harvesting of Lucerne Seed". Fact Sheet.

Schubert, C.A. — "Certification Plot Work". Fact Sheet.

Simons, I.H. — "Subterranean Clover Seed Production". Fact Sheet.

WEED SCIENCE SECTION:

Alcock, C.R. (1975) — "Some Observations on Weed Control in Canada". Agronomy Branch Report No. 72.

Alcock, C.R. — "Furze or Gorse". Colour plate, Journal of Agriculture, November, 1975.

Alcock, C.R. — "Johnson Grass". Colour plate, Journal of Agriculture, November, 1975.

Alcock, C.R. — "Saffron Thistle". Colour plate, Journal of Agriculture, August, 1975.

Alcock, C.R. — "Soldier Thistle". Colour plate, Journal of Agriculture, August, 1975.

Britton, R.S. — "Kikuyu Grass". Weed Control Notes, revised, July, 1975.

Catt, M.J. (1976) — "Cereal Weed Spraying 1976". Extension Bulletin 9.76.

Murrie, D.I. — "Asulox[®] for Bracken Fern Control". Weed Control Notes, August, 1975.

Murrie, D.I. — "Bracken Fern Control in Pastures with Asulox[®]". Weed Control Notes, March, 1976.

Murrie, D.I. — "Dock Control in Pastures". Weed Control Notes, May, 1976.

O'Neil, J.M. (1976) — "A Guide to Bulb Weed Identification". Special Bulletin No. 18.75.

O'Neil, J.M. — "Lawn Care". November, 1975. Fact Sheet.

O'Neil, J.M. — "Lawn Fertilisers". November, 1975. Fact Sheet.

O'Neil, J.M. — "Lawn Maintenance". November, 1975. Fact Sheet.

O'Neil, J.M. (1975) — "Weed Scene". Issue No. 18.

Smith, K.R. (1975) — "Artichoke Thistle". Fact Sheet.

Smith, K.R. (1974) — "Sorrel Control in Pasture Establishment". S.A. Journal of Agriculture, Vol. 78, 126-128.

APPENDIX II

EXTENSION ACTIVITIES FOR YEAR ENDING 30/6/76

The extension of agricultural information is of prime importance in the work of officers of the Agronomy Section. Following is a list of the main extension methods with the approximate number of each activity.

PERSONAL CONTACTS:

On-farm visits	3,500
Rural group-meetings and field days	600
Office, laboratory and trial site visitors	7,000
Telephone enquiries	15,000
Regulatory inspections	2,000
District council visits	300

MASS MEDIA:

News items	350
Information publications	70
Radio broadcasts	150
Agricultural condition reports	170

Expressed in broad terms, this means that on every working day of the year Agronomy Branch officers in various parts of South Australia visited 12 farms, attended two group meetings or field days, talked to 20 visitors, answered 50 telephone enquiries, carried out seven regulatory inspections and called on a district council to give advice and information, plus extension work with mass media.