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Agronomy Branch Report

ACRONOMY BRANCH ANNUAL REPORT

1977 - 78

Report No.
100

AGRONOMY BRANCH ANNUAL REPORT

1977 - 78

EXECUTIVE OFFICERS:

A.F. Tideman, Chief Agronomist

G.D. Webber, Principal Agronomist

M.R. Krause, Principal Research Officer

E.D. Higgs, Senior Research Officer

- C O N T E N T S -

ONE HUNDREDTH

AGRONOMY BRANCH REPORT

This Agronomy Branch Report is the one hundredth. A milestone of which the Branch is proud.

The first Report was issued during August, 1968. They have aimed to record with as little fuss and cost as possible the operations of the Branch in its fields of research, extension and regulatory activities which would otherwise be lost in a maize of Government Dockets or individual filing cabinets. They do not aim to replace scientific papers which are an important part of our specialists work nor do they replace official Government reports.

Usually only eighty or so copies are printed to keep costs to a minimum. Each author is largely responsible for distributing the Report to those thought to be most interested.

Copies are placed in four major libraries throughout the State.

Agronomy Branch Reports have therefore become a measure of accountability of the staff and an historical record of the amazing changes which have occurred in the agricultural scene in South Australia over the last decade.

A.F. Tideman

CHIEF AGRONOMIST

- FOREWORD -

This report is a review of activities within the Agronomy Branch of the S.A. Department of Agriculture and Fisheries for the year ended 30th June, 1978.

The trend towards regionalisation continued with the South-East Region officially established on 1/7/77. This meant the transfer of certain officers from the Branch to that Region. Good communications and technical links have been established with the Region and hopefully this will continue as regionalisation progresses.

The Aphid Task Force set up just before the start of the year under review to combat the newly arrived lucerne aphids has successfully completed its first year of operations with pleasing progress in a three pronged integrated control programme using insecticides, parasites and resistance breeding. This year was also the first year of operation of the newly formed Plant Protection Section, which was set up to provide a specialist technical service on all matters pertaining to insect pest, disease and weed con rol to growers, industry, and our own and other Government Departments. This new concept in service has been very well received.

The two new crop breeding programmes with oats and field peas have made good progress in spite of adverse seasonal conditions whilst the pasture improvement work with medics and lucerne have had to be redirected with the advent of the lucerne aphids.

Involvement with overseas projects involving personnel abroad, providing information by way of films and publications, and conducting briefing sessions and organising field trips for overseas visitors mainly from the Middle East, has again been an area of considerable activity for the Branch.

The Branch is very appreciative of the help and support it has received from farmers in the conduct of research and extension programmes; from officers of other branches and other Government Departments and organisations, and from personnel within a wide range of agricultural industries. Such co-operative effort must surely assist us in our common goal - the advancement of South Australia's agriculture.

A.F. Tideman

CHIEF AGRONOMIST.

AGRICULTURAL CONDITIONS AND HARVEST RESULTS 1977/78

A Drought Year:

1977 proved to be one of the worst years ever experienced for cereal farmers and graziers in South Australia.

There were no definite opening rains and monthly rainfall deficits occurred consistently during the growing season.

By the end of August much of the State was in the grip of a severe drought with large areas of country drifting particularly on Eastern Eyre Peninsula. Some farmers on Eastern and Upper Eyre Peninsula and in the Northern Murray Mallee were experiencing their third consecutive drought.

Aid Schemes Used:

Various schemes were introduced to assist farmers through the drought these included freight concessions for stock and fodder, schemes to dispose of surplus sheep and cattle and "carry on" finance schemes.

Rainfall Ineffective For Cereals:

Although the total rainfall for the year was about 60 to 70% of normal much of it fell outside the effective growing season for cereals, but late crops did gain some benefit from useful falls during late November and early December. These rains also promoted a useful growth of summer growing weeds which helped to hold exposed sandy soils.

Crop Area Up But Production Poor:

Due to the difficult year in 1976 farmers planned for a big increase in the area to be sown to cereals in 1977. Most of the intended area was eventually sown, but production per hectare for wheat was the lowest since 1944/45 (0.38 t/ha) and for barley the lowest since 1959/60 (0.51 t/ha).

Crop Production:

Crop		1977/78			10 Yr. Av. 1967/68 To 1976/77		
		Area ha	Yield t/ha	Production t	Area ha	Yield t/ha	Production t
Wheat	(a)	1 090 000	0.47	510 800	1 128 175	1.14	1 286 900
Barley	(a)	1 073 400	0.55	591 800	678 421	1.16	785 074
Oats	(a)	130 000	0.43	55 400	159 968	0.78	124 080
Rye	(a)	23 000	0.24	5 700	17 244	0.28	4 790
Field Peas	(a)	16 500	0.38	6 300	10 993	1.04	11 408
Lupins	(b)	15 070	0.75	11 301	(1) 6 674	1.05	7 022
Rapeseed	(b)	10 580	0.78	8 361	(2) 2 375	1.00	2 374
Linseed	(b)	4 150	0.87	3 603	1 048	0.99	1 036
Lentils	(b)	100	1.10	110	(3) 182	0.69	126
Safflower	(b)	800	0.90	720	(1) 524	1.12	587
Sunflower	(b)	12 000	1.00	12 000	(1) 2 750	1.08	2 969

(a) Australian Bureau of Statistics.
(b) Agronomy Branch Estimates.

(1) 6 Year Av. 1971/72 to 1976/77
(2) 7 Year Av. 1970/71 to 1976/77
(3) 4 Year Av. 1973/74 to 1976/77

Most Troublesome Insect Pests:

Plague locusts were active in northern areas. There was a rapid build-up of and widespread damage caused by Spotted Alfalfa Aphid in December and wingless grasshoppers caused trouble towards the end of the year in the South East.

AGRONOMY ADVISORY SECTION

SECTION LEADER:

H.R. Day, R.D.A., Senior Agronomist (appointed March 1978)

S.G. Williams, R.D.A., Assistant Senior Agronomist (Acting Senior Agronomist until March 1978).

EXTENSION OFFICERS:

Adelaide Office	N.R. Matz, R.D.A., Senior Agronomist.
Kangaroo Island	R.C. Hagerstrom, R.D.A., G.D.E., Senior District Agronomist - Study leave to December, 1977.
Lower Eyre Peninsula	K.J. Holden, R.D.A., G.D.E., Senior District Agronomist.
Eastern Eyre Peninsula	J.R. Cawthorne, R.D.A., R.D.A.T., District Agronomist (transferred June 1978).
Upper Eyre Peninsula	T.R. Davidson, R.D.A., District Agronomist.
Lower North	W.A. Michelmore, R.D.A., Senior District Agronomist.
Upper North	A.E. Hincks, R.D.A., G.D.E., District Agronomist.
Yorke Peninsula	T.R. Dillon, R.D.A., District Agronomist.
Central District	P.D. Fairbrother, R.D.A., District Agronomist.
Murray Districts	K.G. Bicknell, D.D.A., Senior District Agronomist.
Northern Mallee	B.C. Bull, R.D.A., Acting District Agronomist.
Southern Mallee	J.N. Hannay, R.D.A., R.D.A.T., District Agronomist.

The South East Region was established 1/7/77, and the following officers were then transferred from the Agronomy Extension Section to that Region.

Mid South East	P.J. Mowatt, R.D.A., G.D.E., Senior District Agronomist.
Lower South East	P.L. Marrett, District Agronomist - Returned from overseas service, Libya, August, 1977.
	P.M.S. Potter, B.Ag.Sc., District Agronomist - Study leave from January 1978.
Upper South East	T. Prance, R.D.A., R.D.A.T., District Agronomist - Seconded to overseas service, Libya from August 1977.
	E.S. Hogg, R.D.A., Acting District Agronomist from September 1977.

AGRONOMY ADVISORY SECTION

Function:

The Agronomy Advisory Section has continued to provide technical, advisory and educational services in agronomy and allied matters to primary producers throughout the State. This service is carried out through 14 specified districts with agronomists stationed in each district to provide on the spot service.

The section also has a responsibility to inform government, industry, marketing organisations, servicing institutions and commerce on the state of agronomic industries. The information is developed by the district agronomists and reported on to head office where it is collated and passed on.

Regionalisation:

The South East Region was established in July 1977, and the district agronomists transferred from this section to the Regional administration.

A technical and industry link has been maintained between the Agronomy Advisory Section and the Regional Agronomists. As other regions become established similar links will be maintained.

Special Functions:

* Inspections and reports continue to be made under the "Rural Advances Guarantee Act, 1963".

* Resubdivision assessments and reports were made on behalf of the State Planning Office.

* District agronomists made inspections and reports on applications for loans under the Primary Producers Emergency Assistance Act.

* Six officers from the section spent 30 man weeks with the Rural Assistance Branch in head office assisting in the processing of applications for drought relief.

Overseas Activities:

The section continues to be involved in extending the southern Australian farming system and techniques to overseas countries.

P.L. Marrett returned from service with the Australian Demonstration Farm in August 1977, and was replaced there by T. Prance.

Overseas visitors again made frequent demands on the section. Briefing meetings were arranged and attended and field visits made for visitors from Libya, Algeria, Afghanistan, Iran, Spain, Ghana, South Africa, England, Tunisia and World Bank. In all 17 separate visits were handled.

The section was also involved in the production of the movie film "Food from the reluctant earth" and the publication "Pasture seeds from South Australia". Both these publications support the previous publication "Farming Systems in South Australia" and are aimed at "exporting" South Australian agricultural technology.

Crop Monitoring And Production Reporting:

District agronomists continue to furnish monthly reports on the agricultural situation and crop production estimates for their respective districts. This information is collated in head office and is used extensively by government, marketing authorities, agribusiness, grain storage organisations, transport and commerce to assist in the planning of their operations.

Seed Schemes:

Registered, approved and certified seed schemes were in operation during the 1977/78 season with the aim of providing growers with seed of good quality as an aid to maintaining a high quality standard in crops grown in the State.

The approved cereal seed scheme operates only when there are expected shortages. The drought of 1977 created such a situation.

The following lists the amounts of seed made available under the various schemes.

	Number of growers	Quantity of seed tonnes
Registered Seed Scheme		
Wheat	32	468
Barley	21	450
Approved Seed Scheme		
Wheat	61	3021
Barley	43	2113
Oats	8	94
Cereal Rye	4	177
Certified Seed Scheme		
Oats	15	95
Lupins	14	51

Extension Programmes:

District extension programmes are developed and reviewed at regional meetings. The State is divided into four regions for this purpose and meetings are held in each region three times a year. The regions are Eyre Peninsula, Northern, Murray Lands and South East.

On farm experiments are frequently conducted as part of extension programmes. These experiments may be used to find how new information fits into the local situation or for result demonstration purposes.

Some of the main extension programmes carried out in 1977/78 included:-

Cereal varieties - In conjunction with Crop Agronomy Research group. Promotion of improved varieties of wheat, oats, barley and rye corn.

Cereal grain quality - Improving the quality of grain for marketing through control of insect pests and weeds, and through improved varieties.

Grain legumes - Investigations and demonstrations into varieties of field peas and lupins. Using lupins on dairy farms.

Minimum tillage - Investigation and demonstration in the use of chemical weed control in association with direct drilling. Testing of other tillage implements.

Weed control - Promoting the control of particular weeds e.g. Soursob, Lincoln Weed, Yellow burr weed and emex sps.

Cereal root diseases - A teaching exercise in the first place to make growers aware of the diseases followed by a promotional programme on control measures. Control measures promoted included break crops, adjustments to rotations, control of grassy pastures, resistant varieties etc.

Annual ryegrass toxicity - This problem is extending and in conjunction with Animal Health Branch a programme was conducted to make growers aware of the problem. A stock and pasture management programme to help the situation was evolved and promoted.

Medics in the cereal areas - A series of result demonstration trials were established to promote the use of medics in cereal areas. Because of drought few of these trials were successful.

Drought:

The drought in 1977 meant that changes in emphasis on some extension programmes had to be made. Management strategy under drought became a major programme in itself and involved much of the district agronomists' time.

Publications:

The section maintains a responsibility for the development and management of the Agronomy Branch publications programme.

Publications prepared by officers of other sections and released are listed elsewhere in this report.

Publications prepared by this section are listed below.

S.G. Williams - Irrigated Lucerne, F.S. 1/77.

D.E. Swincer and P.J. Mowatt - Rutherglen Bug in Sunflowers, F.S. 143/77.

P.J. Mowatt and P.R. Birks - Wingless Grasshopper, F.S. 137/77.

S.G. Williams - Fodder Crops for Summer and Autumn Feed (Chart).

W.A. Michelmore and D. Mackie - Annual Ryegrass Toxicity, F.S. 91/77.

PLANT PROTECTION SECTION

SECTION LEADER: (Senior Plant Protection Agronomist)

G.B. Baldwin, R.D.A., B.Sc., M.Sc. (Dist.)

REGIONAL OFFICERS: (Regional Plant Protection Agronomists)

Region 1	Western	J.A. Dickinson, Dip. Agric. (U.K.)
Region 2	Northern	Vacant.
Region 3	Upper Central	R.S. Britton, H.D.A., R.D.A.T.
Region 4	Lower Central	Vacant.
Region 5	Murray Lands	G.M. Fromm, R.D.A.
Region 6	South Eastern	K.R. Smith, W.D.A., R.D.A.T.

SECONDED OFFICER:

To Weed Science Research Section, D.I. Murrie, R.D.A. (Hons.)

OFFICE ASSISTANT:

Mrs. M. Hill

PLANT PROTECTION SECTION

General:

This report covers the first year of the Section as an identity. A significant amount of time was spent by all officers within the group familiarising themselves with various aspects of plant protection particularly those related to Entomology and Plant Pathology. This was assisted by attending training sessions in Adelaide, reading, and studying problems at first hand.

All officers have been encouraged to begin an insect, weed and disease collection and the collections will be used as a base for identification within each region.

The Section has been established on a technical service foundation with each regional officer receiving information on the relevant herbicides, fungicides, and insecticides, that are recommended for agricultural use in his region. Each officer is providing a specialist technical service on all matters concerning insect pests disease and weed control, and on the safe and effective use of agricultural chemicals. This is primarily a resource function available to all regional officers and to officers in other government departments. This resource is also available to staff working in the service industries in the region, (e.g. staff employed by Elders GM). The technical service provided can involve educational training.

Involvement In Research:

Individuals within the group have been involved in a number of research projects during the year. These have included powdery mildew control in barley, Septoria research, annual ryegrass toxicity, sitona weevil parasite releases, legume aphids and cereal cyst nematode control.

Regulatory Activities:

The group has been involved in a technical capacity in a number of regulatory functions.

It has had involvement in pesticide residue trace-back work. Various officers have done inspections on behalf of the Seed Production Section and have been involved in cereal crop inspections under the emergency scheme for approved seed. Technical advice to local government concerning the management and control of pest plants was also provided. Group members have also contributed to state quarantine activities covered under the Fruit and Plant Protection Act.

Involvement In Educational Training Programmes:

Lecturing was undertaken by various members of the group for the Department of Further Education in the certificate courses for weed control and pesticide application.

Committees:

The Section Leader, Mr. G.B. Baldwin compiles the fortnightly legume aphid field report for the State, and is also Technical Secretary to the Pasture Aphid Consultative Committee. Mr. Baldwin is Convenor of the Agronomy Branch Quarantine Committee which met seven times during the year and he has been the Agronomy Branch representative on the Royal Show Committee.

Conferences, Training Schools And Study Leave:

Mr. R.S. Britton completed his graduate diploma in agriculture at Roseworthy during the year. Mr. Baldwin attended a scientific writers school.

It is anticipated that in 1980 Mr. G.M. Fromm will attend a 1 year Post Diplomate training course in plant protection at the Queensland Agricultural College.

Plant Protection Advisory And Extension Services:

Officers within the group soke at a number of bureau conferences and bureau meetings during the year. Some of the subjects they spoke on were:-

* Legume aphids
* Cereal weed control
* Pasture cockchafer
* Insect pests of germinating cereals
* Annual ryegrass toxicity
* Biological control of three corner jack
* Weed control in lupins
* Cereal cyst nematode control.

All officers are involved in farm visits, have farmers come to visit them, and have telephone and letter enquiries to handle. To give an example of this work load the figures for the Regional Plant Protection Agronomist at Murray Bridge for the year are detailed below:-

Farmer property visits	110
Farmer office visits	180
Farmer phone queries	460
Letters to farmers	32

Departmental officer, Agribusiness and Council contacts

Visits to their offices	20
Visits from them	24
Phone enquiries	400
Letters to these people	22

Members of the group were involved in regional shows where they assisted setting up displays illustrating the problems of pasture aphids, cereal cyst eelworm and ryegrass toxicity.

Mapping And Survey Activities:

During the year officers were involved in surveys for ryegrass toxicity, skeleton weed and monitored release sites for biological control agents of Three corner jack. Officers were also involved in mapping and co-ordinating the control of plague locusts in certain areas. An assessment of the extend of crop damage associated with the use of dicamba based herbicides took place.

Plot Work:

The trial and demonstration work programme during the year covered a wide range of activities. Members were involved in work on minimum tillage, screening herbicides for weed control in lupins, field peas, sunflowers, pest plant demonstrations for the control of yellow burr weed, perennial rag weed, and onion weed, as well as work on septoria disease control in cereals, powdery mildew on barley and the control of false wire worms in sunflowers.

Publications:

Members of the Section contributed to three Fact Sheets and one Technote during the year.

These are detailed below:-

Baldwin G.B. and Britton, R.S. (1978) - The safe use of mixtures of Dicamba with either 2,4-D or MCPA in cereals. SADAF Technote 4/78.

Smith, K.R., Simons, I. and Kloot, P. (1978) - A guide to herbicides for weed control in lucerne seed crops. SADAF Fact Sheet 3/78.

Smith, K.R., Simons, I. and Kloot, P. (1978) - A guide to herbicides for weed control in annual medic and subterranean clover seed crops. SADAF Fact Sheet 4/78.

Mathison, M. and Baldwin, G.B. (1978) - A guide to the susceptibility of some pasture and crop legumes to Spotted Alfalfa Aphid, Blue-Green Aphid, Pea Aphid and Sitona Weevil, SADAF Technote 2/78.

Problems During The Year:

In summary it was a period that involved a considerable amount of widening of horizons and establishment of expertise at the regional level. It is expected that this will continue into the future. Problems still exist with the degree of recognition by other staff of the new concept of Plant Protection. It is felt that District Agronomists do as yet, not have a full degree of confidence to make the best use of Plant Protection Agronomists. This lack of confidence results in a lack of consultation at times, which in turn tends to slow the degree of development possible in a plant protection base.

Liaison between the Senior Plant Protection Agronomist and the biological groups conducting research into weeds, diseases and insects is not always easy and the location of the groups in different buildings accentuates this.

The need to provide a better service in the Central Region is recognised and it is hoped that this position will be filled in the near future.

CROP AGRONOMY SECTION

SECTION LEADER:	T.G. Heard, B.Ag.Sc.
RESEARCH OFFICERS:	M.J. Catt, B.Sc. Dip. Bus. Admin.
	A.R. Barr, B.Ag.Sc.
	L. Nitschke, B.Ag.Sc.
TECHNICAL OFFICERS:	R.J. Puckridge, R.D.A.
	(Miss) C.F. Twigger, R.D.A.
	R.D. Wheeler, B.Ag.Sc.
FIELD ASSISTANTS:	S.G. Cornish
	M.R. Schubert
	N.H. Steinborner

Recent Developments:

1. Personnel

Mr. R.D. Wheeler was appointed as a Technical Officer in the Barley Section of the programme in November 1977, filling the position vacated by Mr. I.W. Magarey in March 1977.

2. Varietal evaluation programme

The field trials in this programme continued at about the same level as in previous years. Because of the poor seasonal conditions at a number of sites several trials were not harvested while others provided information of doubtful use.

Halberd proved to be the outstanding commercial variety in the wheat trials. A number of crossbreds and particularly three from the Waite Institute programme outyielded Halberd over a range of sites. Of the soft varieties Tincurrin proved best of the named varieties though a crossbred MKR 1/10 from the Waite Institute was consistently higher yielding.

In the barley trials Weeah once again proved superior to Clipper at the majority of sites with an average yield advantage of 6%. Corvette, the blue grained feed variety returned very variable yields and showed no consistent yield advantage over Clipper. W.I. 2468 and W.I. 2477 once again yielded extremely well. A pleasing feature of the former is the stability of its performance across a wide range of environments. Preliminary tests indicate that malting quality may be acceptable.

The methods of quantitative assessment of crop disease used by FAO and adapted by A. Mayfield were used to estimate leaf scald (Rhyncosporium secalis) and powdery mildew (Erysiphe graminis hordei) in variety trials.

The leaf scald resistant Clipper-type lines developed by Dr. S.M. Ali were sown at Turretfield in 1977 to build up seed and obtain preliminary information on plant type, maturity and disease reaction.

West was again the outstanding variety in the oat variety trials. However the susceptibility of this variety to eelworm (Heterodera avenae) is a cause for concern.

Yield results obtained with a range of triticale lines were extremely variable. Few of the lines outyielded wheat or barley. Some of the lines recently obtained from Professor C. Driscoll gave more promise on the acid sands of Eyre Peninsula.

Seasonal conditions experienced in the 1977 season proved disastrous for the grain legume evaluation programme. This was particularly so for lupins and to a lesser extent for chickpeas.

Peas, lupins and chickpeas were included in trials at 9 sites; less than half the trial sowings were harvested. It had been initially assumed that chickpeas would yield relatively well under the dry conditions experienced. This was not the case and in fact, at not site did chickpeas show a distinct yield advantage over field peas.

3. Oat breeding programme

The oat breeding programme initiated in March 1977 has progressed to the stage where duplicate F2 nurseries have been sown at two sites in 1978. There are approximately 80 crosses between adapted lines and introduced germ-plasm with high oil content/stem rust resistance/improved plant type/high protein/tolerance to manganese deficiency and hopefully higher yield potential.

Some of the features of the past year were:-

* The incorporation of Heterodera avenae resistance in West has progressed to B.C.1.

* An oat rust survey involving 80 samples was typed by Sydney University. All isolates were stem rust (Puccinia graminis f sp. avenae). The six races identified were relatively simple.

* Oats were introduced from the Iowa, Minnesota and Winnipeg breeding programmes for use on parental material.

4. Pea breeding

A pea evaluation and breeding programme is being carried on in association with Dr. M. Ali of Plant Pathology Section. A number of important advances have been made in the past 12 months, including:-

* Introduction of world collection of 1000 pea lines and growing of 383 of these on a trellis at T.R.C. to enable evaluation of their agronomic characteristics.

* A survey of the pea growing areas of the State to enable identification of diseases present.

* Initial crossing of leafless and semi-leafless types with Early Dun, Pennant, White Brunswick, Small Sieve Freezer and Rovar.

* The discovery of five sources of resistance to the "black spot" disease complex and the crossing of these lines with Early Dun, White Brunswick and Pennant.

5. Direct drilling

Direct drilling with a triple disc drill showed itself to be comparable to conventional crop establishment on sandy soils. However on the heavier soils at Minnipa and Karkoo yields from conventional crop were higher. Yields overall on the latter two sites were low.

6. Rotations

The year saw the start of a large rotation trial at Wanilla which will look at continuous cropping with lupins in various rotations with cereals and oilseeds. An adjacent identical direct drilled trial showed that cereals and lupins can be established as effectively by this method although insect pests may pose more problems in direct drilled lupins.

7. Weed control

Weed research continued with minor programmes on red brome grass and ice-plant on Eyre Peninsula. Investigations on the former indicated that germination continues until late July while a water extractable sub-

stance in the seed heads, but not stems or leaves of ice-plant was shown to inhibit germination and early growth of medics and cereals in the laboratory.

Conferences, Training Schools:

* New Zealand Weed and Pest Control Conference, Wellington, N.Z. August 1977. M.J. Catt (privately).

* International Conference on Energy Conservation in Crop Production. Massey University, N.Z. August 1977. M.J. Catt (privately).

* Australian Rapeseed Agronomists and Breeders Workshop. Perth, W.A. September 1977. T.G. Heard.

* Australian Cereal Agronomy Conference. Perth, W.A. October 1977. T.G. Heard.

* Study Tour of Victorian and Southern New South Wales. October 1977. A.R. Barr.

* Barley Improvement Technical Committee Symposium. Adelaide, November 1977. A.R. Barr, T.G. Heard.

* R.A.C.I. Cereal Chemistry Division, Annual Conference. Organising Committee Adelaide. December 1977. T.G. Heard.

* Assembly of Wheat Breeding Society of Australia. Roseworthy, S.A. February 1978. T.G. Heard, R.J. Puckridge, R.D. Wheeler.

* In-Service Training Course - Communications 1. February 1978. M.R. Schubert, C.F. Twigger, R.D. Wheeler.

* Council of Australian Weed Science Societies Conference. Melbourne, Victoria. April 1978. M.J. Catt (privately).

* S.A.D.A.F. Scientific Writing School. Adelaide, June 1978. T.G. Heard.

Major Research Projects:

* Wheat cultivar and crossbred evaluation.

* Barley cultivar and crossbred evaluation.

* Oat cultivar and crossbred evaluation.

* Triticale evaluation.

* Grain legume evaluation.

* Breeding of oat cultivars for South Australia.

* Direct drilling of crops on Eyre Peninsula.

* Examination of continuous cropping rotations on Lower Eyre Peninsula.

* Weed control in cereals.

* Pea breeding.

Publications:

Catt, M.J. and Dickinson, J.A. - The use of herbicides in minimum tillage cereal cropping. Proc. Int. Conf. on Energy Cons. in Crop Production, Massey University, 1977.

Catt, M.J. - Cereal Weed Spraying Guide 1978. S.A. Department of Agriculture and Fisheries.

Catt, M.J. - A researcher's view of what direct drilling offers the farmers. Proc. Regional Conference on Minimum Cultivation. I.C.I. 1978.

Heard, T.G. - Wheat variety recommendations 1978. S.A. Department of Agriculture and Fisheries Fact Sheet 136/77.

Barr, A.R. - Barley variety recommendations for 1978. S.A. Department of Agriculture and Fisheries Fact Sheet 150/77.

Barr, A.R. - Oat variety recommendations for 1978. S.A. Department of Agriculture and Fisheries Fact Sheet 153/77.

Ali, M., Nitschke, L., Dube, A., Krause, M. and Cameron, B. - Selection of pea lines for resistance to pathotypes of Ascochyta pinodes, Ascochyta pisi and Phoma medicaginis var pinodella. Australian Journal of Agricultural Research (in press).

Barr, A.R. - Weed control in wheat and barley variety evaluation trials. Australian Field Crops Newsletter No. 13.

Barr, A.R. - Oat breeding in South Australia. Australian Plant Breeding and Genetics Newsletter No. 28.

Barr, A.R. and McLoud, P. - The use of check plots in the 1975 and 1976 barley variety evaluation trials. Australian Plant Breeding and Genetics Newsletter No. 28.

PLANT PATHOLOGY SECTION

SECTION LEADER:	A.J. Dube, B.Ag.Sc. (Hons), Ph.D.
RESEARCH OFFICERS:	S.M. Alid, B.Ag., M.Sc., Ph.D.
	A.H. Mayfield, B.Ag.Sc.
	A.C. McKay, B.Ag.Sc.
LABORATORY OFFICERS:	C.J. Wilmshurst
	D.J. Richards, B.Ag.Sc.
	D.L. Caird
TECHNICAL OFFICERS:	R.A. Short (Seconded to Libya)
	A. Lush (Vice Short)

PLANT PATHOLOGY SECTION

Some success has been achieved in attracting funds from outside the Department this year. Funds from Australian Meat Research Committee have allowed the appointment of a research officer and an assistant for 3 years. A grant from Rural Credits has allowed the appointment of an assistant to the pea disease resistance breeding programme for 3 years.

Annual Ryegrass Toxicity:

This year's project was to monitor the movement of the nematode (*Anguina funesta*) into Annual Ryegrass and the development of nematode and bacterially infected nematode galls during the season. Preliminary studies were commenced on the evaluation of herbicides in mixed pastures to encourage the development of subterranean clover.

The movement of the nematode is being studied in the field at 4 sites and laboratory techniques have been developed which quickly and accurately assess the numbers of nematodes in plants prior to gall formation. The herbicides Hoe 23408 and Paraquat are being assessed at 2 sites and at different times of application.

Pea Disease Resistance Breeding And Pea Breeding Project:

The objectives of the project are threefold:-

(i) To incorporate adequate source of specific resistance genese against *Ascochyta* complex into selected field and processing pea cultivars through appropriate breeding method.

(ii) Development of leafless and semi-leafless field as well as processing peas.

(iii) Development of new pea cultivars resistant to *Ascochyta* complex along with commercially desirable characteristics such as higher yield and protein content, improved seed quality. It is envisaged that such cultivars, when developed, will replace the existing field peas of South Australia.

Progress In Relation To Each Objective:

(i) Breeding for "black-spot" resistant pea cultivars:

A collection of 1 000 pea lines was screened against 45 isolates of *Ascochyta pinodes*, *Ascochyta pisi* and *Phoma medicaginis* var. *pinodella* in the glasshouse. The above three pathogens are responsible for the black-spot diseases of peas.

Adequate sources of resistance were identified against all the isolates in five unadapted pea lines. The five resistant lines were crossed, in all combinations, with five adapted commercial pea cultivars to transfer resistance genes into adapted cultivars. The F_2 seedlings are in the process of screening against most pathogenic isolates of three pathogens to study the inheritance of resistance and select resistant progeny.

(ii) Two mutant lines were acquired from John Innes Institute, Norwich, U.K., for crossing with five local cultivars to develop leafless and semi-leafless types of peas. The F_2's deriving from these crosses were planted in June 1978, at 50 cm spacings along one side of parallel wire netting trellises 5 m apart at Turretfield Research Centre. 150 agronomically suitable leafless and semi-leafless peas were selected for further breeding.

(iii) Development of new pea cultivars:

The grain yield, seed protein content and agronomic potential of 378 introduced pea lines and five South Australian pea cultivars were investigated in the field during 1977. Five high yielding lines were found with more seeds per pod and pods and flowering nodes per plant than the presently grown pea cultivars. Seed protein percentage of one such line was higher than any commercial cultivar. These lines will be used in crossing with local cultivars. These five lines offer the potential of the much needed reservoir of genotypic variation in a pea breeding programme in South Australia.

Barley Leaf Scald:

Barley leaf scald resistant lines

Thirty scald resistant barley lines containing eight groups, each carrying different combinations of scald resistance genes, were given to the Crop Agronomy Section for field evaluation. These lines were derived from the backcross breeding programme initiated in 1973 and had been back-crossed to Clipper up to four times.

Effects of scald disease on yield of barley

Effects of scald disease on growth and development of barley were studied using controlled environmental conditions. Inoculations at early as well as later growth stages reduced yield of grain. These, and results of field trials, indicate that estimates of disease should be made at early as well as later stages of growth when relating severity of scald disease to losses in yield of grain.

Control Of Powdery Mildew Of Barley:

Fungicides for control of powdery mildew disease of barley continue to be tested in field trials in Warooka and Millicent districts. Seed treatments and foliar sprays reduced the amount of disease and, in some trials, increased yield of grain. Trials are continuing; emphasis of testing is on fungicides which are effective as seed-treatments against powdery mildew and smut diseases.

Smuticide Evaluation:

Smuticide evaluation continued using regression analysis to define dosage response curves. Furvax and KWG0519 appeared to be the most active new chemicals in controlling loose and covered smuts of wheat and barley.

Cereal Eelworm:

Resistance screening

Screening Clipper backcrosses to various sources of resistance is continuing, the third backcross to Clipper has been screened. Wheat from Roseworthy and Waite Institute breeding programmes was commenced. Screening has also commenced for the backcrossing of cereal eelworm resistance into West oats.

Chemical control

Trials continued to study the possibilities and problems associated with chemical control of cereal eelworm effects on cereals. Nemagon was efficacious in controlling cereal eelworm on wheat, barley and oats. Plant emergence counts showed no deleterious effects on Nemagon. Out of the eleven trials where yields were taken the nematicide produced a significant response in seven. The largest response (at 6 l/ha(was 79% in wheat.

Scientific Publications:

Ali, S.M., Nitschke, L.F., Dube, A.J., Krause, M.R. and Cameron, B. - Selection of pea lines for resistance to pathotypes of Ascochyta pinodes, A. pisi and Phoma medicaginis var pinodella. Aust. J. Agric. Res. 1978, 29: 841-849.

Randles, J.W. and Dube, A.J. - Three seedborne pathogens isolated from Vicia faba seed imported from United Kingdom. Aust. Plant Pathology Society Newsletter 1977, 6: 37-38.

Conference Papers:

Ali, S.M., Nitschke, L.F. and Dube, A.J. - Reaction of pea lines to pathotypes of Ascochyta pinodes, A. pisi and Phoma medicaginis var. pinodella. Third National Plant Pathology Conference, May 1978.

Ali, S.M. and Dube, A.J. - Pea disease resistance breeding in plant breeding for resistance. Third National Plant Pathology Conference, May 1978.

Mayfield, A.H. and Clare, B.G. - Effects of stubble removal on levels of scald disease in barley crops. Third National Plant Pathology Conference, Melbourne, May 1978.

Mayfield, A.H. and Clare, B.G. - A comparison between single-tiller and plot methods for estimating losses in yield of barley with leaf scald disease. A.P.P.S. Workshop on Epidemiology and Crop Loss Assessment, Lincoln, N.Z. 1978.

Extension Publications:

Mayfield, A.H. and Short, R. - Wheat stem rust strains in South Australia, 1976. Technote 9/77.

Mayfield, A.H. - Stem rust of wheat. Fact Sheet 43/77.

Beale, P. and Dube, A.J. - Control of clover scorch. Fact Sheet 134/77.

Dube, A. - Identifying Annual Ryegrass Toxicity. Insert to Fact Sheet 91/77.

Dube, A. - Cereal smuticides 1978/79 treatment season. Fact Sheet 62/78.

WEEDS RESEARCH SECTION

SECTION LEADER:	P.M. Kloot, M.Ag.Sc.
RESEARCH OFFICER:	Vacant
WEEDS RESEARCH AGRONOMIST:	D.I. Murrie, R.D.A. Seconded from Plant Protection Section.
FIELD ASSISTANT:	D. Carter

WEEDS RESEARCH SECTION

The Weed Research Section was formed at the beginning of the year from the remaining members of the Research Group of the former Weeds Section. The nucleus consisted of P.M. Kloot and D. Carter. Immediately, D.I. Murrie was seconded from the Plant Protection Group to assist the activities of the Section. The position of a Research Officer was approved on the 1977/78 Manpower Budget, but the position was not filled during the year. This has meant that our programme, particularly in research has not been developed to the full, a situation that we hope will be alleviated in the coming year.

The aims and objectives of the new Section were approved at the October meeting of the Branch Senior Officers. The specific aims and objectives are listed hereunder:-

* To initiate and carry out research work on the biology and control of weeds and to study the place of weedy plants in our farming systems.

* To co-ordinate routine herbicide screening by plant protection agronomists and other agronomy research officers as part of their general research work.

* To provide technical advice to Departmental officers required in the execution of their work.

* To be responsible for technical assessments of herbicide labels.

* To be responsible for the planning and provision of training courses concerned with weeds, arranged by the Department of Further Education.

* To maintain liaison with interstate and local weeds research organisations and personnel and to maintain a flow to relevant information to other Departmental officers.

* To maintain liaison with research and development officers in industry, to advise in the planning of development programmes when requested and to maintain a flow of relevant information to other Departmental officers.

* To maintain and expand a reference library of slides of weeds, weedy situations and similar matters.

Research Activities:

The main projects are those associated with the part-time Ph.D. studies of Kloot. During the year a Census of Alien Plants was completed and this is being prepared for computer storage. Associated with this is a computer listing of all botanical synonyms under which alien plants were introduced or erroneously identified in South Australia. This will assist greatly in the interpretation of old horticultural and agricultural literature which in turn will throw more light on the origins of our weeds.

A preliminary survey of medic-based pastures in the Lower North last spring suggested major differences in the proportions of medic, soursob and ryegrass that were dependent on soil type. Furthermore the data revealed an inverse correlation between levels of soil nitrogen, phosphorus and potassium and the proportion of capeweed. If this result is confirmed it would be completely contrary to the positive relationship found elsewhere between soil fertility and capeweed on acid soils. It would also suggest that extrapolations from the behaviour of sub. clover pastures on acid soils to medic based pastures on alkaline soils could be completely erroneous.

The programme of studies in progress is as follows:-

* C4/A14 Factors affecting the composition of medic pastures.

* C4/A15 Long term management effects on pasture composition.

* C4/A17 The compostion of pastures in the Lower North.

* C5/A15 Comparative phenological studies of alien plants.

Other research activities of the section include:-

Bracken control with asulam

Trials at Lenswood indicate that the addition of 10% distillate to asulam greatly increases its efficacy. Herbicide rates may be reduced from 12 l/ha to 8 l/ha and treatment may be advanced to March in place of May/June. Observations are continuing.

Cultural and chemical control of cut-leaf mignonette

An attempt to use "spray-graze" on this weed at four sites on Yorke Peninsula was largely unsuccessful due to the extremely dry summer and autumn. A preliminary assessment of herbicides at Templars showed that the low-volatile formulation of 2,4-D (LV57 (R)) and Amine MCPA were most effective. The drought also interfered with this work and further screening will continue in the next year.

Control of soldier thistle in crops and pasture

Work at Georgetown showed soldier thistle to be quite sensitive to low rates of a number of herbicides if applied at the seedling stage. An interesting observation was that during 1977, in spite of favourable rains falling after the initial germination, no further germinations were observed. Work will continue in the next year.

Other

Weeds research of the Agronomy Branch carried out in the South East region by K.R. Smith and on Eyre Peninsula by M.J. Catt and J.A. Dickinson is also under the oversight of the Section. Assistance in planning the work, obtaining materials and assessing results is provided as required. Friendly and close co-operation has been found at all times.

Technical Advisory Service:

Constant enquiries regarding the management of weeds in experimental work being carried out by other Departmental officers, are dealt with. It is noticeable that the management of weeds is being considered much more seriously in the planning of experiments than was the case hitherto.

Considerable assistance is given to industry research personnel in the planning of their experiments. The close liaison is most gratifying and a continual flow of information exists.

Enquiries on different facets of weeds and their control have also been handled from interstate and overseas.

Technical advice is provided to other groups within the Department, the Pest Plant Commission and outside bodies which assists in policy formulation on various issues by the respective bodies.

Herbicide Registration:

The technical assessment of herbicide labels submitted for registration and the evaluation of herbicide clearance through the Technical Committees on Agricultural Chemicals is an important contribution of the Section made through the Principal Officer - Agricultural Chemicals (B.D. Robinson). Continuing trends show a decrease in registration assessments and an increase in TCAC clearances over the last few years as shown in the following table:-

Year ended June 30	1976	1977	1978
Registrations assessed	121	95	87
TCAC submissions	11	15	18

Cereal Herbicide Evaluation Scheme:

This scheme commenced during the year under review. It arose from uncertainty about the tolerance of difference cereal cultivars to herbicides, particularly dicamba. As finally developed, the scheme consists of long weed-free plots of a number of current and newly developed cultivars of wheat, barley and oats. Chemical companies have access to strips across the varieties to test the tolerance of the range of cultivars to their herbicides. This year a total of 28 cultivars will be sown at Turretfield Research Centre. A total of 105 strips at $20 each have been sold. The scheme has been warmly welcomed by industry and initial demand was much greater than expected. All companies have foreshadowed an even greater involvement in the future.

Education:

The Section continues to have heavy responsibilities in this field Kloot, as Departmental Convenor of the Weed Officers' Certificate run by the Department of Further Education has been involved in further revision and re-arrangement of the course. He has also given most lectures, although Murrie has also lectured and specialist lectures were drawn from Horticulture Branch and the Pest Plants Commission. Carter assisted at most sessions.

Murrie was responsible for the preparation of almost the entire external studies course. This took much of his time during the year, but the matter was accorded highest priority in accordance with instructions. Some further revision and re-arrangement of the external studies course will still be required, but this will be a minor workload compared to the past year.

Kloot and Carter continued to give a short course on "weeds" for the Certificate in Horticulture (Amenity) also run by the Department of Further Education.

Committees, Conferences And Study Tours:

In 1977 Murrie attended the annual Australian Weeds Committee meeting at Orange. This was as a result of previous arrangements which were changed with the establishment of the Section only a week or so before the meeting. Kloot attended the 1978 meeting as the South Australian delegate and is presently the Chairman of the Committee. Murrie continues to represent this State on the Inter-governmental Liaison Committee on Water Hyacinth which met once during the year. The meetings, conferences etc. attended were as follows:-

1977

July 4-8: Australian Weeds Committee - Orange (Murrie).

August 24-25: Agronomy Branch Conference - Waite Institute (Kloot).

December 6: Prison Officers' Seminar on Horticulture - Yatala Gaol (Kloot).

1978

January 23-26: Study tour - National Herbarium - Melbourne (Kloot).

March 7: Minimum Tillage Seminar - Roseworthy (Murrie).

April 12-14: First Conference of the Australian Weed Science Societies - Melbourne (Murrie).

April 18-19: Local Government Weeds Officers' Conference - Walkerville (Murrie).

May 31 - June 2: Intergovernmental Liaison Committee on Water Hyacinth - Moree (Murrie).

June 20-22: Australian Weeds Committee - Canberra (Kloot).

Publications:

Kloot, P.M. (1977) - Herbicides - A guide to their availability and use in South Australia. S.A. Department of Agriculture and Fisheries Mimeo. 13 pp.

Kloot, P.M. and Smith, K.R. (1978) - Chemical control of annual weeds in lucerne in the Upper South East. Agric. Rec. 4: 52-53.

O'Neil, J.M. and Kloot, P.M. (1977) - Herbicides for use in home gardens in South Australia - Section 6 of "Herbicides for Weed Control 1977/78" Department of Agriculture and Fisheries, South Australia.

Smith, K.R. and Kloot, P.M. (1977) - Herbicides for pasture weed control in South Australia - Section 3 of "Herbicides for Weed Control 1977/78" Department of Agriculture and Fisheries, South Australia.

Smith, K.R., Simons, I.H. and Kloot, P.M. (1978) - A guide to herbicides for weed control in lucerne seed crops. Department of Agriculture and Fisheries, South Australia Fact Sheet 3/78.

Smith, K.R., Simons, I.H. and Kloot, P.M. (1978) - A guide to herbicides for weed control in annual medic and subterranean clover seed crops. Department of Agriculture and Fisheries, South Australia Fact Sheet 4/78.

Smith, K.R., Simons, I.H. and Kloot, P.M. (1978) - A guide to herbicides for weed control in perennial grass seed crops. Department of Agriculture and Fisheries, South Australia Fact Sheet 5/78.

ENTOMOLOGY SECTION

SECTION LEADER:	P.R. Birks, M.Ag.Sc.
RESEARCH OFFICERS:	P.G. Allen, M.Ag.Sc.
	D.C. Hopkins, M.Ag.Sc.
	D.E. Swincer, B.Ag.Sc. (Hons.) Seconded to Aphid Task Force
TECHNICAL OFFICERS:	C. Phillips, R.D.A.
	I.J. McFarland, R.D.A. Seconded to Aphid Task Force
TECHNICAL ASSISTANTS:	G.S. Dearman
	K.R. Henry

Entomology Section

Another outbreak of plague locust occurred in the Crystal Brook, Jamestown to Wilmington and Quorn area during the spring and summer of 1977-78. Hatchings within the agricultural areas were successfully controlled.

At the same time there was an unusually large outbreak of climbing cutworm, *Heliothis punctigera* which highlighted three problem situations.

Firstly the insecticides which have been tested and developed as alternatives to DDT against *Heliothis* is peas proved to be quite unsatisfactory and it was necessary to revert to the DDT recommendation.

Secondly the substantial increase in production during the last two years of crops such as sunflowers, rapeseed and lupins, which are susceptible to *Heliothis* attack has doubled the potential useage of DDT despite the development of alternatives to DDT for most other pests.

Thirdly the increased use of DDT resulted in an increased incidence of pesticide residues in agricultural produce. Although the levels detected were almost all below maximum residue limits, the declining incidence of recent years was interrupted with a return to levels found in 1970/71.

No progress towards the solutions to these problems was possible because of the locust and the pasture legume aphid crises.

Plague Locusts

The section continued its role in monitoring and coordinating the control of plague locusts under the terms of the Noxious Insects Act 1934-1955.

During the spring of 1977 plague locusts hatched in the Southern Flinders Ranges in an area between Crystal Brook and Quorn. Smaller hatchings also occurred in the Mt. Pleasant, Gumeracha and Barossa District Council areas.

Landowners sprayed approx. 12,500 ha in the Southern Flinders area using insecticide supplied free of charge by the State Government. Additional assistance to landowners and Councils was given in surveys the supply and service of ULV misters, and advisory help.

The spraying by landowners reduced hopper numbers so that they caused little important damage, but some swarms developed and they migrated to the north and the east, congregating in the Quorn, Wilmington, Melrose and Jamestown areas during late November and December.

Unusually high rainfall occurred in late November (up to 280 mm) and this provided suitable conditions for sexual maturation and egglaying during late December.

Farmers controlled hatchings in the Jamestown to Caltowie area during January, but in the Wilmington to Quorn area numerous scattered

hopper bands in generally rough terrain remained untreated. Dense hatchings also occurred on Yadlamulka Station and six square kilometers was sprayed by aircraft on 25th January.

During late January and early February light to medium density swarms drifted southwards onto lucerne at Melrose and Wirrabara causing severe damage. Some landowners used ULV misters to protect their lucerne.

Very dry weather occurred during February and March and the swarms gradually dispersed and the locusts died with little or no egglaying.

A total of 15,000 hectares was sprayed 12,500 hectares in the spring and 2,500 hectares including the aerial spraying, during the summer. Officers of Plant Pathology, Bushfires Research, Pasture Research and Plant Protection Sections as well as the District Agronomist, Jamestown were involved.

Costs also involved $58,000 worth of insecticide and $1,200 for aerial spraying.

Although serious pasture loss was averted during the spring, lucerne fodder and seed losses between October and March may have been as high as $300,000. Prevailing drought conditions make the loss more serious.

Regular information on locust activity has been provided to the Australian Plague Locust Commission for collation with information from the Eastern States. Insecticide and a ULV mister were supplied in spring to Wompinie Station, Mingary to help combat an outbreak localised in that area. With the establishment of a base at Broken Hill during the year, the Plague Locust Commission took over control and sprayed a further 2000 ha. Subsequently they have undertaken regular surveys in the Far North and North East areas of the State.

Pasture Cockchafer

The grazing experiment at Mundulla, 1977, differed in design from previous experiments studying pasture losses due to pasture cockchafer larvae. This different design appeared to offer a more reliable and less expensive method.

An area 100 m x 100 m, of naturally infested pasture was fenced and measured into 400 equal sub-areas. The area was stocked with sheep at a stocking rate equivalent to the average for the district. The sheep were allowed to free-graze the sub-areas.

At the beginning of the experiment, the density of larvae in each sub-area was estimated by counting the larvae in one soil core, 108 cm^2 in area, taken at random in each sub-area. The larvae were mainly in the mid to late-second instar. Five sub-areas were sprayed with lindane.

The available pasture dry matter (DM) in each sub-area was estimated at the beginning of the experiment and a number of times during the experiment, especially when differences became apparent. Visual

assessment, which ranked the available pasture on a nine-point scale, was used by at least three independent observers each time. The visual assessments were quantified by using a regression of ten measured dry weights of pasture per sampling area against the visual assessment ranking for the ten respective dry weights.

The data was analysed with regressions of the available pasture DM compared to the initial larval densities for each sub-area, at different times of the year.

The regressions were significant and showed a decrease in available pasture DM with increasing densities of larvae. However, the negative slope of the regressions were less than expected and this appeared to be due to the relatively low mean density of larvae (200/m^2) in the site. There were not many sub-areas with very high densities of larvae and it appeared that the regression was weighted by the majority of sub-areas which had minimal pasture losses caused by low densities of larvae.

Future experiments should be carried out using sites where there is a greater number of sub-areas having more heavily infested pasture.

A sequential decision plan to determine whether pasture cockchafer infestations were economic to treat was prepared for the Plant Protection Advisers to test in the field.

Integrated Control of Lucerne Aphids in Dry-land Lucerne

An experiment is being conducted at Culburra to measure the impact of spotted alfalfa aphid (SAA) and blue-green aphid (BGA) on dryland Hunter River lucerne grown on sand, and to develop control programmes for these aphids when the lucerne is grazed by livestock.

The experiment is based on a six-paddock system, where paddocks are grazed for one week then rested for five weeks. The four treatments in the experiment are no insecticide, and treating with insecticide when there is an average of 40-60 aphids per stem of lucerne, 180-200 aphids per stem of lucerne and when the first leaves begin to drop from the lucerne due to aphid damage, respectively.

Regular monitoring of aphid density, aphid flight, native predators, meteorological parameters at the site, and available lucerne dry matter was carried out. Also, lucerne plant densities and root reserves were measured periodically. In late-autumn, the introduced parasite, *Trioxys complanatus*, was releated at the site.

SAA was the only aphid present at the site in the period covered by this report.

Data from the experiment indicated that:

- native predators did not significantly reduce SAA densities.
- lower rates of application of demeton-s-methyl (37.5 g/ha a.i.) were as effective (95% control) as higher rates (70 g/ha a.i.).

- the only increases in yield of lucerne dry matter or in the level of lucerne root reserves occurred in the treatment where SAA were not allowed to increase above 40-60 per stem of lucerne.

- rotational grazing and stategic use of insecticide, especially within about two to three weeks of grazing, could be used to economically control aphids in dryland Hunter River lucerne.

- the intensity of grazing with livestock was important in controlling aphids. The greatest reduction in the numbers of SAA, in excess of 90%, only occurred when lucerne was grazed very hard, such that there was virtually no green lucerne remaining. With less intensive grazing, the reduction in numbers was variable and ranged from about 50% to in excess of 95%.

The data on aphid densities was remarkably consistent and is being used to develop a predictive model based on accumulative day degrees. Such a model should indicate how often a landowner may need to apply insecticide during the spring, summer and autumn period in the absence of *Trioxys*. *Trioxys* is established throughout the dryland lucerne in the Upper South East, hence, this estimate should be an over-estimate.

From this experiment together with landowner experience, a fact sheet has been written outlining the principles governing the build-up of aphids and management techniques that can be used to maintain an acceptable productivity of dryland Hunter River lucerne by controlling aphids to a reasonable level.

The experiment will be continued next year to measure the impact of *Trioxys* and other introduced parasites on the system, as well as B.G.A. This should lead to an integrated control programme for SAA and BGA in dryland Hunter River lucerne.

Dung Beetles

Euoniticellus intermedius adults were found at Cootabarlow No. 3 Bore, Frome Downs Station, in April, 1978. The closest release site of this species was on Moolawantana Station, 70 km NW, in February, 1974. Since the release, there were two very wet years followed by two very dry years. *E. intermedius* has also spread from southern Northern Territory to Mt. Willoughby Station in South Australia. These findings are encouraging for *E. intermedius* in our pastoral areas.

Onthophagus taurus was released at Minnipa in December, 1977, and April and May, 1978.

The numbers of native dung beetles trapped at Turretfield and near Port Lincoln were very low during 1977/78. This was due to the exceptionally dry summer. This trapping programme will continue through the next year.

Cereal Curculio

Pirimiphos-ethyl, isofenphos and Miral^{R} seed dressings did not

provide any better protection to cereals from cereal curculio than the currently recommended chlorpyrifos powdered seed dressing in an experiment at Turretfield. Field experience has shown that the chlorpyrifos treatment is not completely satisfactory with the very heavy densities of cereal curculio larvae. The above insecticides are not expected to be any better.

The failure with high densities of larvae may be due to the high number of larvae relative to the number of cereal seeds, and that larvae may eat out at least one seed before they die from insecticidal poisoning. The insecticide treatments will give an excess of 80% control of larvae, yet there is poor plant emergence.

For these reasons, an experiment has been initiated at Turretfield to test different rates of application of chlorpyrifos to seed and different rates of sowing of the seed. Also, liquid seed dressings, which are more easily applied and cheaper than powder seed dressings, are being evaluated.

Sitona weevil

For the 3rd consecutive year, seasonal conditions during 1977 were unfavourable for both medics and sitona weevil. Drought conditions prevailed over most of the State for the whole year, medic pastures generally were very poor and hence sitona weevil numbers did not increase markedly from the low numbers of the past two years.

Population Studies

In late June 1977, it was decided that the normal trial site at Brentwood would be unsatisfactory for this season (poor medics and low sitona numbers) and an alternative site was selected at Urania on Yorke Peninsula. This site had received sufficient rain to allow good germination and establishment of the medic pasture.

All stages of sitona were sampled at this site over a six month period beginning in July 1977. The sampling showed that sitona weevil can, given good medics, build up its numbers very quickly with an increase of about 150 fold being recorded.

It is possible for increases of a similar magnitude to occur over large areas of the State in a year when average or better than average autumn and winter rains lead to good medic pastures.

Parasites:

(a) Sitona Egg Wasp (*Patasson lameerei*)

Further supplies of *Patasson lameerei* collected in Greece were obtained from C.S.I.R.O. in June 1977 for multiplication and release. Multiplication progressed well for 3 generations and then the culture collapsed. The main problems were humidity control in culture containers and controlling the numbers and sex ratio of parasites in each container.

In the latter half of 1977, solutions to these problems were sought. A new culture container with a plaster of paris base and a vent in the lid for aeration was developed successfully to overcome the problem of humidity control and it was decided that all parasites should be handled individually so that numbers and sex ratios of parasites per container could be regulated.

The above problems severely retarded the release programme of this parasite and as a result it was released at only 1 site in 1977. A total of 4000 parasites were released at Urania (Yorke Peninsula) in early September 1977. The release site was sampled for sitona eggs on October 25th, 1977 but no parasites were recovered.

Laboratory stocks of this parasite were maintained over the 1977/78 summer period. The whole culture entered diapause in November, 1977 but no parasites emerged in autumn 1978.

Fresh laboratory stocks were received from C.S.I.R.O. in early May 1978 and cultures were restarted. Cultures progressed well and 4000 parasites were released at Urania in June, 1978. Further releases in 1978 were planned.

(b) Sitona adult wasp *(Microctonus aethiopoides)*

The first stocks of this parasite were received from C.S.I.R.O. in early June and July, 1977. It was cultured successfully with increases of 5-10 fold per generation.

Approximately 800 parasites were released at Urania in July, 1977 and a total of 1700 were released at Laura in late July and August, 1977.

The release site at Urania was sampled on August 1st, 1977 and parasitised weevils were recovered. A similar recovery was made at Laura on the 25th August, 1977 but no recovery was made on the 6th October, 1977 when this release site was re-sampled.

A field cage experiment at Urania from September 1977 until May 1978 showed that this parasite can survive South Australian summer conditions but until it has survived for a complete seasonal cycle in the field it cannot be assumed that it has established permanently. The 1977 release sites had not been checked for permanent establishment by 30th June 1978 because of the late start to the 1978 season.

The wide dispersal of sitona weevil adults during their spring and autumn flight is seen as a major hazard in establishing this parasite. The small numbers of parasites that are involved in initial releases become inactive diapausing larvae in the newly emerged weevils in spring. These weevils undergo strong flight activity in spring which eventually takes them to an over-summering shelter. In autumn, less obvious flights occur from these shelters back to feeding and egg laying sites. Both of these flights will disperse the parasites and if this dispersal is too extensive, the parasites may emerge from their hosts in autumn to resume activity but fail to find a mate.

Further stocks of this parasite were received from C.S.I.R.O. in late May, 1978. This material was combined with the parasites recovered from the field cage to restart cultures for the 1978 release programme. The first release of 400 mated female parasites was made at Northfield in June 1978 and other releases in the northern agricultural areas and on Eyre and Yorke Peninsulas were planned for later in the year.

Conferences, Training Schools, Study Leave

* Second Australasian Grassland Invertebrate Ecology Conference Palmerston North, New Zealand 22-26th May. P.R. Birks.

* Australian National Course on Mosquito Vector Control, Mildura. P.G. Allen.

* Review of Research/Extension needs of the mixed farming areas of South Australia. 24-25th August 1977. P.R. Birks, D.C. Hopkins.

* Regional Conference on Minimum Tillage, Roseworthy, P.G. Allen.

* Writing school, S.A.D.A.F. May 1978, D.C. Hopkins.

* Science Technician Certificate Course, K.R. Henry.

Committees

* 9th Entomology Committee of Standing Committee on Agriculture, Sydney, October 1977 - P.R. Birks (Chairman).

* Exotic Insects Subcommittee of Entomology Committee - P.R. Birks.

* Australian Plague Locust Commission, P.R. Birks.

* South Australian Grain Hygiene Committee - P.R. Birks.

* South Australian Advisory Committee on Australian Encephalitis - P.G. Allen.

* Torrens Island Mosquito Control Committee - P.G. Allen.

* Agronomy Branch Quarantine Committee - P.R. Birks

* Lucerne Aphid Task Force - D.E. Swincer

* Arid Zone Working Party - P.G. Allen

* Northfield Safety Committee - K.R. Henry

Major Research Projects

* Damage assessment of pasture cockchafer *(Aphodius tasmaniae)* in pasture - P.G. Allen, K.R. Henry.

* Release of introduced dung beetles in South Australia - P.G. Allen, K.R. Henry.

* Insect pests of germinating cereal crops - P.G. Allen, KR. Henry.

* The biology and ecology of sitona weevil. D.C. Hopkins, G.S. Dearman.

* Multiplication, release and evaluation of parasites of sitona weevil. D.C. Hopkins, G.S. Dearman.

* The development of integrated control of lucerne aphids in dryland grazing lucerne on the deep sands of the Upper South East. P.G. Allen, K.R. Henry.

* The incidence of stored product pests on farms and their resistance to insecticides - P.R. Birks, C. Phillips.

Extension Projects

Survey and control of Australian Plague locust - P.R. Birks, C. Phillips, A. Hincks.

Publications

Phillips, C. (1978). Summary of Crop and Pasture Pest Recommendations, 1978, Extension Bulletin.

Allen, P.G. (1978). "A study tour - management of insect pests in agronomic crops". Agron Branch Rep. No. 79.

Potter, JS., Blencowe, J.P., and Allen, P.G. (1977). "A case study of group learning - Pasture cockchafer at Pine Creek Valley". Focus on Extension, Dept. Agric. & Fish. S. Aust. No. 5 (77).

Birks, P.R. (1978). "Insect Migration". Proc. Second Australasian Grassland Invert. Ecol. Conf. 1978.

Hopkins. D.C. (1978). "Sitona Weevil". Fact Sheet S.A.D.A.F.

Hopkins. D.C. (1978). "Sitona egg wasp" Tech. Note S.A.D.A.F.

Extension Activities

Personal contacts

On farm visits	128
Rural group - meeting, field days	26
Office, laboratory, trial site visitors	60
Telephone enquiries	934
District Council visits	60
Specimen identifications	246

Mass media

News Items	10
Information publications	4
T.V., radio broadcasts	6

SEEDS SECTION

SECTION LEADER:	K.G. Boyce, M.Ag.Sc., Ph.D.
RESEARCH OFFICER:	C.M.J. Williams, B.Ag.Sc. (Hons.) S.E.R.H.Q., Struan.
SEED PRODUCTION ADVISERS:	Adelaide
	N.M. Brooks, R.D.A.
	G.E. Cooper
	C.A. Schubert
	Struan
	E.S. Hogg, R.D.A.
	P.D. Smith, R.D.A.
	I.H. Simons
TECHNICAL OFFICERS:	Ms A.M. Kelly
	Ms H.A. Lawrie
TECHNICAL ASSISTANTS:	Mrs. D.B. Keough
	Mrs. V.A. Wilks
	Ms A.M. Scanlan
	Mrs. D.J. Fraser
	Mrs. J.G. Pergoleto
	Mrs. N.T. O'Sullivan

SEEDS SECTION

The Seeds Section was formed in April by the amalgamation of Seed Physiology and Seed Production Sections in Agronomy Branch, and the Seed Testing Laboratory in Horticulture Branch. The Seeds Section now has responsibility for seed production research and extension, seed certification and seed analytical functions within the Department.

It is anticipated that this integration will lead to a greater flexibility and efficiency in seed services provided by the Department to Departmental personnel, the Seed Industry, the farming community and the public at large.

Staff:

Mr. Ron Kain retired as Senior Seed Analyst on 30th March, after 44 years in the Department.

On return from a consultancy in Thailand on June 14, Mr. D. Ragless transferred to Marketing and Economics Branch as a Market Development Officer.

Mr. E.S. Hogg transferred to Keith as Acting District Agronomist in September, 1977, but is expected to resume duties at Struan in September 1978.

Mr. W.O. Coleman another Seed Production Adviser at Struan retired on 30th April, after 13 years service and was replaced by Mr. P.D. Smith, a recently graduated diplomate from Roseworthy Agricultural College.

Mr. N.M. Brooks, Acting Seed Production Adviser in Adelaide during Mr. Ragless' leave, was transferred to the Plant Protection Section on 30th June.

Mrs. A. Ricci, seed analyst resigned on 19th August, and was replaced by Mrs. N.T. O'Sullivan.

Both Ms Scanlan and Mrs. Fraser sat for and gained their Australian Seed Testing Proficiency Certificate during the year.

Seed Research And Development:

The research and development involves generation of technical information relating to production, processing, storage and utilization of all types of seeds.

Investigations are in progress on herbage, cereal, grain legume, vegetable, flower and turf seeds.

Seed Production

Evaluation continued on the 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 continued with the development of preferred time of harvest of Seedmaster and Sirocco phalaris seed crops.

Development continued on the new methods for pre-harvest management of vegetable seed crops which are prone to loss due to seed shattering from the mature head.

Significant increases in seed yield and economic returns were possible by spraying the crop prior to harvest with a quick-drying glue. Development continued on the use of cheaper alternate glues, spraying methods and time of spraying in a number of crops, but particularly in onion and carrot seed crops.

Studies on time of harvest in onion seed crops was initiated and the use of growth retardants continued.

Seed Quality

Storage studies of a range of herbage grass and legume seed under warehouse conditions is continuing. Seed moisture and germination was assessed monthly. Results after two years of storage indicate that germination of all species at all warehouses has not changed significantly. However, moisture content of some lines, particularly grasses in the Lower South East reached high figures in the late winter - early spring period.

Studies on seed quality in lupin seed is continuing. The relationships between laboratory germination, field germination and plant establishment and individual plant seed yield were assessed.

Seed Physiology

Experiments are in progress to assess germination response to temperature of a range of annual medic species. Response to range of temperature and diurnal fluctuations was assessed on a two-dimensional thermogradient germination plate.

Studies were initiated on the seedcoat anatomy of seeds of the major annual medic and subterranean clover species using the scanning electron-microscope.

It is apparent from initial observations that in all species permability of the seedcoat to water is achieved by progressive widening of a field of fissures developed in the seedcoat radiating from the region of the chalza.

Research Projects

* Time of harvest studies for perennial grass seed crops - K.G. Boyce.

* Evaluation of seed production potential of foreign bred species - K.G. Boyce and C.M.J. Williams.

* Influence of temperature on seed germination - K.G. Boyce.

* Seed quality investigations with lupins - K.G. Boyce.

* Harvest studies on vegetable seeds - C.M.J. Williams.

* Storage studies with herbage seeds - K.G. Boyce, E.S. Hogg and G.E. Cooper.

* Long term storage studies with annual legume species - K.G. Boyce, E.J. Crawford.

* Anatomical studies on the seedcoat of annual pasture legumes - K.G. Boyce.

Seed Production:

The function of the seed production group is to assist the Seed Industry produce a quality product for both export and domestic market. This involves operation of the domestic and the OECD certification schemes. As well as these regulatory functions staff are heavily involved in extension activities both in seed production technology and in integration of seed production with the general farming system.

Production

Total production of certified seed was substantially less than the previous year due to drought conditions during most of the growing season; 1977/78 production was 1492.4 tonnes compared with 2040.8 tonnes the previous year. Notable decreases were in crops which are mainly grown in non-irrigable areas, particularly Jemalong barrel medic, Paragosa gama medic and all the subterranean clovers. Demeter tall fescue production was very low; only about one third of the 1976 production.

Increased production came from Hunter River lucerne, Marri and Uniharvest lupin, Avon, Cassia and Swan oats.

Average yields per hectare of all dry grown crops were down on the previous year, particularly Jemalong, Tornafield and Paragosa medics and Demeter tall fescue. Irrigated crops e.g. Paravivo lucerne, Sirocco phalaris, Harbinger medic and the two strawberry clover cultivars, had substantially higher yields per hectare.

Prices

Lack of supply of seed of most lines caused prices to rise substantially over that of the previous two seasons. Generally prices were from 30 to 50% higher with some lines double or more.

Despite the price increase supply of seed of all lines was almost exhausted by the end of June.

Certification programme

Total seed lines and area

Of 537 lines of seed assessed under certification for the season, 93 were rejected. This was less than the 94 rejected from 642 for the previous season.

A significantly high number of rejections or failure to meet seed standards continues in the oat cultivars (mainly wild oat contamination), Harbinger medic, Mount Barker and Trikkala sub. clovers and Demeter tall fescue (ryegrass contamination).

The total area of crops inspected for certification was 7415.4 hectares, about 30% down on the previous season. The rate of rejection was however only 2.6% compared with 4.1% in 1976/77.

New crops

A number of crops were certified for the domestic market for the first time. These were Sanza barrel, Saleğ disc, Paraponto and Sapo gama, and Sava and Sair snail medics. Esperance and Nungarin sub. clovers, Namoi woolly pod vetch, Sirolan phalaris, CUF 101 lucerne, Rovar peas and Ultra lupins.

O.E.C.D. Certification

The number and range of crops being produced under O.E.C.D. certification for re-export continued to increase from previous years. This trend is encouraging and indicates some success in penetrating the world seed trade.

Plot testing

Post control testing of grasses sown in 1975 was completed in 1978. All lines tested were accepted as true to variety.

Palestine and O'Connors strawberry clover lines being observed were also accepted as true to variety.

Annuals

282 lines of annual post control plots were sown and analysed, five failed to meet the required standard.

Grow-on testing (annuals)

Three lines of subterranean clover (Clare) were grown-on and subsequently accepted for certification.

Pre-certification testing of Hunter River lucerne

During 1978 fifty-eight lines of lucerne were accepted as being Hunter River. Another fifty one lines are under observation.

Luna lucerne

Three generations of this variety are being compared with the breeders line as spaced plants and the relevant information is being forwarded to the importers in Germany.

Lupins

All lines of lupins for certification were grown for identification and proved to be satisfactory.

Oats

All generations of Swan, Avon and Cassia oats were grown for identification as well as breeders West oats.

Breeders Currie cocksfoot

The breeders Currie cocksfoot stand has been maintained and approximately 30 kilograms of seed was harvested. 30 kilograms of breeders seed was sown in the South-East area.

Extension Programmes

Annual legume demonstration programme - N.M. Brooks

This programme was continued into 1978. Sites were harvested for seed yield data at maturity and at the "break" of the season. Selected sites were oversown with cereal to obtain comparisons in yield between different cultivars and sowing rates of annual medic.

WAITE CAMPUS LIBRARY
THE UNIVERSITY OF ADELAIDE

Maintaining field resistance to legume aphids of subterranean clovers and medics

Fourteen sites were sown to monitor the effect of aphids (Blue-Green Aphid and Spotted Alfalfa Aphid) on popular current cultivars, older less popular cultivars and newer cultivars.

Perennial legume pasture demonstration

A site at Murray Bridge (Monteith) was sown with five clovers for a comparison. The different cultivars were included as the white clover component in a perennial grass based mixture of a flood irrigated dairy pasture.

Tama ryegrass and Maral shaftal clover - sowings and performance "out of season" - N.M. Brooks and C.A. Schubert

Final production figures obtained confirmed that spring sowings are a worthwhile proposition under irrigated conditions of the above pasture mix.

The Seed Industry Newsletter published results progressively.

Field Days

The Seed Production Section was represented with the Seed Industry Association and the South Australian Seed Producers Association (now the Seed Section of U.F. & G.) at the Agricultural Field Days at Paskeville on August 16, 17 and 18, 1977.

Seed Industry Newsletter

Six Seed Industry Newsletters were published during the year with the co-operation of the Southern Division of the Seed Industry Association and the S.A. Seed Producers Association.

Seventy articles varying in nature from news items through reports, Industry comments, statistics and technical articles were published. Participation came from private growers. Industry representatives, seed companies and officers of the Department.

This venue for information exchange is now widely read both within South Australia and interstate and overseas with over 500 copies now being produced.

Dr. K. Boyce is the senior editor of the panel consisting of representatives of the Department, growers and marketers.

Seed Industry Working Party

This group comprising of representatives of all sides of the Seed Industry and the Department is the primary body for liaison on Seed Industry matters. The Working Party met six times during the year to formulate Industry policy on such matters as seed production of aphid resistant legumes, promotion of selected pasture cultivars, development and promotion of publications and development of new Seeds Legislation.

Current Projects

* Sirosa phalaris promotion
* Lucerne seed production under irrigation
* Medic seed production
* Costs of seed production
* Seed storage
* Promotion of certified seed

Seed Testing Laboratory

The main function of the seed testing laboratory is to test seeds for germination and assess samples for purity of both inert matter, other crop and weed seeds.

The laboratory also carried out other, more specific tests when required, conducts referee testing with the International Seed Testing Association (I.S.T.A.) and acts as a resource centre for seed identification.

Testing programme

The laboratory tested a total of 8031 seed samples despite the poor season. Quality assessments were made for germination potential, physical purity, weed seed content and seed identification. In addition, tests for moisture content, fluorescence hard seed and tetrazolium testing for the viability of seeds were carried out.

Samples were processed for Seed Certification, the Seed Industry, individual growers, Commonwealth quarantine, the State Seeds Act, Departmental research programmes and seed exporters. Work in co-operation with the I.S.T.A. on a referee purity and germination tests was also included.

With the exception of seed export and the Departmental programmes, sample numbers were well down from the previous season. Work for Departmental officers included the usual medics, lupins and cereals with a large increase in the numbers of vegetable and flower seed samples. These latter species also increased significantly in the Industry area.

A total of 1361 International Seed Lot Certificates were issued, an increase of 1123 on the previous year. These were required for overseas export of pasture grasses, vegetables, legumes and cereal seed.

Work in connection with the I.S.T.A. Bulking and Sampling Committee and the Pelleted Seeds Committee was continued.

To facilitate seed identification reorganisation of the crop and weed seed collection was started along with the addition of many new seed species received from overseas and interstate.

Specimens of both common and noxious weed seeds have been collected for preparation of specimen seed collections, to be presented to all South Australian Seed Cleaners and interested Departmental officers, sometime during the next season.

The Seed Testing staff again co-operated with the Seed Industry Association, the Seed Section of U.F.&G. and the Seed Production Section of the Department by preparing samples and weed seed displays for the annual field days held at Paskeville in August 1977.

Visitors:

Visitors to the Section came from Algeria, Federal Republic of West Germany, Phillipines, Portugal, Sweden, Spain, Sudan, Somlia, Losotho, Turkey, South Yemen, Tanzania and Pakistan.

Conferences:

Meeting in Melbourne in February, 1978.

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

Attended by Mr. R.M. Kain and Dr. K.G. Boyce.

Australian Seed Producers Conference, Wagga Wagga, N.S.W. attended by Dr. K.G. Boyce, September, 1977.

Lucerne Field Day, Numurkah, Victoria attended by Mr. G.E. Cooper, 12th April, 1978.

Paskerville Field Days, attended by Mr. C.A. Schuber, August 16, 17, and 18, 1977.

Publications:

Boyce, K.G. (1978) - "The significance of abnormal seedlings of lupin in the field". Aust. Seed Science Newsletter 4 (in press).

Brooks, N.M. (1978) - "Monitoring field resistance to legume aphids of subterranean clover and medics and annual pasture legume cultivar demonstrations". Agronomy Branch Report No. 99.

Coleman, W.A. and Patterson, A.J. (1978) - "Pasture Seed Production - a comparison of returns: 1978". Agronomy Branch Report No. 97.

Cooper, G.E. (1978) - "Seed Production Report for 1977". Agronomy Branch Report No. 90.

Fraser, D. (1978) - "Germination temperature for sub. clovers". Aust. Seed Science Newsletter 4 (in press).

Simons, I. (1978) - "Demeter tall fescue - a profitable seed crop". Fact Sheet 49/78.

Smith, K., Simons, I. and Kloot, P. (1978) - "A guide to herbicides for weed control in lucerne seed crops". Fact Sheet No. 3/78.

Smith, K., Simons, I. and Kloot, P. (1978) - "A guide to herbicides for weed control in annual medic and subterranean clover seed crops". Fact Sheet No. 4/78.

Wilks, V. (1978) - "Observations on mechanical damaged lupin seed in the laboratory". Aust. Seed Science Newsletter 4 (in press).

Williams, C.M.J. and Boyce, K.G. (1978) - "Wool and seed production from demeter tall fescue". Proc. Aust. Soc. Animals Production, 12: 217.

APHID CONTROL TASK FORCE

SECTION LEADER: E.D. Higgs, B.Ag.Sc.

Introduction:

Early in 1977 two aphids - the spotted alfalfa aphid (SAA) Theyioaphis trifotii (Monell) for maculata and the blue-green aphid (BGA) Acyrthosiphon kondoi Shinji invaded eastern Australia, became established and progressively spread over the agricultural and high rainfall grazing areas of eastern and southern Australia. Both were sufficiently well known in world agriculture for the serious threat they posed to our legume based farming systems to be appreciated to a degree which warranted the immediate initiation of a large scale multidiciplinaries control campaign. The principal initial control measures envisaged were:-

*Introduction, mass rearing and distribution of known parasites of the aphids.

*The use of insecticide as needed to retain existing stands of lucerne and other susceptible legumes until such time as biological controls could be more fully implemented.

*Encouragement of native predators by minimal use of selective aphicides.

*Selective introduction of lucerne seed of varieties resistant to both SAA and BGA through quarantine for seed multiplication in South Australia.

*Breeding lucerne, annual medics and if needed, other legumes with resistance to both aphids.

Ultimately the aim is to develop an integrated control programme based on insecticides, resistant varieties, parasites, predators, fungal pathogens and grazing management.

A full time Aphid Control Task Force comprised of Mr. E.D. Higgs, Senior Research Officer, Pastures, Mr. M.J. Mathison, Senior Research Officer, Plant Breeding and Mr. D. Swincer, Research Officer, Entomology was established to both plan and supervise the execution of a suitable campaign.

Diversion Of Existing Staff:

From the existing entomology group of Agronomy Branch, Mr. D. Swincer Research Officer, Entomology, Mr. P. Allen, Senior Research Officer, Entomology and Mr. K. Henry, Technical Assistant, were progressively occupied on aphid research matters to almost 100% of their available time.

Mr. M.J. Mathison, Senior Research Officer, Plant Breeding and his staff involved in the medic breeding programme, Mr. D.W. Parker, Mr. A. Heard, Technical Officers, Mr. G. Patten, Field Assistant and Miss J. Harris, Laboratory Assistant have all devoted the great majority of their time to work involved in bringing aphids under control. Likewise,

Mr. I.D. Kaehne, Senior Research Officer, Plant Breeding, and his assistants Mr. A. Lake, Technical Officer, Miss B. Martin, Laboratory Assistant and Mr. R. Hahesy, Field Assistant have all devoted the great majority of their efforts over the past twelve months to producing aphid resistant lucernes.

Diversion Of Facilities:

The whole of the pre-existing Weeds Research glasshouse and potting shed and a substantial proportion of the remaining glasshouse space at Northfield as well as the glasshouses specifically involved with lucerne and medic breeding have all been diverted to aphid research programmes.

A glasshouse of quarantine status under the care of the Horticultural Branch at Northfield Research Centre was entirely diverted to quarantining lucerne plants. An insectory and glasshouse at Loxton Research Centre were diverted to produce Trioxys wasps to release on farms in the Upper Murray district.

Acquisition Of Staff:

No additional staff were employed under the normal provisions of the Public Service Act. All staff were recruited from registered unemployed and were employed using funds provided by the State Unemployment Relief Scheme apart from a small number employed on a special grant of $10 000 at the very outset of the campaign. Staff employed at the 30th June, 1978 are given in Table 1. Many of these staff have been employed for nine months or more and are now highly experienced at all aspects appropriate to their particular area of work.

Table 1

Name	Classification	
Mr. C. Wilson	Research Officer	SAA parasite culturalist
Mr. K. Walden	Research Officer	BGA culturalist
Mr. H. Ting	Research Officer	SAA culturalist
Dr. C. Cordingley	Research Officer	BGA parasite culturalist
Mr. E. Kobelt	Research Officer	Plant breeder
Ms A. Walker	Technical Officer	
Mr. R. St. J. Sweeting	Technical Officer	
Ms G. Caon	Insect Sorter	
Mr. B. Wilson	"	
Ms J. Anock	"	
Ms K. Whitbread	"	
Mr. J. Hill	"	
Mr. P. Carlson	"	
Mr. G. Flannagan	"	
Mr. J. Blake	"	
Mr. D. Bell	"	
Ms J. Dawson	"	
Mr. D. Reeve	Field Assistant	
Mr. B. Earnst	"	
Mr. G. Chamberlain	"	
Ms G. McKinley	"	
Mr. S. Neate	"	
Mr. S. West	"	

Name	Classification
Ms D. Quinton	Insect Sorter
Mr. A. Pitt	Field Assistant
Mr. R. Anchor	Fitter, welder
Mr. P. Burne	Field Assistant
Mr. G. Lucas	Field Assistant

New Facilities:

A battery of four insectory units, constructed by the prefabricated building organisation ATCO, to specifications suitable for the tasks of insect parasite, predator and aphid rearing and divided into 2,3 or 4 air-conditioned compartments have been acquired and commissioned.

Five plastic covered temperature controlled greenhouses with dimensions 20 ft. x 60 ft. and made using a cast concrete base and framed using standard pre-fabricated garage units have been erected and are in use.

One plastic covered temperature controlled greenhouse with dimensions 100 ft. x 30 ft. is being erected.

Three large aphid-proof tents suitable for raising potted lucerne plants in aphid free conditions have been erected, two at Northfield Research Centre and one at Loxton Research Centre.

New Equipment:

A steam generator and equipment for sterilising soils have been installed. Two air-conditioned motor vehicles have been purchased to transport parasites to field release sites. Several high quality binocular microscopes and light sources and much other laboratory equipment has been acquired. A large number of insect rearing cages and cages for field establishment of aphid parasites have been built and are in regular use. A high quality 35 mm camera has been acquired for insect photography.

Specific Projects Undertaken:

A full list of the project undertaken is given in Table 2.

Table 2

Project Number	Project Title
339 01	SAA Parasite Multiplication and Distribution.
339 02	SAA Parasite Multiplication and Distribution based at Loxton Research Centre.
339 03	BGA Parasite Multiplication and Distribution.
339 04	Breeding of lucernes resistant to the SAA, the BGA, the PA and other biotic and abiotic factors.
339 05	CUF 101 Basic Seed Production and Maintenance Breeding.
339 06	Breeding of annual medics resistant to SAA, BGA, PA and Sitona Weevil.
339 07	Introduction and Performance Testing of foreign lucerne cultivars.

Project Number	Project Title
339 08	Developing Integrated Aphid (SAA and BGA) control for Dryland lucerne pastures.
339 09	Border Quarantine Signs.
339 10	Developing Seedlings Insecticide Protectant techniques for aphid susceptible lucerne and medic cultivars.
339 11	Monitoring the rate of migration of aphids across South Australia. This is a WARI project.
339 12	Developing aphid resistant pasture legume cultivars from species other than Australia's widely cultivated species.
339 13	Aphid Control Task Force management and basic support.
339 14	Critical assessment of the impact of insecticides on populations of aphids (SAA and BGA), their predators and parasites on lucerne and other legumes.
339 15	Aphid predator life history and voracity studies.
339 16	State aphid control extension programme.
339 17	South East Regional aphid control extension programme.
339 18	Insect sampling.
339 19	Rehabilitation of aphid damaged dryland lucerne.
339 20	Seed production of early generation aphid resistant cultivars.
339 21	Screening naturalised strains of subterranean clover for BGA resistance.

The scope and scale and duration of these porjects vary greatly. An indication of the scale and staff involved in these projects can be seen in tables 3 and 4 which give the extent and source of funds devoted to each project, itemized into the categories salaries, operating, travel and capital.

Achievements:

Mass rearing of Trioxys complanatus, Praon exsoletum, and Ephedrus plagiator

All three of these parasites have been successfully mass reared in insectory conditions. In the case of Trioxys this has covered the period from August 1977. In the case of Praon and Ephedrus the period is only a matter of a few weeks towards the end of the financial year 1977/78.

Field Establishment of Trioxys complanatus

Trioxys has become widely established in South Australia. In areas where it was released at the earliest date in September, 1977, it has been apparently keeping SAA numbers down for many months. From this site Trioxys has spread spontaneously for at least 20 km and possibly as far as 50 km. The whole region surrounding the metropolitan area of Adelaide has become widely colonised by Trioxys apparently from this primary release site. At more distant primary release sites natural spread has also occurred, but has been greatly assisted by farmers collecting from primary release sites and by mass distribution undertaken by the South Australian Department of Agriculture and Fisheries and Adelaide & Wallaroo Fertilizers Limited.

TABLE 3: ESTIMATED EXPENDITURE FROM ALL SOURCES OF APHID CONTROL PROJECTS 1/7/77 - 30/6/78

(See also table showing expenditure listed by Project and Salaries, Operating, Travel and Capital)

Project	State	W.R.T.F.	State Wheat Committee	Wheat Council	State Aphid Grant	S.U.R.S.	A.E.S.G.	Chemistry	Loan	TOTAL
01	-	-	-	-	79 719.63	35 208.08	-	-	15 763.00	130 690.71
02	4 000.00	-	-	-	2 381.81	6 637.99	-	-	-	13 019.80
03	-	-	-	-	30 624.99	19 016.46	-	-	-	49 641.45
04	23 585.61	34 382.67	-	-	54 900.82	8 495.13	-	-	-	121 364.23
05	-	-	-	-	2 210.86	3 999.43	-	-	-	6 210.29
06	6 795.28	-	21 916.38	25 877.49	6 412.15	13 534.45	-	-	-	74 535.75
07	-	-	-	-	-	-	-	-	-	-
08	25 089.00	-	-	-	2 600.01	12 564.69	-	-	-	40 253.70
09	-	-	-	-	2 760.00	-	-	-	-	2 760.00
10	-	-	-	-	-	6 064.56	-	-	-	6 064.56
11	WAITE INSTITUTE PROJECT									
12	-	-	-	-	209.61	4 034.53	-	-	-	4 244.14
13	51 033.73	-	-	-	37 920.42	43 019.05	28 536.86	-	-	160 510.06
14	-	-	-	-	-	3 454.53	-	-	-	3 454.53
15	-	-	-	-	526.14	23 607.75	-	-	-	24 133.89
16	-	-	-	-	1 521.45	-	-	-	-	1 521.45
17	10 000.00	-	-	-	1 795.37	-	-	-	-	11 795.37
18	2 000.00	-	-	-	158.33	8 976.43	-	-	-	11 134.76
19	2 500.00	-	-	-	157.25	-	-	3 234.00	-	5 891.25
20	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	1 164.05	-	-	-	1 164.05
	125 003.62	34 382.67	21 916.38	25 877.49	223 898.84	189.777.13	28 536.86	3 234.00	15 763.00	668 389.99

TABLE 4

ESTIMATED EXPENDITURE FROM ALL SOURCES ON APHID CONTROL PROJECTS 1/7/77 - 30/6/78

Project	Salaries	Operating	Travel	Capital	TOTAL
01	35 208.08	7 293.66	3 732.67	84 456.30	130 690.71
02	10 637.99	535.80	224.38	1 621.63	13 019.80
03	19 016.46	41.35	330.81	30 252.83	49 641.45
04	65 353.91	2 676.01	1 069.47	52 264.84	121 364.23
05	3 999.43	1 187.32	281.40	742.14	6 210.29
06	56 409.26	7 793.02	4 981.13	5 352.34	74 535.75
07	-	-	-	-	-
08	37 453.69	579.49	2 018.01	202.50	40 253.70
09	-	2 760.00	-	-	2 760.00
10	5 577.65	486.91	-	-	6 064.56
11		WAITE INSTITUTE PROJECT			
12	4 034.53	107.21	102.40	-	4 244.14
13	133 146.87	9 033.34	2 495.35	15 834.50	160 510.06
14	3 454.53	-	-	-	3 454.53
15	23 607.75	157.45	158.69	210.00	24 133.89
16	-	321.20	178.65	1 021.60	1 521.45
17	10 000.00	264.06	1 020.51	510.80	11 795.37
18	9 976.43	1 010.63	147.70	-	11 134.76
19	2 500.00	3 297.70	93.55	-	5 891.25
20	-	-	-	-	-
21	1 164.05	-	-	-	1 164.05
	421 540.63	37 545.15	16 834.73	192 469.48	668 389.99

Systematic monitoring of aphid predators and aphid parasites

A key feature of the South Australian aphid control campaign has been the regular sampling and assessment of samples from the primary release sites and other regularly sampled sites, numbering in all 15, on a weekly basis. This has enabled the population of aphids, aphid predators and aphid parasites to be assessed accurately on a week by week basis. This has indicated at the earliest possible date the successful colonisation by aphid parasites and the possible role of predators in the aphid control programme. As and when parasites were established at particular sites the percentage of parasitism at the 4th instar of SAA was determined weekly.

Insectory Predator Studies

Following the identification of the species which predate on SAA in the field in South Australia, a series of studies have been undertaken under controlled temperature conditions on fecundity and voracity of these species on a pure SAA diet. This has indicated that there is an extremely wide range of voracity between the various predators and this coupled with field observation has enabled the definition of the role of these predators in aphid control to be elucidated to some degree. Unfortunately some of the highly voracious species are relatively rare in the field. Overall field studies indicate that the numbers of highly voracious predators build up too slowly to prevent massive build up of SAA populations and only become really numerous late in the period of aphid attack when aphid numbers are declining due to shortage of feed. It has been concluded therefore that predators have not yet played a useful role in protecting susceptible legumes from SAA attack in South Australia.

Insecticides

Granulated insecticides

A number of granulated insecticides were studied in detail in greenhouse conditions and the effect of these on aphid numbers on lucerne seedlings studied. This work was extended to the field situation and included a study of aphids on barrel medic. As a result of these studies a firm recommendation for the use of product Disyston (R) has been made for establishment of lucerne and medic under heavy threat from SAA.

Sprays

Several studies have been made on the impact of a number of insecticides on the complete insect population in lucerne fields including SAA, their predators and parasites. These trials have been evaluated over a number of days starting from prior to spraying and continuing for up to twenty one days. This type of work has only been done in irrigated hay producing lucerne.

In the grazing situation on dryland lucerne a study has been made of the impact of insecticides and grazing on rotationally grazed lucerne pastures. Insecticides have been applied at three arbitrary levels of SAA. The most economic use of insecticide occurs when insecticide is sprayed at the lowest threshold studied namely 40-60 SAA per lucerne stem.

Assessment of South Australian legumes for aphid susceptibility

SAA

A wide range of medics, sub. clovers and lucernes have been studies in this programme. Virtually all pasture legumes used in South Australia are capable of at least sustaining populations of SAA and the widely used annual medic cultivars are affected to a considerable degree up to and including being absolutely devastated by SAA.

BGA

The BGA did not arrive at Northfield Research Centre and Laboratories until late May 1978. A little earlier sufficient numbers were present at Loxton Research Centre to commence a small scale study. Indications are that most legumes used in South Australia in pastures are capable of carrying some BGA and certainly some for instance Hannaford barrel medic are rapidly killed.

Medic breeding

Due to studies undertaken in New Zealand for BGA resistance prior to the arrival of BGA in Australia and earlier SADAF work aimed at producing medics tolerant or resistant to the sitona weevil, medic varieties with SAA, sitona weevil and BGA tolerance or resistance were rapidly identified. Cultivars named as a result of these studies are Sair, and SAva, snail medic, Sanza barrel medic, Sapo gama medic and Saleg disc medic. Seed build up has been organised. Further sources of resistance to SAA have been identified for breeding.

Lucerne breeding

Screening of breeding programmes of SAA resistance

Many resistant plants have been identified either in the field or in the greenhouse which combine attributes being sought previously in breeding programmes together with SAA resistance. A number of sources of SAA resistance not hitherto used in American breeding programmes have been identified.

CUF 101 seed production

Seed of this SAA and BGA resistant variety has been introduced through conventional quarantine and a modified field quarantine for seed production. A basic seed producing area has been established near Gawler and a number of fields established for seed production of certified seed in the south-east of South Australia. Due to late arrival of seed (October 1977) the only seed produced has been 375 kilograms which has all been used to increase the area for seed production in the South East.

Production of composite varieties from U.S. SAA resistant varieties

Two composite lines based on surviving plants from the most productive U.S. hay varieties in a 4 year old hay production variety trial under irrigation at Northfield Research Centre have been interpollinated to produce composites. Unless there is a change of policy these will not be reproduced further as they are believed to have no worthwhile level of BGA resistance.

Sainfoin and strawberry clover

A number of Sainfoin and Strawberry clover introductions have been assessed in the field of performance. To date their level of resistance to SAA and BGA has not been finally assessed. As a result of the study on Sainfoin it is quite obvious that varieties superior to the English types previously imported to Australia exist both as cultivars from France and as wild types from various other localities. Other leguminous species are to be progressively added to this study of species of potential value, but as yet unproven in South Australia.

PASTURE ECOLOGY SECTION

SECTION LEADER:	Dr. P.S. Cocks, M.Ag.Sc. Ph.D.
SENIOR RESEARCH OFFICERS:	Mr. M.V. Smith, M.Ag.Sc. M.Ec.
	Mr. P.R. Gibson, M.Ag.Sc.
FIELD ASSISTANT:	Mr. J.R. Phillips

PASTURE ECOLOGY SECTION

Major Achievements And Developments:

Research in the Pasture Ecology Section is now firmly directed towards studying the role of legumes in dryland agriculture. Towards this end the Section was fortunate to be allocated money from two trust funds, the Wool Research Trust Fund, for work on the ecology of subterranean clover by Dr. P.S. Cocks, and the Wheat Industry Research Council, for work on symbiotic nitrogen fixation in pasture and grain legumes by Mr. P.R. Gibson.

Ecological studies on subterranean clover, in progress for three years, continue to yield exciting results. More than 500 new lines of clover have been discovered, their flowering times measured, their isoflavone levels assayed, and their morphological characteristics described. From these lines it is becoming clear that valuable new genetic material is available for incorporation into new commercial varieties. Furthermore their origin will become clear, as the results are subject to detailed analysis.

Further to the work on naturalized ecotypes, 100 new lines of Trifolium brachycalycinum were introduced from the Mediterranean basin with a view to finding adapted lines suitable for crop rotations in the cereal zone. Many of these lines flower earlier than Clare, the only cultivar of the species. Mixtures of these varieties will be sown on commercial farms and subjected to normal farm practice: the most abundant survivors will be selected for advanced testing and possible release.

A project which measured sheep performance on three different perennial grass pastures at three stocking rates in the southern Adelaide Hills was consluded after three years collection of data. The major highlights from the experiment were:-

* Pasture based on Demeter tall fescue produced more wool and carried heavier sheep than the other two pasture treatments (Mt. Alma perennial ryegrass and Siro 1146 hybrid phalaris). This was due to the growth of Demeter after summer rains compared with no growth by the other grasses, deep in their summer dormancy.

* Perennial ryegrass was less persistent than the other grasses at high stocking rates.

Mr. Smith prepared a discussion paper for a proposed departmental submission to the Hart Inquiry into the Control of Private Development in South Australia. This was completed with Mr. I.R. Lewis of Horticulture Branch during the period September 1977, to January 1978.

Spotted Alfalf Aphid caused damage to dryland lucerne pastures on sandy soils in the Upper South East during the period February-June 1978. Mr. Smith assessed progressive damage to these pastures and calculated costs of alternative strategies for farmers with extensive lucerne areas. Work with Mr. P.G. Allen from the Entomology Section on an aphid management experiment at Culburra followed lucerne root reserves from March 1977, to March 1978.

Conferences, Training Schools, And Study Leave

Mr. M.V. Smith convened a review conference on the research and extension needs of the mixed farming areas of South Australia. Dr. Cocks and Mr. Gibson also attended this very successful seminar.

Dr. Cocks was invited to present the keynote address at the Riverina Outlook Conference at Wagga Wagga, N.S.W., organised by the Australian Institute of Agricultural Science. Mr. Smith attended the Australian Farm Management Society Conference, Churchill, Victoria.

Publications:

Cocks, P.S., Webber, G.D., Mathison, M.J. and Crawford, E.J. (1977) - Pasture Seeds from South Australia. Department of Agriculture and Fisheries, South Australia.

Cocks, P.S., Mathison, M.J. and Crawford, E.J. (1978) - From wild plants to pasture cultivars: annual medics and subterranean clover in southern Australia. Proc. International Legume Conference, London (in press).

Gibson, P.R. (1977) - Persistence of perennial ryegrass (Lolium perenne L.) under grazing in a Mediterranean-type environment of South Australia. Proc. XIII Int. Grassl. Cong. Leipzig, GDR (in press).

Gibson, P.R. (1977) - Inter-relationships of pasture production, pasture utilization and animal production from grazed pastures on Kangaroo Island, South Australia. Proc. XIII Int. Grassl. Cong. Leipzig, GDR (in press).

Gibson, P.R. (1977) - Botanical composition and productivity of five grazed pastures on Kangaroo Island. DAFSA Agron. Br. Rep. No. 89, 129 pages.

Gibson, P.R. (1978) - Evaluation of three perennial grasses under grazing in the Adelaide Hills of South Australia. Proc. Aust. Soc. Anim. Prod. 12: 206.

Gibson, P.R. (1978) - Effects of stocking rate and botanical composition on animal production from sown pasture in a Mediterranean-type environment. M.Ag.Sc. Thesis, University of Adelaide, Adelaide, S.A. 161 pages.

Smith, M.V. (1977) - Review of Research/Extension Needs of the Mixed Farming Areas of South Australia - Agronomy Branch Report No. 95.

Smith, M.V. and Lewis, I.R. (1978) - The Control of Private Development in Rural Areas of South Australia - Agronomy Branch Report No. 96.

Major Research Projects:

* Survey of annual legume adoption in mixed farming areas - M.V. Smith.

* Vegetable fault in wool - P.S. Cocks and J.R. Phillips.

* Colonization, persistence and evolution of subterranean clover - P.S. Cocks.

* Preliminary evaluation of local variants of subterranean clover - P.S. Cocks and J.R. Phillips.

* Autecology of adapted lines of subterranean clover - P.S. Cocks and W.G. Wootton.

* Nitrogen fixation by lupins - P.R. Gibson.

PLANT INTRODUCTION SECTION

SECTION LEADER: Mr. E.J. Crawford, R.D.A.

LABORATORY ASSISTANT: Mrs. M.S. Schubert (part-time)

PARAFIELD PLANT INTRODUCTION CENTRE:

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

Mr. P.C. Mobbs, H.D.A.

Mr. P.L. Blesing
(seconded to overseas service, Libya)

Mr. L.K. Ramsay

Mr. S.H. Kelly

Mr. K.S. Roberts

Mr. W.R. Porter

Mr. R.C. Bellchambers
(State unemployment relief scheme Terminated February 1978)

PLANT INTRODUCTION SECTION

Major Achievements And Developments

Plant exploration and seed collection

International co-operation continued between the Section and developing countries in the Middle East, culminating in the Senior Plant Introduction Officer, Mr. E.J. Crawford, leading a collecting mission for the International Centre for Agricultural Research in the Dry Areas (I.C.A.R.D.A.) in Iraq, Jordan and Syria from June to August, 1977.

ICARDA is concerned with expanding its germplasm base in potentially useful pastures and fodder crop species native to the region. This forms part of the Centre's overall policy of seeking to improve the productivity of farming systems in the zone.

Emphasis in collecting was placed on annual species of Medicago and Trifolium, on wild grain legumes, such as Vicia and Lathyrus, and other annual species with production potential.

Regions covered

Iraq - North West of Mosul - Dohuk, Zakho to the Turkish border. North to Zawita and Sarsank and East to Erbil and Shaqlawa regions. (Distance travelled 1520 km)

Jordan - South of Amman through Madaba, Karak, eastern Dead Sea, Shaubak, West through Salt to the Jordan River Valley and North through Ajlun, Irbid to the Syrian border. (Distance travelled 2320 km)

Syria - From the Jordanian border North through Ezraaa, Zabadini, Homs, Aleppo, Rajd to the Turkish border and many points West from Kassab through Lattakia, Tartous, Safita, Massiaf, Idlib. North-East through Hassake, Kamechlie, Malkyeh, Ayn Diwar to the Turkish border. (Distance travelled 6770 km)

These regions covered a range of altitudes from 390 m in the Dead Sea region through sea level on the Syrian coast to 1365 m at Shaubak in southern Jordan and represent a geographical range from 30° 30' to 37° 17' N. Climatically, collection was confined to the region above the limit for regular dryland farming as delineated by the FAO - UNESCO - WMO Inter-Agency Project on Agroclimatology which closely follows the 250 mm mean annual rainfall isohyet.

Although collections were made in some high altitude regions in excess of 1000 mm mean annual rainfall, the majority of the collection came from the 350-800 mm region. In the current season, however, annual rainfall in some regions such as North-East Syria, was as much as 50% below normal.

The material collected

A total of 942 accessions were collected in the three countries.

Iraq	182
Jordan	269
Syria	491

In all, representative samples of 33 genera were collected, the most important genera Medicago and Trifolium contributing 47 and 28% of the collection respectively. Vicia, Astragalus and Hymenocarpus species were prominent in that order in the remaining 25%.

The dominant Medicago species were:

orbicularis	88 accessions
polymorpha	85 "
rigidula	70 "
rotata	42 "

whilst the dominant Trifolium species included:

argutum	27 accessions
pilulare	27 "
purpureum	27 "
cherleri	24 "
echinatum	23 "
spumosum	23 "

A disappointing feature of the collection is the poor distribution of the species currently commercialised in Australia, e.g.:

Medicago truncatula	17	accessions (16 from Jordan)
" scutellata	14	"
" rugosa	11	"
" littoralis	4	"
" tornata	Nil	
Trifolium cherleri	24	"
" hirtum	5	"
" subterraneum	Nil	

It is not unexpected that T. subterraneum does not exist in such calcareous soils.

Soil characteristics and rainfall distribution do not, however, explain the poor distribution of M. truncatula only one sample of which was found in Syria and none in Iraq. Low winter temperatures ($-10^{\circ}C$) no doubt explain the absence of the species more commonly found in maritime environments.

The collection was shared between the two organisations and much of it will be grown in both countries in 1977/78.

Representative samples of 100 genotypes of each Cicer arietenum, Lens culinaris and Vicia faba were supplied from the ICARDA gene pool and will be grown under quarantine in 1978.

The local programme

The Department's gene pool was increased during the year with the addition of a further 2900 genotypes, essentially of Mediterranean origin. Of these, 725 accessions of annual Medicago species were grown and assessed in the nursery.

Morphological and agronomic assessment of this material at the Parafield Plant Introduction Centre revealed genotypes with better seedling vigour, better winter production and a range of flowering times with many lines producing more seed than the control species.

Late infestations of spotted alfalfa aphid (Therioaphis trifolii maculata) adversely affected seed production of some species, particularly Medicago intertexta. This, associated with adverse climatic conditions throughout the growing season, resulted in below average production both on the Centre and in regional districts. At Parafield, the annual rainfall of 387 mm was 18% below average, August having the lowest monthly total of 18.4 mm. This very seriously affected spring herbage production and subsequent seed production of annuals.

During June, July and August, 8 frosts were recorded on the Centre, the lowest terrestrial minimum being -2.3°C. Mean minimum July temperature was 6.4°C. The mean daily sunshine recording for the three winter months was 5.5 hours.

Rainfall of 36 mm in April 1978 indicated a good start to the new season.

All regional experiments were adversely affected by drought. Sowings in low rainfall areas failed whilst those in longer growing season districts had poor seasonal herbage production and greatly reduced seed yields.

No data was gathered from the Ghor barrel medic evaluation trials on Eyre Peninsula.

Sward evaluation of four selected lines of Medicago rugosa continued with the third consecutive year of sowing at Narridy and Manoora. Seed yields were comparable at both sites, three accessions outyielding the control cultivar Paragosa. As a result of this series of experiments, the accession SA 2220 has been registered as cultivar Paraponto (see below).

Resowings of the trials incorporating four lines of Trifolium subterraneum spp. brachycalycinum at the same sites failed because of drought.

Extension of an earlier programme designed to select an annual legume for the hardsetting sandy red brown earth soils at Caltowie failed in that only a few of the control cultivars set seed.

These cultivars have been unsatisfactory in the overall farming system in the past. The trial will be resown in 1978.

Evaluation of soft seeded lines of annual Medicago species

Seedcoat impermeability is the greatest single factor affecting plant population in naturally regenerating annual medic pastures in the year following seed maturation.

An experiment was established at the Parafield Plant Introduction Centre with the object of selecting a cultivar or cultivars which reg nerate densely in the year following seed maturation, and

* are high winter herbage producers
* are high seed yielders
* do not have objectionable seed pod characteristics.

From results obtained between 1968 and 1975, 122 lines of 12 species were selected as having less than 70% impermeable seed by mid April and had pod characteristics equal to or less spiny than the cultivar Jemalong barrel medic. These were compared with 14 registered cultivars.

Although drought conditions seriously affected winter production, yields were determined for herbage and seed production and pod samples taken at three weekly intervals over the summer/autumn to assess changes in seed coat permeability.

Natural regeneration was good following rains in April 1978, and seasonal herbage production will be measured between June and October, 1978.

Registration of new cultivar

As the result of an intensive programme of evaluation of the complete Medicago rugosa collection available at the time, one line designated SA 2220 from Italy has been selected and submitted for registration as the cultivar Paraponto.

Being approximately two weeks early flowering than the cultivar Paragosa (currently in commercial use), Paraponto's adaptation extends beyond that cultivar to at least the 300 mm mean annual rainfall and 4½ month growing season regions.

Paraponto has approximately 20% better seedling vigour than Paragosa. Because of this and its high natural regenerating capacity, it is capable of greater early winter herbage production than Paragosa.

Paraponto maintains seedcoat impermeability longer into the autumn than does Paragosa, but has a similar level of permeable seed by mid-April.

Paraponto is well adapted to soils of heavy texture, particularly friable red-brown, grey and black clay loams.

These characteristics and a high degree of aphid tolerance in the pre-flowering stage make Paraponto a worthy new cultivar for the cereal ley-farming programme in South Australia.

Training schools, conferences etc.

* Staff training school	3
* Conferences	1
* Symposia	7

Publications

Cocks, P.S., Webber, G.D., Mathison, M.J. and Crawford, E.J. (1977) - Pasture seeds from South Australia.

Crawford, E.J. (1977) - Paravivo still the best lucerne hay. Rural Press.

Crawford, E.J. (1978) - News and personal items. APG Newsletter, 1978.

Crawford, E.J. (1978) - Purpose and principles of Plant Introduction. Revised Edition.

Crawford, E.J. (1978) - Summary of report of plant exploration and seed collecting mission, June-August, 1977. Report to International Centre for Agricultural Research in the dry areas, (I.C.A.R.D.A.).

Extension services

* Field days	4
Visitors	
* International	30
* Interstate	7
* Local	75

Current major research projects

* Classification of new herbage plant introductions.
* Sward evaluation of Ghor barrel medic (Medicago truncatula) at four 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 of twenty-nine annual legume species on a hard-setting sandy red-brown earth soil at Caltowie.
* Extension of annual Medicago gene pool.

PLANT BREEDING SECTION

SECTION LEADER:	M.J. Mathison, B.Ag.Sc.
RESEARCH OFFICERS:	I.D. Kaehne, M.Ag.Sc.
TECHNICAL OFFICERS:	* B.C. Bull, L.D.A.
	D.W. Parker, R.D.A.T.
	A.W.H. Lake, B.Sc., B.Ag.Sc.
	A.R. Heard, B.Ag.Sc.
LABORATORY OFFICERS:	Miss B.M. Martin
	Miss J.M. Harris
FIELD ASSISTANTS:	R.D. Hahesey
	G.W. Patten

*Seconded as District Agronomist, Loxton.

PLANT BREEDING SECTION

Major Achievements and Developments

The annual *Medicago* and the lucerne breeding programmes were re-oriented to incorporate tolerance/resistance to spotted alfalfa aphid (SAA) and blue green aphid (BGA) as very high priority breeding objectives. Screening for SAA resistance was carried out in both greenhouse and field situations. Blue green aphid resistance screening was commenced towards the end of the financial year at Northfield as soon as the aphids were prevalent in the state. Screening of medics and sub clovers for BGA resistance was until then carried out at the D.S.I.R. Palmerston North campus in New Zealand by Dr. A.O. Taylor of the Plant Physiology Division and Mr. M.J. Esson of the Entomology Division. This New Zealand collaboration assisted greatly in the selection of five new medic cultivars which have been accepted for naming and have been sown under contract for seed production for further testing before release.

Three cultivars SAPO gama medic, SAVA snail medic and SAIR snail medic have good tolerance to both SAA and BGA and tolerance to attack by adult sitona weevil. SANZA barrel medic and SALEG disc medic have good tolerence to SAA and some tolerance to BGA.

Cooperation from lucerne breeders in New Zealand and U.S.A. has also resulted in their BGA resistant germplasms being incorporated into the lucerne breeding programme.

As reported in the Aphid Task Force Section much of the above work and the initiation of new projects seeking other pasture legumes resistant to SAA and BGA was made possible by the emergency grants from the State Government for aphid control.

The annual medic programme largely funded by the Australian Wheat Research Council and the South Australian Wheat Research Committee and the lucerne breeding programme mainly funded by the Australian Wool Corporation have taken on an even more national role since the advent of the aphids and there is now considerable interchange of technology and germplasm with research workers in other states.

Although the 1977 season was unfavourable for field experiments with sitona tolerant medics, further progress was made in detecting and using sources of resistance to sitona weevil in both the medic and lucerne programmes and three of the new medic cultivars were derived from this programme funded by Australian Wheat Research Council.

The perennial grass evaluation experiments on the property of Mr. E.H. Wuttke at Woodside were completed in June 1978 and selected plants removed to Northfield for further recombinationand selection.

State Government Unemployment Relief Funds permitted further pasture legume germplasm material to be put into long term storage in the plant genetic resources unit at Northfield Research Laboratories.

Conferences, Training Schools, Study Tours etc.

Mr. Kaehne attended a meeting in Melbourne in July 1977 convened

by the Victorian seeds trade and Victorian Department of Agriculture with Dr. Vern Marble world famous lucerne extension agronomist from California.

Mr. Mathison as deputy leader of the Aphid Control Task Force visited New Zealand in October 1977 to attend a one day New Zealand Workshop on blue green aphid, pea aphid and sitona weevil research at Lincoln, and confer with New Zealand pasture aphid research workers in their institutions.

Mr. Hahesy attended the Communications I course in February 1978.

Mr. Mathison departed for Syria in June on a seed collecting and consultancy mission in Syria, Turkey and Iran for SADAF and the International Centre for Agricultural Research in Dry Areas (ICARDA).

Farmer Contacts, Field Days, etc.

Progress reports on research in the Plant Breeding Section have been given to farmers and the general public in the form of radio talks, addresses at Agricultural Bureau conferences and grower meetings, and talks and guided tours for groups and individuals visiting Northfield Research Laboratories. Further contact with the farming community occurs at the Section's regional experimental sites which are mostly on the properties of farmer co-operators. Farmers and agri-businessmen frequently contact members of the Section for professional advice. There has been especially marked contact this year through the Aphid Task Force Medium.

As well as local and interstate visitors, many overseas research workers visit the Section for exchange of information and/or training. Overseas visitors during 1977-78 included research workers and administrators from Algeria, Libya, Sweden, Tunisia, United Kingdom and U.S.A.

Current Major Research Projects

Breeding New Cultivars of Annual Medics for the Australian Wheatbelt.

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 Adaptation 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 of Tall Fescue Introductions for Selection and Breeding.

Maintenance of Herbage Plant Seed Collection (in collaboration with Plant Introduction and Pasture Seed Physiology Sections).

Breeding of Lucernes resistant to the SAA, the BGA, the PA and other biotic and abiotic factors - see Aphid Task Force Section .

Breeding of annual medics resistant to SAA, BGA, PA and sitona weevil - see Aphid Task Force Section.

Introduction and Performance Testing of Foreign Lucerne Cultivars - see Aphid Task Force Section.

Developing aphid resistant pasture legume cultivars from species other than Australia's widely cultivated species - see Aphid Task Force Section.

Publications

Cocks, P.S., Webber, G.D., Mathison, M.J., and Crawford, E.J. (1977). "Pasture seeds from South Australia". 68 pp. Dept. Agriculture and Fisheries, South Australia.

Kaehne, I.D. (1978). Breeding aphid resistant lucerne in South Australia. Technote No. 5/78. Dept. Agriculture and Fisheries, South Australia.

Kaehne, I.D. (1978). Progress in screening lucernes for resistance to spotted alfalfa aphid. Australian Plant Breeding and Genetics Newsletter 28/1978 in Press.

Mathison, M.J. (1978). A guide to the susceptibility of Medic and Sub-clover cultivars to Spotted Alfalfa Aphid and Blue Green Aphid. Fact Sheet No. 28/78. Dept. Agriculture and Fisheries South Australia.

Mathison, M.J. and Baldwin G.B. (1978). A guide to the susceptibility of some pasture and crop legumes to Spotted Alfalfa Aphid, Blue-Green Aphid, Pea Aphid and Sitona Weevil. Technote No. 2/78.

Mathison, M.J. (1978). Personal and News Items. Australian Plant Breeding and Genetics Newsletter 28/1978 in Press.