



DEPARTMENT OF AGRICULTURE AND FISHERIES, SOUTH AUSTRALIA

Agronomy Branch Report

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AGRONOMY BRANCH ANNUAL REPORT

1978 - 79

REPORT NO. 110

AGRONOMY BRANCH ANNUAL REPORT

1978-79

EXECUTIVE OFFICERS:

A.F. TIDEMAN,
G.D. WEBBER,
M.R. KRAUSE,
E.D. HIGGS,

Chief Agronomist
Principal Agronomist
Principal Research Officer
Senior Research Officer

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- FOREWORD -

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This report is a review of activities of the Agronomy Branch of the S.A. Department of Agriculture during the year ended 30th June, 1979.

Regionalisation of the Department's functions have progressively extended over the last twelve months to the point where from the 1st July, 1979 the whole of the Department functions on a Regional basis with a Divisional structure to maintain an overall administrative and technical role.

Because of this restructuring this will be the last Agronomy Branch Annual Report. It is probable that future reports will be made on a Divisional basis and include contributions from Regions on agronomy aspects.

It is recognised that effective liaison between Industry, Division and Regions will be necessary under the new Departmental structure and the Agronomy Branch has appreciated the co-operation from Regions it has already had in this area. We hope that this very necessary liaison can be maintained as the new structure develops.

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

(A.F. TIDEMAN)
CHIEF, PLANT INDUSTRY DIVISION

AGRICULTURAL CONDITIONS AND HARVEST

RESULTS 1978/79

RECORD CEREAL PRODUCTION

1978 was a very favourable year for cereal production in South Australia and the total grain yield of 3.685 million tonnes for wheat, barley and oats was a record. The generally favourable season across most of the State provided a welcome recovery from several years of drought. The recovery was most dramatic on Eyre Peninsula where many thousand hectares were bare and drifting at the beginning of 1978. These areas quickly recovered to produce good crops and pastures.

The season opened erratically with patchy rains through April and May. The situation was consolidated with good rains in the winter months and favourable growing conditions continued through to late October. A dry period at this stage put some crops under stress and they finished a little too quickly. Late crops, however, received a real boost with good mid November rains.

The only disease to have any significant affect on the states cereal crop was cereal cyst nematode. This was seriously affecting wheat crops through the wet winter months but crops made some recovery later in the season. Hay die, septoria and powdery mildew influenced yield in some crops.

The record total grain production resulted from a record total area sown to cereals and a high wheat yield per unit area. The fact that livestock numbers had been depleted during previous years' drought influenced the area sown to cereals. Growers were trying to crop themselves out of financial difficulties.

MINOR CROPS INCREASING

The area sown to minor crops also increased in 1978/79. Record sowings of cereal rye, field peas, oil seed rape, safflower and sunflower were made. Yields were also high and with good prices for most minor crop products this trend towards diversifying crops is likely to continue. Growers are also recognising the value of including minor crops in their cropping rotations as break crops for the control of cereal cyst nematode.

OTHER TRENDS IN CROP PRODUCTION

Other trends that became apparent during the 1978/79 season were:-

- (a) Increasing area cropped using direct drilling and minimum tillage techniques.
- (b) Increased use of nitrogen fertilisers - approximately a 40% increase on 1977/78. Eyre Peninsula and Yorke Peninsula were areas where this trend was most evident.

- (c) Intensification of cropping incorporating the more wide-spread use of grain legumes in rotational systems.
- (d) More widespread use of tolerant varieties of cereals in control of cereal cyst nematode. Festiquay wheat increased in area sown by 20%.
- (e) Use of "big balers" for hay making.

CROP PRODUCTION

Grain and Seed

Crop	1978/79			10 Year Av. 1969-70 - 1978-79		
	Area ha	Yield t/ha	Production tonnes	Area ha	Yield t/ha	Production tonnes
Wheat	a 1 295 296	1.61	2 085 729	1 099 101	1.13	1 247 003
Barley	a 1 091 115	1.30	1 422 672	785 508	1.13	891 411
Oats	a 170 507	1.04	176 772	147 899	0.81	119 726
Cereal Rye	a 37 728	0.45	17 101	18 241	0.30	5 539
Field Peas	a 21 077	1.45	30 463	13 126	1.06	13 858
Lupins	b 10 779	0.80	8 664	(8) 8 023	1.01	8 113
Linseed	a 1 031	1.04	1 075	1 465	0.90	1 323
Rapeseed	a 11 053	1.14	12 614	(9) 4 164	1.04	4 347
Safflower	b 1 070	0.88	943	(8) 523	0.74	387
Sunflower	b 10 492	0.77	8 094	(8) 4 000	0.92	3 699
Lentils	b 200	1.00	200	(6) 176	0.68	119

a Australian Bureau of Statistics. (8) = 8 year average.
(1978-79 Preliminary figures)

b District Agronomist estimates.

PASTURES

The pasture season was variable across the state with a heavy growth of legume dominant pastures in the cereal areas and below average pastures in the South East. Apart from some periods of feed shortages in the South East pastures generally were able to meet livestock requirements and made sufficient growth to enable large quantities of hay to be cut.

SAA and BGA were active and necessitated control measures in some situations. With good seasonal conditions most medic pastures that were affected earlier in the season grew away from aphids and set plenty of seed.

Many lucerne stands have died out due to a combination of effects of drought, over stocking and aphids. The area most critically affected is the Upper South East where lucerne pastures have been a vital factor in the farming system.

AGRONOMY ADVISORY SECTION

SECTION LEADER

H.R. Day, RDA, Senior Agronomist.

S.G. Williams, R.D.A., Assistant Senior Agronomist.

EXTENSION OFFICERS

Adelaide Office	N.R. Matz, RDA, Special Agronomist.
Kangaroo Island	R.C. Hagerstrom, RDA, GDE, Senior District Agronomist.
Lower Eyre Peninsula	K.J. Holden, RDA, GDE, Senior District Agronomist.
Eastern Eyre Peninsula	T.M. Yeatman, RDA, District Agronomist.
Upper Eyre Peninsula	T.R. Davidson, RDA, District Agronomist.
Lower North	W.A. Michelmore, RDA, Senior District Agronomist.
Upper North	A.E. Hincks, RDA, GDE, District Agronomist.
Yorke Peninsula	T.J. Dillon, RDA, District Agronomist.
Central District	P.D. Fairbrother, RDA, District Agronomist.

The South East Region was established 1-7-77 and the Murray Lands Region on 1-7-78. The Agronomy Advisory Section is thankful to have had the co-operation of the District Agronomists in these two Regions. They are:-

South East Region

P.J. Mowatt, RDA, GDE, Senior District Agronomist, Naracoorte.
A. Grainger, RDA, District Agronomist, Naracoorte.
P.L. Marrett, District Agronomist, Mt. Gambier.
B.C. Bull, RDA, District Agronomist, Keith.

Murray Lands

K.G. Bicknell, DDA, Senior District Agronomist, Murray Bridge.
P.M.S. Potter, B.Ag.Sc. District Agronomist, Loxton.
J.N. Hannay, RDA, RDAT, District Agronomist, Lameroo.

AGRONOMY ADVISORY SECTION

FUNCTION

The Agronomy Advisory Section has continued to provide technical advisory 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 Murray Lands Region in July 1978. District Agronomists transferred from this section to the Regional administration when these Regions were established.

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.
- * A feasibility study and report to determine the need and economics of reticulating water to the Edillilie area was made for the E&WS Department.
- * Surveys including annual ryegrass toxicity and plague locust surveys.

EXTENSION

Extension activities are aimed at providing producers with an advisory service on all agronomic and allied matters and on farm management.

These activities are carried out through on farm visits, office and telephone enquiries, farmer group meetings, result demonstrations, and mass media.

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 minor crops.

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. Fitting grain legumes into intensified cropping rotations.

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, emex sps. wards weed and ice plant.

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 and nematicides.

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.

Oilseed crops - Promoting the growing of sunflowers and oil seed rape and advising on cultural techniques.

Whole farm management - Promoting the concept of "Whole Farm Management" and assisting growers in implementing it.

Pasture Aphids - Monitoring the population of SAA and BGA and assessing the damage they cause. Using the information from this monitoring service to advise producer on management techniques to minimise the problem.

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.

FIELD CROP SEED SCHEMES

Registered and certified seed schemes were in operation during the 1978-79 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 following lists the amounts of seed made available under the various schemes.

<u>Registered Seed Scheme</u>	<u>Quantity of seed</u> <u>Tonnes</u>
Wheat	830
Barley	700

Certified Seed Scheme - (operated by the Seeds Section)

Oats	95
Lupins	51
Linseed	1.5

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.

- B11/78 Agriculture in South Australia - Lower Eyre Peninsula -
K.J. Holden.
- B15/78 Agriculture in South Australia - Northern Murray Mallee
and Riverland -
B.C. Bull and
T. Simes.
- F/S19/79 Some Pests of Germinating Cereals -
W.A. Michelmore
- F/A18/79 Chemical ploughing and sod seeding -
N.M. Brooks and
P.D. Fairbrother

APHID CONTROL TASK FORCE

SECTION LEADER:

E.D. Higgs, B.Ag. Sc.

Introduction:

Early in 1977 two aphids - the spotted alfalfa aphid (SAA) Therioaphis trifotii (Monell) for maculata and the blue-green aphid (BGA) Acyrtosiphon 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 multidisciplinary 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.

APHID CONTROL TASK FORCE

Progress Report

In all 29 specific projects have been undertaken with the object of meeting the stated aims of the Task Force and some of the most significant of these prospects are reported on.

1. SAA Parasite Multiplication and Distribution

Trioxys complanatus, Praon exsoletum and Aphelinus asychus have been mass reared and released into irrigated lucerne weekly at about 15 sites throughout the year. At times releases were suspended to determine whether the existing populations of parasites were able to sustain themselves over a number of generations. Trioxys is now firmly established in most districts with substantial areas of lucerne. Praon exsoletum and Aphelinus asychus have persisted over several months towards the end of this period as minor components in the suite of SAA parasites at Northfield Research Centre. Recoveries of mummies of Praon and Aphelinus have also been made a number of other sites.

It is believed that Trioxys now plays a significant role in controlling SAA in irrigated lucerne. It has spread to dryland lucerne and annual medic areas but has not achieved high levels of parasitism in these situations.

2. BGA Parasite Multiplication and Distribution

A number of strains of two introduced parasites Ephedrus plagiator and Aphidius ervi have been obtained from CSIRO Division of Entomology, mass reared and distributed to primary release sites on irrigated lucerne throughout the state. More recently Aphelinus abdominalis a naturalized aphid parasite has become somewhat of a pest in the plant breeding programme due to its capacity to parasitize BGA. It has been mass reared and distributed to primary release sites during the latter part of this period.

To date recoveries have been extremely limited and there is no reason to believe that any introduced parasites have become established.

3. Breeding Lucerne resistant to SAA, BGA, PA and other Biotic and Abiotic factors.

This breeding programme is based on a well developed pre-existing lucerne breeding programme which was commenced in 1970. Particular objectives of that programme were to produce lucernes adapted to continuous hard grazing, lucernes with resistance to

Hard grazing and treating aphid populations with insecticide when the density reached 40 to 60 SAA per stem, considerably improved lucerne persistence and yield. Plant losses were only about 20% over the past two years, compared to about 70% in untreated plots. In the 78/79 summer there was about a three-fold increase in the available lucerne dry matter during the peak of SAA activity due to insecticide application and about a two-fold increase from the beginning of December to the end of May.

7. Developing Aphid Resistant Pasture Legume Cultivars from Species other than Australia's Widely Cultivated Species

In an effort to broaden the genetic base of aphid resistance, the potential for use in South Australian pastures of 3 species Onobrychus viciaefolia, Trifolium fragiferum and Ornithopus compressus was investigated by growing a collection of these in the field and in the greenhouse. The comprehensive array of introductions was examined in each species, both at Northfield Research Centre and a number of country sites in differing soil and climatic situations.

As aphids have not significantly damaged the extensive Trifolium fragiferum pastures in the South East of South Australia and as Ornithopus compressus has had some previous evaluation in South Australia without becoming an important species, most interest is now centred on Onobrychis viciaefolia (Sainfoin). The combination of winter active plants and a suitable Rhizobium culture transforms the prospects of this species from one of little interest to one of considerable excitement, particularly in view of the species resistance to lucerne flea and red legged earthmite as well as both aphids and on American experience, alfalfa weevil. An experimental line composed of plants of similar growth pattern principally from a French cultivar but including plants from a number of other countries has been endorsed by the South Australian Herbage Plant Liaison Committee for registration. Seed is being built up in anticipation of release in the autumn of 1980, when it is anticipated that sufficient seed will be available for commencing commercial scale multiplication.

8. Rehabilitation of aphid damaged Dryland Lucerne.

It was believed at the outset of the aphid invasion that the level of root reserves in lucerne would be a useful index in indicating how close to death lucerne plants might be following aphid attacks. During this year an experimental site was sampled at regular intervals for determination of the total non structural carbohydrates (TNC) on both the insecticide treated plots and the plots

where aphid damage was allowed to proceed without any control other than defoliation by grazing on a one week on five weeks off basis.

Both the treated and untreated plots had quite low levels of TNC. Although these levels had a seasonal trend, the differences between the treated and the untreated were particularly significant in the autumn of 1979 when lucerne plant losses were much more severe. (TNC treated 14.5% - Untreated 8.5% at that time.) Plant populations on the treated declined from 6.7 to 5.5 plants per square metre as against a decline from 5.5 to 2.5 plants per square metre on the untreated plots. The 8.5% TNC on the untreated plot is the lowest level recorded during this study.

A number of observations on commercial lucerne stands made in mid March 1979 indicated higher levels (18.4% to 28.8%) than on the Culburra experiment. Possible causes for this higher level of TNC were younger stands and lower stocking rate.

Levels while not as high as could be expected in the pre-aphid era did not suggest the stands were in immediate danger of severe plant losses from a single further aphid attack.

9. Seed Production of Early Generation Aphid Resistant Cultivars.

The cultivars Paraponto and Sapo gama medic (M. rugosa) Sava and Sair snail medics (M. Scutellata) Sanza barrel medic (M. truncatula) Saleg disc medic (M. tornata) were grown by a number of professional seed growers under supervision of SADA medic breeding and SADA seed certification staff. Normal certification charges were made to the growers and seed cleaners.

Total production - Paraponto 130 Kg. Sapo 1 500 kg, Sava 200 kg, Sair 200 kg, Sanza 150 kg, Saleg 750 kg.

During the course of the project the decision to withdraw proposals for release of Sanza barrel medic and Saleg disc medic was made due to their poorer than expected field performance under aphid attack. Further investigations of the performance of Sava and Sair snail medic under aphid attack are required before the necessity for release of these can be ascertained. Paraponto was released in the autumn of 1979. The release of Sapo gama medic was deferred to enable further performance data to be presented to the South Australian Herbage Plant Liaison Committee.

10. Screening of Naturalized Strains of Subterranean Clover for BGA resistance.

A collection of naturalized sub clover strains collected throughout South Australia and representative of the types of sub clover now occurring throughout South Australia was planted as spaced plants on a site at Northfield Research Laboratories. BGA were present during the growing season and did some damage to volunteer Jemalong barrel medic on this site. However, no significant damage was seen on subterranean clover, which appears to indicate that as a species subterranean clover has field resistance to BGA comparable with the more resistant annual medics.

late winter inundation to fit them for use in areas too waterlogged for Hunter River lucerne, lucernes with high hay yield under irrigation and lucernes with resistance to stem nematodes. Since the advent of the Aphid Control Campaign the necessity to breed for other disease resistances has become evident.

Populations generated for the initial programmes and the extensive gene pool of over 1 000 lucerne introductions have been screened for resistance to SAA and BGA in greenhouses. Over 1.5m seedlings have been tested for either SAA or BAA resistance. Field resistant plants from introductions and populations have also been selected. New populations of single or dual aphid resistant lucernes have been generated by inter pollinating selected plants in the field in bee-proof cages using small hives of bees provided by SADA apiarists. These populations form a range of dormancy classes and combinations of disease resistances.

Preliminary work to develop techniques for greenhouse screening for disease and other insect pest resistances has been undertaken.

A new programme to produce by selection a dual aphid resistant Hunter River, entirely from within collections of Hunter River seed made Australia wide before the advent of aphids and the mass introduction of foreign lucernes, has been commenced and has made good progress. Selected SAA and BGA tolerant plants are to be inter-pollinated by hand during 1979 winter.

Four replicated field trials with about 40 breeders lines (30 of South Australian origin) plus commercially available lucernes are sown or planned to be sown during the spring of 1979.

Three lines of lucerne all with SAA resistance to a high order with varying levels of BGA tolerance are being multiplied on seed growers properties, with a view to further testing and commercial release if performance is adequate in the autumn of 1980.

4. Breeding Annual Medics resistant to SAA, BGA, PA and Sitona Weevil

SADA has maintained a major annual medic breeding programme for about 15 years. The initial objective was to produce more productive better adapted medics for the cereal medic farming system of South Australia and other Australian medic growing states. In recent years a specific objective has been to produce medics with resistance to the adult feeding of Sitona humeralis both in the flowering stage when emerging adults feed prior to aestivation and at the seedling stage, when overwintering adults feed prior to egg laying.

Following the invasion of Australia by SAA and BGA this breeding programme has thoroughly characterized the susceptibility of Australian medic cultivars and has sought resistance to both aphids. A feature of the annual Medicago is that the expressed resistance to aphids varies between the various phenological stages. Lines can only be adequately characterized for aphid resistance by testing resistance at the very early seedling stage, the late pre-flowering seedling stage and following the onset of flowering.

A major conclusion of studies completed, is that satisfactory field dual SAA/BGA resistance throughout the growing cycle is common in M. scutellata and M. rugosa rare in M. truncatula and to date not yet discovered in M. littoralis. Sources of SAA resistance in M. truncatula have been found in a geographically diverse range of introductions. Comparatively few introductions have been found with tolerance to BGA.

Initially efforts in the screening programme have been concentrated on medic lines for which field performance data is available. More recently testing has been extended to breeding populations containing SAD 655 barrel medic M. truncatula one of the best sources yet discovered of BGA resistance in this species. The only major developments specifically related to aphid resistance, is the building up of seed stocks of SAD 6297 for further testing and possible release in about two years time. This is the first barrel medic with resistance to both aphids to be identified.

5. Performance testing of locally bred and foreign Lucerne Cultivars

This project covers the multiplication and field plot testing of lucerne derived from the SADA breeding programme, plus field testing of interstate and overseas bred varieties. Sufficient seed was produced under field cage conditions to establish four trial sites, two irrigated, two rainfed during the 1979 sowing season. Sites planned are Marrabel (red-brown earth) and Keith (deep sand) both rainfed and Mannum (Mallee sandy loam) and Langhorne Creek (heavy alluvium) both irrigated. The dryland sites were sown in May and the dry period in June ensued with little germination at the Marrabel site. The irrigated sites will be sown in the late winter or early spring.

6. Developing Integrated Aphid (SAA and BGA) Control for Dryland Lucerne Pastures

A study of the impact and management of SAA and BGA in a 10 year old rotationally grazed (6 paddock system) Hunter River lucerne pasture was made at Culburra.

CROP AGRONOMY

SECTION LEADER

T.G. Heard B.Ag. Sc.

RESEARCH OFFICERS:

A.R. Barr B.Ag. Sc.
M.J. Catt B.Sc. Dip. Bus. Admin
L.F. Nitschke B.Ag. Sc.

TECHNICAL OFFICERS:

J.B. Cocks B.Ag. Sc.
R.J. Puckridge R.D.A.
Miss C.F. Twigger R.D.A.
R.D. Wheeler B.Ag. Sc.

FIELD ASSISTANTS

S.G. Cornish
J. Pannell
M.R. Schubert
N.H. Steinborner

CROP AGRONOMY SECTION

Recent Developments

1. Personnel

Mr. J. Pannell was appointed as a Field Assistant in the oat breeding programme in February 1979 while Mr. J.B. Cocks was appointed as a Technical Officer in the rapeseed programme in April 1979. Both these were new appointments. At 30th June 1979 Messrs Catt and Cornish were transferred to Eyre region.

2. Varietal evaluation programme

The field trials in this programme continued at about the same level as in previous seasons with more than 80 trials being carried out to assess yield, quality, agronomic characteristics and disease reaction of a range of more than 380 varieties and crossbreds of the following crops -

wheat, barley, oats, triticale, cereal rye, field peas, chick peas, lupins, rapeseed.

Halberd was once again the outstanding commercial variety in the wheat trials. Of the other named varieties the recently released Lance and Warigal proved little inferior to Halberd. While several crossbreds returned somewhat higher yields than Halberd in the primary trials few were consistently better. At the primary trial site where there was evidence of cereal cyst nematode the line PF41/W4 which appears to be tolerant to CCN yielded extremely well. This line is being widely tested in 1979.

In the barley trials Clipper and Weeah were once again the highest yielding of the named varieties. Extremely pleasing yields were obtained from two of the advanced crossbreds. W.I. 2231, a two row feed type will be considered for release after the 1979 trials. This line has exhibited a yield advantage of at least 15% over Clipper. W.I. 2468 appears to have malting characteristics similar to those of Clipper and coupled with its yielding ability, 11% better than Clipper in 1978, it could be considered for release within 2 or 3 years.

The diseases powdery mildew (*Erysiphe graminis hordei*) and leaf scald (*Rhynchosporium secalis*) were assessed in some detail in barley plots during 1978. While Clipper and Weeah appear similar in their susceptibility to mildew several of the crossbreds appear resistant, or nearly so, to this disease. The lines 2231 and 2468 are in this category.

Leaf Scald, while relatively severe on Clipper and Wecah was extremely bad on Ketch and Corvette. WI 2231 and several of the back cross lines developed by Dr. S.M. Ali appeared relatively free of this disease.

In the (oat trials) the recently released variety proved slightly higher yielding than West at several sites. All other entries were significantly lower in yield. Grain holding ability and straw strength of oat varieties were assessed in several trials. West appears to be very good in both these aspects.

A number of herbicides were examined in 1978 with a view to controlling annual ryegrass in oat crops. Evidence was gathered that several herbicides including Trifluralin, Surflan, Lasso, Stomp and Hoe 22870 could be used in the majority of current commercial oat varieties for the control of annual ryegrass.

Of the Triticale lines those obtained from the Waite Institute and tested on Eyre Peninsula gave promise of yields equivalent to those of wheat. Older lines were generally disappointing and the majority of these have been phased out in 1979.

Field peas proved to be more consistent yielders than either lupins or chick peas in the series of comparative trials carried out during 1978. The low level of "black spot" disease through the season probably had a major bearing on this result. The most recent field pea releases, Dundale and Pennant proved to be higher yielding than Early Dun and White Brunswick respectively. A number of lines of *Lupinus albus* obtained from CSIRO showed promise in a trial at Turretfield in 1978 and these are being more widely tested in 1979.

In the rapeseed totals the recently released variety Wesro proved outstanding. Only at Northfield was it outyielded by either Tower or Midas. The incidence of blackleg in some trials and the general late rains which assisted later maturing varieties including Wesreo would have had considerable bearing on these results.

Pea Breeding

The pea breeding programme being carried out in association with Dr. M. Ali of Plant Pathology Section was continued during 1978-79.

The following advances were made.

- * The progeny from a number of crosses between locally adapted varieties and "black spot" resistant material are being grown as F3's at Waite Institute in the birdcage.
- * The progeny from crosses between locally adapted varieties and leafless and semi leafless introductions were grown as F2's at Turretfield during 1978. The F3's from these were grown in a summer generation at Littlehampton during 1978-79 and the F4's are currently in the field at Turretfield.

Oat Breeding

F2 nurseries were sown at Turretfield and Pinery during 1978-79. Material in these nurseries included crosses made for high protein high oil, rust resistance and good agronomic type. Elite F3 selections were sown in hill plots over summer at Northfield as produce seed for F4 yield trials in 1979-80.

Advances were made in the following areas during 1978-79.

Rust - survey collections from a wider area a total of 142 samples, primarily of stem rust were collected.

Stem nematode - several Australian oat varieties appear to have some tolerance. One line from Wales has already been used in the crossing programme.

Cereal cyst nematode - screening has been carried out of first backcross populations of West* A. sterilis crosses

High protein and oil content - several overseas introductions exhibited superiority in one or other of these traits to local varieties. F2 populations involving this overseas material have been examined and results are encouraging.

Continuous cropping with lupins - conventional and direct drilled

Seasonal conditions in 1978 favoured direct drilling of crops on lower Eyre Peninsula. Sowing some four weeks earlier was possible with the triple disc drill - conventionally worked areas remained too wet for sowing. Lupin yields were significantly higher under direct drilling reflecting the earlier sowing date viz. 2.66t/ha vs 1.54t/ha.

Yields of wheat, barley and oats were comparable under both systems. Barley yields following lupins were not significantly different from those following sub-clover pastures.

Wheat and barley response to nitrogen and phosphorus

In general Weeah gave a greater response to nitrogen than Clipper. It would appear that the optimum rate of ammonium sulphate at seeding is around 60 kg/ha. Applications of nitrogen split into some at seeding and more applied six weeks later appear promising for increased yield and profit.

Cereal rye response to nitrogen and cycocel (CCC)

An attempt was made to determine the maximum yield possible from S.A. Cereal Rye grown under good conditions. Ammonium sulphate at 100 kg/ha was applied at seeding as well as CCC to reduce lodging.

No response to either N or CCC was obtained but reasonably high yields of rye (2.17 t/ha) were obtained.

Septoria tritici control in wheat

Four fungicides were applied at two growth stages to a wheat crop at Wanilla. Dithane M45, Bravo, Difolatan and an experimental fungicide AGWP4 were used. No significant yield increases were obtained as seasonal conditions following application were not conducive to build up of the disease.

Direct drilling trials

These trials comparing conventional cultivation and sowing methods with direct drilling using herbicides and triple disc drill and normal combine sowing were conducted at four sites. The highest yields were obtained overall and at three of the four sites by using a Spray-Seed(R) plus diuron mixture and sowing with a normal combine. Mean yield was 2.44t/ha. Conventional cultivation and sowing gave second highest mean yield 2.32t/ha (significantly less than direct drilling at one site only). Sowing with a triple disc drill was disappointing except following a Spray-Seed (R) plus diuron mixture where the mean yield of 2.19t/ha was third highest.

Conferences, Training Schools

In Service Training Course - Communications II
Roseworthy S.A. L. Nitschke

S.A. Dept of Agriculture Scientific Writing School
Adelaide August 1978 A. Barr L. Nitschke

Workshop on Jojoba Adelaide Feb 1977
T.G. Heard

Publications

Ali, M. Nitschke, L. and Dube, A. - Pea Breeding Programme
S.A. Dept of Agriculture Tech Note

Barr A.R. Barley Variety Recommendations for 1979
S.A. Dept of Agriculture Fact Sheet 59/78

Barr A.R. Oat Variety Recommendations for 1979
S.A. Dept of Agriculture Fact Sheet 60/78

Heard T.G. Wheat Variety Recommendations for 1979
S.A. Dept of Agriculture Fact Sheet 52/78

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:

G. Caon, B.Sc.
I.J. McFarland, R.D.A.
(seconded to Aphid Task Force
- transferred to Eyre Region,
Dec. 1978)

TECHNICAL ASSISTANTS:

G.S. Dearman
K.R. Henry

ENTOMOLOGY SECTION

The major achievements and developments in the main research projects are discussed under each project.

In addition to these projects, personnel in the Section were responsible for a number of extension activities and regulatory functions. The latter included technical assistance to the Agricultural Chemical Section for the clearance and registration of insecticides, and co-ordinating a traceback system on pesticide residues.

With the traceback system, the property of origin of any agricultural produce which was tested by Department of Primary Industry and shown to contain pesticide in excess of the allowable maximum residue limit for that pesticide was visited by SADAF personnel to elucidate the cause of the problem. A major problem causing DDT residues in meat was due to grazed pastures being contaminated with DDT spray drift when nearby crops, mainly oil-seed crops and lupins, were being treated. This emphasised the need for further research to find suitable alternative insecticides which could be recommended in lieu of DDT for the above crops. Pilot trials were carried out with synthetic pyrethroids in 1978.

Australian Plague Locust

The section continued its responsibility for monitoring and co-ordinating the control of Australian plague locust under the terms of the Noxious Insects Act, 1934-1955.

Early warning of an imminent invasion of adult locusts into South Australia from remote areas of inland Australia was provided by the Australian Plague Locust Commission (APLC) in January.

In February, 1979, a joint survey by officers of SADAF and APLC revealed alarmingly widespread and dense numbers of adult locusts in the far North of South Australia. Southward migration of adults into areas near Whyalla, Pt. Augusta, Hawker, Peterborough and Burra occurred on March 20th. Widespread egg-laying then occurred in these areas.

This invasion of adults stimulated the Section to second additional SADAF personnel to monitor locust populations and egg-laying in the near-pastoral and marginal agricultural areas of South Australia during autumn. Such information was vital to develop a contingency plan for the control of hoppers in the spring.

During winter the control campaign for spring was organised and depended heavily on the favourable decision that the Government would assist with the surveying and control of hopper bands and fledging locusts in near-pastoral and marginal agricultural areas. This programme necessitated the involvement of the Commonwealth Department of Defence and landowners as well as a considerable number of SADAF personnel. This also included purchase of additional spray equipment, detailed estimates of the total insecticide to be purchased from overseas and aerial spraying contracts.

The control programme resulted in successful control of the locusts in spring without damage to agronomic and horticultural crops.

Alternative Insecticides to DDT

Pilot experiments testing alternative insecticides to DDT for the control of *Heliothis punctigera* (climbing cutworm) larvae in field peas were carried out in the spring of 1978. The synthetic pyrethroid, fenvalerate (Sumicidon^R), gave outstanding results and promising results were achieved with another synthetic pyrethroid, permethrin (Ambush^R), and methomyl (Lannate^R).

Fenvalerate also gave good control of *H. punctigera* in other pilot experiments with oil-seed rape, lupins and linseed crops.

Stored Product Pests

Samples of grain insects collected through the Co-operative Bulk Handling (CBH) grain insect trace-back project were tested for resistance to maldison. Fifty percent of the samples tested were resistant to maldison. Testing for resistance was curtailed because of additional resources required for planning the Australian plague locust control programme.

Integrated Control of Lucerne Aphids in Dryland Lucerne

The experiment which 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 being grazed by livestock was continued for the second year.

BGA was first detected at the site in mid-September, 1978, and increased to mean densities up to about 70 BGA/lucerne stem in the following five weeks. In the sixth week, mean densities decreased to less than one BGA/lucerne stem, apparently due to higher than normal maximum daily temperatures (26-28°C) in that week. BGA did not cause measureable damage to the lucerne during 1978/79.

Weekly monitoring of SAA densities during 1978/79 confirmed that a combination of hard grazing with livestock and strategic use of low rates of application of insecticide could be used to maintain reasonable production and persistence of Hunter River lucerne. During 1978/79, 2-3 sprays were required to keep SAA below the threshold of 40-60 SAA/lucerne stem. SAA did not begin to substantially increase in numbers until about mid-December, 1978, and declined in activity by about the end of May, 1979. The strategies used to manage SAA in dryland lucerne were outlined in a Fact Sheet.

During the summer and autumn period of 1978/79, treated lucerne produced a total of 950 kg/ha of dry matter compared to 575 kg/ha from untreated lucerne. During the peak activity of SAA in February/March, a time when lucerne is valuable to the area, available lucerne dry matter five weeks after hard grazing was 270 kg/ha in treated lucerne compared to only 80 kg/ha in the untreated lucerne.

After the second year of damage by SAA, plant numbers were reduced by about 20% in the treated area and 70% in the untreated area. Extremely dry seasons prior to and during the initial SAA infestations would account for much of the 20% reduction in the treated lucerne.

The effects of native predators on SAA during summer and autumn were studied in 1979. The most commonly occurring predator was the ladybird, *Coccinella repanda*. The experiment confirmed that native predators could not maintain SAA populations below economic densities in the above period, even though some treatments markedly increased the abundance of the predators.

Trioxys complanatus was released at the experimental site but the influence on numbers of SAA in rotationally-grazed, dryland lucerne appeared to be minimal, especially during summer and autumn.

The interaction of SAA on lucerne growth was studied in more detail on a single plant basis in the field.

Insect Pests of Germinating Cereals

Results from an experiment conducted at Turretfield Research Centre in 1978 to improve the control of cereal curculio (*Desiantha caudata*) larvae in cereals with chlorpyrifos seed dressings showed that:

- . 80 g and 120 g a.i. chlorpyrifos/100 kg wheat did not provide reliable protection to germinating wheat when the wheat was sown at 70 kg/ha.
- . 80 g and 120 g a.i. chlorpyrifos/100 kg wheat provided reliable protection to germinating wheat with larval densities up to 320 larvae/m² when the wheat was sown at 96 kg/ha.
- . Untreated wheat sown at 96 kg/ha did not compensate for cereal curculio damage when larval densities exceeded about 100 larvae/m².
- . liquid seed dressings appeared to be as effective as powder seed dressings at comparable rates of application.
- . the most practical recommendation for control of cereal curculio in cereals was 80 g a.i. chlorpyrifos/100 kg seed at a sowing rate of 96 kg/ha.
- . treatment was warranted for 10 larvae or more per square meter.

Introduced Dung Beetles

Further releases of introduced dung beetles were made in South Australia during 1978/79 in co-operation with the Division of Entomology, C.S.I.R.O.

Five releases of *Onthophagus binodis* were made on dairy properties at Jervois, Murray Bridge and Walls Flat during February, 1979. This species is native to south-western South Africa where there is a mediterranean-type climate, however, its survival appears to depend on assured high soil moisture during the summer months. It is well established in south-western Western Australia and beetles were collected from the field in this area for release in South Australia. Also, *O. binodis* is established near Wangary, Eyre Peninsula, in an area with high soil moisture during the summer due to a very high water table. Summer irrigation on dairy properties along the River Murray and in other areas of South Australia may provide ideal conditions for this species.

Onitis agylus was released on a property at Eden Valley in March and May, 1979. This species is also native to south-western South Africa and is found in areas with a predominantly winter rainfall of 4-500 mm per annum. Survival of this species does not depend on high soil moisture during the summer.

Sitona Weevil

Seasonal conditions during 1978 were favourable for both annual medics and sitona weevil. The numbers of sitona weevil increased markedly from the low levels which occurred during the previous three years. There were reports of large infestations of weevils from many areas of the state in November and December. Damage was confined mainly to lucerne as medics were already drying off when weevil emergence began in early November, three to four weeks later than usual.

Sitona egg wasp (*Patasson lameerei*)

The rearing programme for this parasite continued from June 1978. As there had been no parasites recovered in the first two years of the project, an experiment using small field cages was set up in the release site at Urania to see if any initial establishment was taking place. In July and early August, parasites were released into 4 cages (either 200 or 400 wasps per cage) which had been seeded with approximately 5000 newly laid sitona eggs. On the 16 August 1978, all four cages were sampled for sitona eggs and these eggs were kept to record parasite emergence. Parasites were recovered from 1 of the 4 cages. On the 17 October 1978, more sitona eggs were collected from the cages and parasites were recovered from all four cages showing that initial establishment had taken place.

On the 17 October, 1979, egg samples were also taken from the release site (4000 parasites released in June 1978). All unhatched eggs were kept and 12 parasites emerged from them by the end of November. Another 2 parasites did not emerge from these eggs until February 1979, indicating they were in diapause when they were collected from the field (i.e. 17/10/78). Further samples on 8 November, 1978 revealed that parasites were still present at the release site and most of them were probably in diapause.

While these results were most encouraging, the egg wasp still had to survive the 78/79 summer before it could be considered to be permanently established.

The release site was sampled for eggs once in April and May and twice in June 1979 to check for permanent establishment. No parasites were found in April or June and only one individual male was recovered in May. It appears that low numbers of the parasite were present in the release site following the 78/79 summer but the number may be too low for the population to survive.

Sitona adult wasp (*Microctonus aethioides*)

The rearing programme for *M. aethioides* (ex Morocco) continued from June 1978. Releases were made at Gulnare (900 mated females), Mt. Hope (700) and Northfield (1100) during July, August and September 1978. A check of these release sites approximately two months after release showed that parasites were present at Northfield. Parasites were also released into a field cage at Northfield in October, 1978, to set up an over summering culture.

Areas adjacent to the 1977 release sites at Urania and Laura were sampled during late winter 1978 but no recoveries were made.

A new technique for collecting sitona weevil adults in large numbers was developed in July 1978 and markedly reduced the amount of time spent on this part of the project. The new method, which involved towing a large net behind a small motor bike, yielded up to 20 times more weevils per man hour than the old hand sweep net technique.

In April, May and June 1979, sitona weevil adults were collected from the release site at Urania (1018 weevils) Gulnare (2011), Laura (234), Mt. Hope (10) and Northfield (1273) and kept to record parasite emergence. A single parasite was recovered from Urania and sixty nine were found at Northfield but none were found at Gulnare, Laura or Mt. Hope. These results confirmed that the parasite was established at Northfield and possibly at Urania. At Northfield, the rate of parasitism increased steadily from about 4 percent in April to approximately 25 percent in late June. This recovery marks the first record of permanent establishment of this parasite in South Australia.

The parasites recovered from Northfield were combined with those from the over summering cage to restart a laboratory culture during May and June 1979. By the end of June, parasite numbers in the culture were approaching a level at which releases for the 1979 season could commence.

During the first six months of 1979, C.S.I.R.O. imported several more shipments of parasite material from Europe. The parasites imported were -

1. *Microctonus aethioides* (ex. France)
2. *M. aethioides* (ex. Greece)
3. *Allurus moricatus* (wasp parasite ex. Italy)
4. *Campogaster exigua* (parasite fly ex. Greece)

Unfortunately, only *M. aethioides* ex. Greece survived through the quarantine period.

Cultures of this material were expected to arrive in South Australia in July 1979.

Conferences, Training Schools, Study Leave

- * Australian Applied Entomological Research Conference, Lawes, Queensland - D.C. Hopkins, D.E. Swincer.
- * Australian National Course on Mosquito Vector Control, Mildura, Victoria - P.G. Allen.
- * Agronomy Conference, S.A. Department of Agriculture and Fisheries, Adelaide - P.G. Allen, P.R. Birks, D.C. Hopkins, C. Phillips, D.E. Swincer.
- * National Direct Drilling Conference, I.C.I., Adelaide - P.G. Allen.
- * Jojoba Workshop, S.A. Department of Agriculture and Fisheries, Adelaide - P.G. Allen.
- * Lucerne Aphid Workshop, Tamworth, New South Wales - P.G. Allen, D.E. Swincer.
- * Science Technician Certificate Course - G.S. Dearman, K.R. Henry.
- * Degree of Doctor of Philosophy, W.A.R.I., internal, half-time candidate - P.G. Allen.

Committees

- * Entomology Committee of Standing Committee on Agriculture - P.R. Birks
- * Exotic Insects Sub-committee of Entomology Committee - P.R. Birks
- * Stored Products Sub-committee of Entomology Committee - P.R. Birks
- * Australian Plague Locust Commission - P.R. Birks
- * Agronomy Conference Planning Committee - P.R. Birks
- * South Australian Grain Hygiene Committee - P.R. Birks
- * Aphid Task Force - D.E. Swincer
- * 1978 Open Day Organising Committee, Northfield Research Laboratories - D.C. Hopkins.
- * South Australian Advisory Committee on Australian Encephalitis
P.G. Allen.
- * Torrens Island Mosquito Control Committee - P.G. Allen
- * Working Party on Treatment of Argentine Ant - P.G. Allen
- * Tillage Task Force - P.G. Allen
- * Northfield Safety Committee - K.R. Henry

Major Research Projects

- * Insect pests of germinating cereals - P.G. Allen, K.R. Henry.
- * The development of integrated control of lucerne aphids in dryland lucerne on sands in 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.
- * 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. Caon, G.S. Dearman
- * Release of introduced dung beetles in South Australia - P.G. Allen, K.R. Henry.

Extension Project

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

Publications

- Allen, P.G. (1978) - "Integrated control of aphids in dryland Hunter River lucerne on sands in South Australia". Proc. Lucerne Aphid Workshop, Tamworth, Dept. Agric., N.S.W.: 172-174.
- Allen, P. (1978) - "Control of aphids in dryland lucerne on sandy soils". Fact Sheet No. 51/78, Dept. Agric and Fish., S. Aust.
- Allen, P.G. (1979) - "Integrated control of introduced aphids in dryland lucerne". Agron. Conf., Dept. Agric. & Fish., S. Aust. : 1-2.

- Allen, P.G. and Grierson, I.T. (1979) - "Cereal curculio control and direct drilling". Agron. Conf., Dept. Agric. and Fish., S. Aust. : 34-35.
- Allen, P.G. and Grierson, I.T. (1979) - "Direct drilling and insect pests of germinating cereals". Proc. National Direct Drilling Conference, I.C.I. : 74-78.
- Birks, P. and Phillips, C. (1979) - "The Australian plague locust". Fact Sheet No. 11/79, Dept. Agric. and Fish., S. Aust.
- Birks, P. and Phillips, C. (1979) - "Winged locust survey". Technote No. 2/79, Dept. Agric. and Fish., S. Aust.
- Crawford, E.J. and Allen, P.G. (1979) - "Jojoba - current knowledge". Agron. Conf., Dept. Agric. and Fish., S. Aust. : 152-153.
- Hopkins, D.C. (1978) - "Review of literature on the genus, *Patasson* (Hymenoptera:Mymaridae)". Agron. Branch Rep. No. 103, Dept. Agric. and Fish., S. Aust.
- Hopkins, D.C. (1979) - "A report on the release programme of *Patasson laneerei*, an egg parasite of sitona weevil". Agron. Conf., Dept. Agric. and Fish., S. Aust. : 244-245.
- Hopkins, D.C. (1979) - "A report on the release programme of *Microtonus aethiopoidea*, a parasite of the adult stage of sitona weevil". Agron. Conf. Dept. Agric. and Fish., S. Aust. : 246-247.
- Hopkins, D.C. (1979) - "Sitona adult wasp". Technote No. 1/79, Dept. Agric. and Fish., S. Aust.
- Hopkins, D.C. (1979) - "Controlling red-legged earthmite and lucerne flea". Fact Sheet No. 7/79, Dept. Agric. and Fish., S. Aust.
- Hopkins, D.C. (1979) - "Release and monitoring for establishment of *Microtonus aethiopoidea* a parasite of *Sitona humeralis* Steph." Working Paper, 3rd Aust. Applied Ent. Res. Conf., Lawes.
- Phillips, C. and Birks, P.R. (1979) - "Alternatives to DDT for control of *Heliothis punctigera* (climbing cutworm) in field crops". Agron. Conf., Dept. Agric. and Fish., S. Aust. : 239-241.
- Phillips, C. (1979) - "Summary of Crop and Pasture Pest Control Recommendations". Bull. No. 7/79, Dept. Agric. and Fish., S. Aust., 21 pp.
- Swincer, D.S. - Publications listed under the report of the Aphid Task Force.

Extension Activities

Personal contacts

On farm visits	90
Rural group - meetings, field days	20
Office, laboratory, experimental site visitors	35
Telephone enquiries	825
District Council visits	50
Specimen identifications	236

Mass media

News items	9
T.V. and radio broadcasts	5

Regulatory Activities

Insecticide label registrations	146
Clearances of insecticides for Technical Committee of Agricultural Chemicals (TCAC)	29

PASTURE ECOLOGY SECTION

SECTION LEADER: P.S. Cocks, M.Ag. Sc., Ph.D.

SENIOR RESEARCH OFFICERS: M.V. Smith, M. Ag. Sc., M.Ec.
P.R. Gibson, M. Ag. Sc.

FIELD ASSISTANT: J.R. Phillips
P. Ciganovic

PASTURE ECOLOGY SECTION

1. Studies in techniques of measuring symbiotic nitrogen fixation in pasture and grain legumes

P.R. Gibson, Senior Research Officer, Agronomy.

The aim of this project is to develop a cheap reliable technique for the quantitative determination of nitrogen fixation in field grown legumes.

The work has been based on developing the acetylene reduction technique* to quantitatively determine the inputs of biological fixed nitrogen by legumes within the ley farming system of southern Australia. The assay, as originally proposed, appeared the ideal technique for measuring nitrogen fixation on an extensive field scale. However, although the assay has since proved both sensitive and adept to field work (in particular, screening and survey work and for making between-treatment comparisons) it has proved unreliable when used quantitatively. However, recent experimental work indicates that the unreliability of the assay, when used quantitatively, may largely have been due to; a) assaying excised nodules or decapitated root systems rather than whole plants and/or b) not accounting for the production of hydrogen via the nitrogenase enzyme system in situ.

New techniques have been developed in the glasshouse for assaying whole plants in situ; only the soil-root system is subjected to acetylene and other gases. A simple procedure has been developed to enclose whole potted plants in special plastic bags which seal around the stem. Rather than rely on the absolute retention of hydrogen and ethylene we have developed tracer techniques utilizing helium and acetylene. The technique has proved of tremendous practical benefit, particularly with respect to hydrogen, because the actual concentration ** of hydrogen need not be known; only the helium to hydrogen ratio. In addition, gas samples can be stored in vials for a much longer period of time prior to analysis. We anticipate that this factor will be paramount in the success of the technique under isolated field conditions.

Glasshouse experiments using field peas and lupins inoculated with commercial inoculum were carried out in 1979 incorporating the above techniques. The aim has been to:

- a) Verify that legume symbionts may evolve substantial quantities of hydrogen in situ;
- b) Determine whether the measurement of any such hydrogen evolution, when used in conjunction with acetylene reduction measurements, increases the quantitative precision of the assay.

- * In the presence of acetylene the reduction of dinitrogen by the enzyme nitrogenase is inhibited and the acetylene itself reduced to ethylene. Nitrogenase activity is assessed by measuring the rate of production of ethylene.
- ** It is extremely difficult to retain hydrogen gas for more than a few hours even in special laboratory apparatus. If tracer techniques were not applied large errors would be introduced under glasshouse and particularly field conditions by hydrogen leaking rapidly from the system.

The plants were exposed to ^{15}N -enriched N_2 in these experiments to provide an absolute measure of nitrogen fixation. The plant samples are still awaiting isotopic analysis and therefore the extent to which the quantitative precision of the assay is increased by measuring hydrogen evolution cannot be reported at the time of writing this report. However, not only have significant quantities of endogenous hydrogen from the commercial varieties of peas and lupins been measured but also significant uptake of exogenously supplied hydrogen under certain conditions. This indicates that the activity of a unidirectional uptake hydrogenase* may also be important in the overall quantitative determination of nitrogen fixation in legumes using acetylene reduction techniques. The incorporation of hydrogen uptake measurements under conditions of hydrogen evolution inhibition (e.g. in the presence of acetylene which is already essential to the assay) is currently being assessed in this project.

* The presence of an active uptake hydrogenase in peas (*Pisum sativum* cv. Alaska) has also recently been reported by workers in the U.S.A.

2. Evaluation of newly evolved strains of subterranean clover

A mixture of 180 strains of low-formononetin subterranean clovers were sown at four sites - Saddleworth, Parndana, Keith and Penola. At each site high and low levels of superphosphate were imposed. The sites had previously received little or no superphosphate were imposed. The sites had previously received little or no superphosphate and there was no subterranean clover present. These sites will be sampled each summer for seed, and the seed grown-on at Northfield for identification into strains.

The four sites at which the mixtures were sown established satisfactorily. With the good winter rains in South Australia it is likely that seed set at all sites will be sufficient for good re-establishment in the coming years.

3. Evolution of subterranean clover in old pasture

Three established pastures, each with mixtures of oestrogenically safe and active cultivars, were sampled in the summer of 1978/79. At least 250 samples were taken from each pasture on a systematic basis and 19 000 plants were grown at Northfield for identification and isolation. Seed is being collected

from all the divergent strains, and populations of many of the strains will be established for further study next year.

Analysis of the first stage of the project has been partly completed (Cocks and Phillips 1979).

Analysis of the populations of subterranean clover originally sown to mixtures of oestrogenically active and safe cultivars has revealed that the number of strains now present greatly exceeds that originally sown. Indeed in the 40 year-old Kangaroo Island pasture in which the Mt. Barker and Dwalganup strains were sown, divergent strains now comprise 65% of the total population. It seems that the importance of the divergent strains is directly related to the years since the mixture was established. It seems also that some strains are able to colonize parts of a paddock where other strains fail, indicating the possible significance of establishing suitable mixtures of strains.

4. Publications

Cocks, P.S. (1980) - Limitations imposed by nitrogen deficiency on the productivity of subterranean clover - based annual pasture in Southern Australia.

Aust. J. Agric. Res. 31, 95-107

Cocks, P.S., Mathison, M.J., and Crawford, E.J. (1979) - From wild plants to pasture cultivars: annual medics and subterranean clover in South Australia in 'Advances in Legume Science' eds. R.J. Summerfield and A.H. Bunting, Royal Botanic Gardens, Kew, England.

Cocks, P.S., and Phillips, J.R. (1979) - Evolution of subterranean clover in South Australia 1. The strains and their distribution. Aust. J. Agric. Res. 30, 1035-52

PLANT BREEDING SECTION

SECTION LEADER: M.J. Mathison, B. Ag. Sc.

RESEARCH OFFICER: I.D. Kaehne, M. Ag. Sc.

TECHNICAL OFFICERS: B.L. Bull, L.D.A.*

A.W.H. Lake, Bsc., B. Ag. Sc.

A.R. Heard, B.Ag. Sc.

TECHNICAL ASSISTANTS

Miss B.M. Martin

Miss J.M. Harris

FIELD ASSISTANTS G.W. Patten

** R.D. Haahsy

*** M. Stanley

* seconded as District Agronomist Loxton

** resigned 8/9/78

*** 27/10/78 to 6/4/79

PLANT BREEDING SECTION

Major Achievements and Developments

As reported last year, the arrival in Australia and spread of spotted alfalfa aphid (SAA) and blue green aphid (BGA) quickly led to changed directions in the largely wheat industry funded medic breeding and wool industry funded lucerne breeding projects.

Some of this is reported in the section for the aphid task force annual report, where there have been very large capital, salaries and maintenance inputs from the S.A. Government. With a major effort concentrated on seeking tolerance to both these aphids, most of the developments and achievements were in this area. Some earlier activities of the section were sharply curtailed to allow the top priority activities. One of these was the perennial grass breeding programme particularly with tall fescues. After closing down the Woodside field experiments, selected plants were returned to Northfield where they are being maintained until the programme can be re-activated. Dried herbage samples of the tall fescues are being held for in vitro digestibility determinations before proceeding to put together some synthetic populations.

The year saw the commissioning of the final greenhouse in the aphid control programme and for plant breeding this allowed the development of full scale screening with BGA during the early spring period of abundance in the field in 1978. Greenhouse cultures of BGA were maintained continuously from then onwards, permitting a limited amount of screening all year round. Greenhouse culturing of SAA was improved to the stage where virtually all the screening requirements are met from these cultures.

The real highlights directly attributable to the success of the aphid screening team working in very close cooperation with the normal complement of the plant breeding section, were in the derivation of germplasms for developing new cultivars.

In the lucerne project this resulted in producing three germplasms ready to proceed into contract seed production of breeder's seed. Two of these are largely based on SAA resistant selections from the grazing type lucernes just about developed when the aphids arrived, and have excellent SAA tolerance, one has little BGA tolerance (about the same as Hunter River) and the other has a moderate amount.

The third lucerne is based on SAA resistant selections from BGA tolerant material from New Zealand and has better tolerance to both aphids than CUF 101 and is a highly productive bushy and leafy type. In addition to lucerne germplasms being developed from the previous lucerne breeding programme, true Hunter River type plants with SAA or BGA tolerance were isolated for developing a Hunter River type lucerne highly tolerant to both aphids.

Other BGA tolerant lucerne germplasms and an adult sitona tolerant population were also developed.

In the annual medics, the initial contract production of breeder's seed of SAPO gama medic, SAIR and SAVA snail medics and SANZA barrel and SALEG disc medic was undertaken. Seed of all was widely distributed throughout the medic growing areas of Australia for further testing and evaluation in 1979.

Disappointing tolerance to BGA by SANZA and SALEG became evident late in 1978 and these two are being held pending further evidence. The release of SAPO was sought from the S.A. Herbage Plant Liaison Committee (S.A.H.P.L.C.) in autumn 1979 but release deferred pending production of agronomic field testing data. By June 1979 this data was being analysed from the previous seven years experiments to present with data from further experiments conducted to demonstrate the superior tolerance to adult sitona weevils of SAPO compared with other gama medics. These gama and snail medics are expected to fill some immediate needs for aphid and sitona tolerant medics but for many situations will be unsuitable or of interim value only due to limited adaptation to Australian medic growing environments and special management needs.

The real highlight in the medic project was therefore the discovery in barrel medic of excellent BGA resistance among the advanced progeny of one of the crossbreds, made before the arrival of the aphids, combined with moderate tolerance to SAA. The parent conferring BGA resistance has been identified and examination commenced of crosses with this parent. These barrel medic crosses include some with even better SAA tolerance. Also by June 1979 many introductions of barrel medic had been identified with good tolerance to SAA and a very few others with moderate to good tolerance to BGA. Several of these aphid tolerant introductions have some tolerance to sitona weevil. One barrel medic introduction sown in field experiments for the first time in 1979 appeared to be tolerant to both aphids in initial greenhouse tests (this has subsequently been confirmed).

Other developments of note in the medic project were the establishment of field experiments at Northfield, Mindarie and Lameroo with recent introductions of barrel medic and a largely untested species in S.A. Medicago aculeata. Many of the barrel medics were collected by Departmental staff in North Africa and the Middle East in the period 1974 - 79 (Messrs. Mathison, Crawford and Bull from Plant Breeding and Plant Introduction Sections and Mr. Bicknell and other members of the South Australian Dryland Farming teams in Libya). The species M. aculeata has shown some initial promise for hard setting red brown earth soils in the coldest of S.A. medic areas (Belalie - Yongala) and in similar situations in N.S.W. and overseas. It also appears to have some lines with good tolerance to SAA and/or BGA, and some with sitona weevil tolerance.

Further screening with adult sitona weevil revealed more medics with tolerance. Seed was produced of about 50 of these sitona tolerant medics for establishing field experiments in 1979 at Northfield, Korunye and Kadina, all areas fairly highly prone to attack by sitona weevil.

Another development was the participation by Mr. Mathison in pasture and forage plant collecting at the invitation of the forage Programme of the International Centre for Agricultural Research in Dry Areas (ICARDA) based in Syria. This followed collecting by Messrs. Crawford and Bull in 1977 in Syria, Iraq and Jordan under a similar arrangement. Mr. Mathison collected between June and September 1978 with Turkish and Iranian nationals respectively in South Eastern Turkey and in Iran in the West and in the Eastern Caspian zone. Much of this material includes annual medics and other annual legumes from high altitude cold winter areas needed for developing dryland farming systems akin to ours. In Iran in particular many new recordings were made for the distribution of annual medics, including those for two species M. noeana and samples subsequently identified as M. tornata not previously recorded for Iran.

As a completely new development from the aphid control programme investigations were carried out with introductions of other pasture legumes, particularly the perennials strawberry clover and sainfoin (Onobrychis viciaefolia). This, by June, had led to the development of a population of sainfoin in anticipation of further seed production, testing and release of a new cultivar. Sainfoin's attributes include tolerance to SAA, BGA, Sitona weevil and many other traditional insect pests of Medicago and Trifolium, freedom from bloat-inducing agents, high digestibility and good nutritional traits and a growth habit akin to lucerne.

Conferences, Training Schools, Study Tours etc.

Messrs. A. Lake and A. Heard attended the Department's Communications I course in 1979. Mr. Kaehne proceeded with his part time Ph.D. project in Plant Breeding at the Waite Institute in addition to the heavy commitments in directing the lucerne breeding project.

As already stated Mr. Mathison was on a joint seed collecting and consulting mission with ICARDA. During that period he attended an International Legume Conference at the Royal Botanical Gardens Kew, London, U.K. and presented a joint paper by Dr. Cocks, himself and Mr. Crawford on the domestication of annual medics and sub clover in southern Australia.

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 and seed 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 through the Aphid Task Force Medium.

As well as local and interstate visitors, many overseas research workers and seed industry personnel visit the Section for exchange of information and/or training. Overseas visitors during 1978/79 included research workers and administrators from Algeria, Iraq, New Zealand, South Africa, 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 and Tolerance to SAA and BGA.

Lucerne Selection for Adaptation to Waterlogged and Poorly Drained Conditions and Tolerance to SAA and BGA.

Selection of Lucerne for Persistence under Continuous Grazing and Tolerance to SAA and BGA.

Lucerne Selection for Resistance to Stem Nematode and Tolerance to SAA and BGA.

Maintaining 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 also Aphid Task Force Section.

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

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

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

Publications

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- Kaehne, I.D. (1978) Breeding aphid resistant lucerne in South Australia In Handbook, Lucerne Aphid Workshop, Agricultural Research Centre, Tamworth N.S.W. 27- 30th November 1978 pp. 213-214.
- Kaehne, I.D. (1978) Breeding Aphid Resistant Lucerne in South Australia. Technote No. 5/78 South Australian Department of Agriculture and Fisheries August 1978.
- Kobelt, E.T. and Mathison, M.J. (1978) Screening for SAA and BGA tolerance in annual Medicago species and other pasture legumes, In Handbook, Lucerne Aphid Workshop, Agricultural Research Centre, Tamworth N.S.W. 27-30th November 1978 pp. 228-230.
- Mathison, M.J., Kobelt, E.T. and Baldwin, G.B. (1978) A guide to the susceptibility of Medic and sub-clover-cultivars to spotted Alfalfa Aphid (SAA) and Blue Green Aphid (BGA) Fact Sheet 28/78 South Australian Department of Agriculture and Fisheries. September and December 1978.

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. S.H. Kelly
Mr. W.R. Porter
Mr. L.K. Ramsay
Mr. K.S. Roberts
Mr. M. Wurst

HERBAGE SORTERS: Mrs. L. Langridge
Mrs. F. Gear
Mr. J. Cocks (part-time)
Mr. S. Jenkins (part-time)

PLANT INTRODUCTION SECTION

Following the joint collecting mission with the International Centre for Agricultural Research in the Dry Areas (I.C.A.R.D.A.) in Iraq, Jordan and Syria in 1977, 100 lines of each of the grain legumes Cicer arietenum and Vicia faba were grown in quarantine and resultant seed supplied to the Crop Agronomy Section for future evaluation.

Of the annual Medicago species collected, the following were grown in the nursery for initial classification:

<u>M. blanchena</u>	16 lines plus 8 selections.
<u>M. orbicularis</u>	88 lines plus 58 selections.
<u>M. rotata</u>	43 lines plus 6 selections.
<u>M. rugosa</u>	11 lines.
<u>M. scutellata</u>	14 lines plus 1 selection.
<u>M. truncatula</u>	16 lines plus 4 selections.

Other species and genera of the collection will be grown in future years.

Seed of 92 lines which was in short supply at collection, was regrown and returned to I.C.A.R.D.A.

An extension of the joint collecting mission with I.C.A.R.D.A. in Iran and Turkey in 1978 (conducted by Mr. M.J. Mathison) resulted in a further 193 accessions being added to the annual Medicago gene pool.

In addition to this, a further 683 lines were indexed, representing many species and genera from several Middle East and Mediterranean countries.

During the year, 678 seed samples were despatched to interstate and international organisations.

Herbage Plant Evaluation Programme

The reduction in man hours worked brought about by Administrative Instruction had an adverse effect on the overall programme both inside and outside the function of the Plant Introduction Centre. In consequence, no new regional trials will be established in 1979.

Statewide production improved under more favourable climatic conditions than that of the preceding drought years. At the Parafield Plant Introduction Centre, total annual rainfall of 491.9 mm was made up of 463 mm during the April to November growing season - rainfall being recorded on 108 separate days. A total of 17 frosts were recorded during June, July and August including 9 on consecutive days at the end of August, ranging from -1.0°C to -4.6°C **terrestrial**.

The mean minimum July temperature was 7.2°C whilst the mean maximum for January was 29.1°C .

Late spring rains ensured good growth and seed set on previously sown experiments and the three new sites established in 1978.

* The Nursery Row Programme

Two major groups of newly introduced species were grown for classification, purification and further seed production.

** 934 lines of 8 annual Medicago species

** 77 lines of Trifolium subterraneum

Main emphasis was placed on M. truncatula (274 lines) and M. orbicularis (493 lines). Major characteristics recorded such as seedling vigour, time of flowering, winter herbage and seed production potential revealed some very useful data for future sward evaluation programmes.

Within the major groups, 14 M. orbicularis and 19 M. truncatula lines had better seedling vigour than the control cultivar Jemalong, confirming earlier findings that Algeria, Greece, Jordan and Morocco are a source of good early vigour. Many more lines revealed better winter herbage production than Jemalong viz. 34 M. orbicularis and 31 M. truncatula lines. The majority of these originated from Jordan with lesser numbers from Algeria and Libya.

Earliness has always been a feature of material received from Cyprus and Libya and although very few lines from Cyprus were grown in 1978, all were early flowering whilst 64 of the 97 M. truncatula lines that flowered earlier than Jemalong came from Libya with a further 16 from Jordan.

Similarly, the early flowering M. orbicularis lines came essentially from Jordan, Syria and Libya.

Of a small group of 22 lines of M. rugosa, 5 of the Jordanian lines flowered earlier than Paragosa although none were earlier than the recently released cultivar, Paraponto. However, the only Libyan line grown flowered 2 weeks earlier than Paraponto.

The outstanding feature of the T. subterraneum collection was a single line from Libya that flowered 6 days earlier than the earliest flowering cultivar, Nungarin.

As a result of good spring rainfall, all lines seeded well.

* Release of New Gama Medic Cultivar (M. rugosa) cv. Paraponto.

Paraponto gama medic was registered as a new annual medic cultivar in August, 1978. Subsequent data from natural regeneration following the cropping phase of the respective experiments at Narridy and Manoora was presented to the South Australian Herbage Plant Liaison Committee and Paraponto was released to commence in April, 1979. Its major attributes are recorded in the Register of Australian Herbage Plant Cultivars.

* Annual Legume Evaluation on a Hard-Setting, Sandy Red-Brown Earth at Caltowie.

The problem of legume establishment, growth and persistence is being actively investigated in this environment. Initial screening of 932 genotypes of 14 annual legume species resulted in a selection of 28 lines for further evaluation. 1977 sowings failed due to drought and the lines were resown in 1978. The larger seeded T. subterraneum and T. hirtum species established best but all were relatively unproductive during the winter months but some outyielded Geraldton sub-clover which has often failed in earlier commercial sowings. T. argutum produced at least 50% more dry matter by late September than Geraldton but is an aerial seeding species with a greater level of impermeable seed. All seeded well following late spring rains and natural regeneration and winter herbage production will be studied in 1979.

* Evaluation of Early Flowering Annual Medicago Genotypes at Black Hill and Cambrai.

The need for a cultivar earlier flowering than Harbinger for the early maturing and climatically variable areas of the lower rainfall wheatbelt has resulted in experiments being established at Black Hill (275 mm mean annual rainfall and Mallee sand) and Cambrai (300 mm mean annual rainfall and Mallee loam).

After considering seedling vigour, flowering time, winter production and pod spininess, 17 lines of 7 annual Medicago species were selected for comparison with 6 cultivars. This project incorporates the evaluation work with Ghor barrel medic initially started at Buckleboo, Mudamuckla and Pygery on Eyre Peninsula.

Establishment was good at both sites in 1978 but spring infestations of blue green aphid (Acyrtosiphon kondoi) severely affected most lines at Black Hill. The button medic (M. orbicularis), gama medic (M. rugosa) and snail medic (M. scutellata) groups proved to be the most tolerant. A subsequent infestation of cow pea aphid (Aphis craccivora) also had less effect on the snail and gama medic groups.

Because of these infestations which were deliberately not controlled so that further evidence of field tolerance could be recorded, no herbage production data was gathered and seed yields were low, the gama and snail medics reflecting their tolerance to the aphids in the highest seed yields.

At Cambrai, in the absence of aphids, 4 M. polymorpha, 1 M. rugosa and 1 M. scutellata line produced exceptionally well and recovered well after grazing. Although all seeded well, dry conditions in winter resulted in no regeneration before August, 1979. Given suitable conditions, natural regeneration and winter herbage production will be measured in 1980.

* Evaluation of Soft Seeded Lines of Annual Medicago Species at Parafield.

From results obtained between 1968 and 1975, 122 lines of 12 annual medic 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 for seasonal herbage and seed production and hardseed breakdown with 14 registered cultivars.

Of the 122 lines selected:

- ** 56 regenerated better than the mean
- ** 42 had better winter production than the mean
- ** 36 recovered from defoliation better than the mean
- ** 31 had total annual production (sum of 5x4 weekly cuts) better than the mean
- ** 24 had better seed production than the mean
- ** 20 had better winter production than Jemalong
- ** 12 recovered from defoliation better than Jemalong
- ** 5 flowered earlier than Jemalong

As a result of this screening, the 12 lines were compared with six commercial cultivars in a newly established experiment under sward conditions at Parafield Plant Introduction Centre. These lines originated from Tunisia (4), Italy (2), Spain (2) and Algeria, Australia, Greece and Morocco (each 1) and consisted of 9 M. truncatula and 3 M. tornata lines. None of the other annual medic species approached these two species in overall performance.

Seasonal herbage and seed production will be further evaluated in 1979.

* Sward Evaluation of Ghor Barrel Medic (M. truncatula) at Buckleboo, Mudamuckla and Pygery.

Following the droughts of 1976 and 1977, natural regeneration and subsequent herbage production of Harbinger strand medic was far superior to Ghor barrel medic.

The poor recovery of Ghor and a further assessment of its pod spininess has resulted in withdrawal of Ghor barrel medic from further consideration as a potential commercial cultivar under South Australian conditions and the trials on the three sites on Eyre Peninsula have been concluded.

Training Schools, Conferences etc.

* Staff training schools	3
* Conferences	1
* Symposia	7

Extension Services

* Field days/Bureaux	4
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Visitors

* International	6
* Interstate	9
* Local	49

Current Major Research Projects

- * Classification of new herbage plant introductions.
- * Sward evaluation of Medicago rugosa at two regional centres.
- * Sward evaluation of annual legume species on a hard-setting, sandy red-brown earth soil at Caltowie.
- * Sward evaluation of Ghor barrel medic (M. truncatula) at four regional centres.
- * Sward evaluation of 122 lines of 12 annual Medicago species with soft seeded characteristics.
- * Extension of the annual Medicago gene pool.

PUBLICATIONS

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.

CRAWFORD E.J., (1978) - Registration of Paraponto gama
medic (Medicago rugosa Desc).

CRAWFORD E.J., (1979) - Evaluating annual Medicago
species.

RAGLESS D., MATHESON W., PIKE C., and CRAWFORD E.J., (1979) -
Jojoba.

PLANT PATHOLOGY SECTION

SECTION LEADER:

A.J. Dubé, B. Ag. Sc. (Hans) Ph.D.

RESEARCH OFFICERS:

S.M. Ali, 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.

B. Hall

D. Cairn (until March 1979)

J. Walton (after March 1979)

TECHNICAL OFFICERS:

A. Lush (until March 1979)

H. Wagner (after April 1979)

PLANT PATHOLOGY SECTION

Most of the work of the Plant Pathology Section has been on research projects on control of diseases. Most projects involved collaboration with personnel elsewhere in the Department of Agriculture (Crop Agronomy, Plant Protection Officers and District Agronomists), plant pathologists and plant breeders at Waite Agricultural Research Institute and personnel from chemical companies. An extension service was also provided.

A. Research Projects

Cereal eelworm

a) Resistance Screening. Material from wheat and barley breeding programmes at Waite Agricultural Research Institute, the wheat breeding programme at Roseworthy College and the oat breeding programme in the Department of Agriculture was evaluated for resistance to cereal eelworm (Heterodera avenae). Resistance in a high yielding feed barley line (W12231) has been achieved. Good resistance in a well-adapted wheat line (Pitic x Festiguay) was detected but further breeding and testing is required because of unsatisfactory quality and yielding ability of this line. A total of 2,270 plants were screened in the laboratory.

b) Tolerance. In association with the wheat breeder at Waite Agricultural Research Institute, tolerance of wheat lines to cereal eelworm was evaluated in plant breeding plots with a severe infestation of H. avenae. A visual rating at an early growth stage by the breeder was highly correlated with final yield. Lines were also assessed for numbers of females for an assessment of resistance.

This is the first evidence of useful tolerance in a wide range of wheat genotypes.

c) Chemical Control. Trials were conducted using Nemagon and EDB, at a total of 5 sites on Eyre Peninsula and Yorke Peninsula. EDB applied as a liquid was compared with equivalent rates in superphosphate applied through a fertilizer box. Both gave similar control of cereal eelworm and similar increase in yield (90-100%).

(A.J. Dube).

Foliar diseases of barley

Fungicides were tested in field trials, at 8 locations, for efficacy of control of powdery mildew and scald diseases. Seed-treatment with triadimenol (KWG0519) resulted in good control of both diseases. Ethirimol controlled powdery mildew but not scald. Other chemicals tested as seed-treatments (benomyl, thiophanate methyl, nuarimol, RH2161

and triforine) gave only a little or no control of either disease at practical, non-phytotoxic rates. Maximum increases in yield, following seed-treatment with triadimenol, ranged from 11% at Roseworthy to 41% at Warooka.

Foliar sprays with the systemic fungicides tridemorph and triadimefon gave good control of foliar diseases in trials at 5 sites but no significant increases in yield. Applications were made after stem elongation growth stage. Results of trials with seed-treatments indicate that sprays should be applied before stem elongation growth stage to give sufficient control of foliar diseases to increase yields to the extent obtained with seed-treatments.

(A.H. Mayfield)

Leaf scald resistant barley lines

Thirty barley lines, selected for resistance to scald disease, and backcrossed with cv. Clipper, were evaluated in trials at South Australia and New South Wales. Five lines showed good resistance to scald. These are being used by Dr. D.H.B. Sparrow in his barley breeding programme.

(S.M. Ali)

Evaluation of smuticides

Smuticides were tested for control of covered and loose smuts of wheat, barley and oats. A wide range of active ingredients of each chemical were used. Chemicals tested were triadimenol, fenfuram, methfuroxam, TCMTB, femanosulf, benomyl and carboxin. Safe, economic minimum amounts of active ingredients were calculated from regression equations.

Advisory Group

A Smuticide Advisory Group, consisting of farmers and personnel from chemical industry and seed-treatment companies, had several meetings. Aims and aspects of smuticide research projects were discussed. Current projects were endorsed. The Group agreed that a cereal smuts bulletin should be published and that the present Fact Sheet on smuticides should contain more detail on new chemicals.

(A.J. Dubé)

Annual Ryegrass Toxicity

The aim of this project, funded by the Australian Meat Research Trust Fund, is to provide a practical method of control of the disease so as to prevent economic losses of stock. The ecology of the causal nematode (Anguina funesta) has been studied. Various methods of control have been tested

a) Ecology. Infection of ryegrass by A. Funesta in the field was studied in detail to identify times for application of control measures likely to produce the best control. Some aspects of development of nematodes were consistent in studies at several sites and in two quite different growing seasons (1978 and 1979). Fortunately, at these stages, the nematode is likely to be controlled most readily.

b) Control. Herbicides ("Hoegrass" and paraquat) reduced numbers of galls by approximately 80%, at a cost of about \$12/ha. This control is not sufficient and improving the efficiency of kill increases the cost. In addition, these treatments reduce pasture growth considerably, particularly early in the season when pastures are scarce. Hence, studies on early use of herbicides as a suitable control measure have been discontinued.

A fungus (Verticillium sp.), parasitic on A. funesta, was inoculated onto infected pasture in the field, but gave only little control. Studies are continuing on another parasitic fungus (Dilophospora sp.).

Mowing ryegrass pasture after penetration of florets by larvae and before hatching of the next generation reduced greatly numbers of galls at the end of the growing season. The same area was sampled the following year and a 99% reduction in galls was obtained. Further studies are necessary to develop this technique for it to be used commercially.

(A.C. McKay, A.J. Dube)

Development of Ascochyta complex resistant pea cultivars with other commercially desirable characteristics

a) Disease resistance. Adequate sources of resistance against Ascochyta complex disease, due to Ascochyta pinodes, Ascochyta pisi and Phoma medicaginis var. pinodella, were identified in five unadapted introduced pea lines. These resistant lines were crossed, in all combinations, with local commercial field and processing pea cultivars. 142 F3 lines were artificially inoculated in the field. Spread of the disease was uniform throughout the trial enabling effective selection for resistance to these diseases.

b) Leafless and semi-leafless peas. A large number of selected F3 and F4 leafless and semileafless peas were planted at Turretfield Research Station. Leafless or semi-leafless plants with higher yields and with resistance to Ascochyta diseases were selected. These are being used as parent material for new commercial cultivars.

(S.M. Ali).

B. Surveys

1. Wheat stem rust

Wheat stem rust (Puccinia graminis tritici) was rare during 1978. No new strains were found in the 45 samples collected (identified at the Plant Breeding Institute, University of Sydney). There was an apparent increase in the relative frequency of strain 343-1,2,3,5,6. This strain is virulent on Condor, Oxley, Egret, Lance, Warigal and Warimba.

(A.H. Mayfield)

2. Bacterial Wilt

Bacterial wilt (Corynebacterium insidiosum) was identified for the first time in South Australia in April 1979. Because of quarantine restrictions on all lucerne, including spotted and blue-green aphid-resistant cultivars, a survey was conducted to find the distribution of this disease in South Australia.

Staff of Murraylands, South-East and Central Regions assisted with the survey. Only irrigated stands were surveyed. The results showed that bacterial wilt was a common disease in irrigated lucerne stands in the Murray Bride and the Mount Gambier districts. North of Murray Bride infections were scarce, and loss in production was negligible. However, irrigated lucerne stands in the Meningie area had a much higher incidence of infection, which would have resulted in reduced production.

3. Survey of Vicia faba crops

Diseases of Vicia faba crops in the South-East were surveyed to screen crops, intended for seed, for infection with serious diseases. The survey was conducted by plant pathologists from the Department of Agriculture and Waite Agricultural Research Institute and personnel from Wright Stephenson and the South-East Region. Twelve crops were inspected. No True Broad Bean Mosaic or Broad Bean Stain Virus diseases were observed. One crop was infected with Ascochyta fabae. Bean Yellow Mosaic Virus was common; up to 85% of plants were infected. Leaf Roll Virus was also common; up to 30% of plants were infected.

C. Extension

Approximately 160 specimens, mostly from District Officers, were examined for identification of diseases. Most (70) were cereals and a relatively high number (42) grain legumes. In addition, many enquiries, from farmers and officers of the Department of Agriculture on identification and control of diseases, were answered.

Some disease situations were inspected with District Officers to obtain more information for better diagnoses and recommendations for control. Talks on control of diseases were given at meetings of farmers and over the radio. Press articles and information sheets were prepared for farmers.

D. Conferences Attended

3rd International Congress of Plant Pathology, 16th-23rd August, 1978, Munich (A.H. Mayfield)

Mr. A.H. Mayfield visited research institutes in the United Kingdom, Switzerland and West Germany during July to November 1978. The main topics discussed were methods for estimating the economic importance of diseases of cereal crops and the use of fungicides for control of the major foliar diseases of these crops. This tour was funded, in part, by the Wheat Industry Research Council.

SEEDS SECTION

SECTION LEADER:

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

RESEARCH OFFICER:

C.M.J. Williams, B.Ag.Sc. (Hons.)
SERHQ, Struan.

SEED PRODUCTION ADVISERS:

Adelaide

G.E. Cooper

C.A. Schubert

Struan

E.S. Hogg, R.D.A.

P.D. Smith, R.D.A.

I.H. Simons

TECHNICAL OFFICERS:

Mrs. A.M. Dale

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

This year has been a year of consolidation for the Section along with a near record seed production to handle.

Staff:

Mr. C.M.J. Williams resigned in February 1979 to accept a position with Massey University, New Zealand.

Mrs. V. Wilks sat for and gained her Australian Seed Testing Proficiency Certificate during the year.

Mr. E.S. Hogg returned from his Acting District Agronomist position at Keith to resume duties as Senior Seed Production Adviser at Struan.

Ms H.A. Lawrie was appointed Supervisor of the Seed Testing Laboratory taking over the day-to-day duties of managing the Seed Testing Services.

Mrs. A.M. Dale, Technical Officer, in the research programme changed duties to a permanent part-time basis in January 1979.

Seed Research and Development:

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

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

Seed Production

Evaluation continued on the seed production potential of foreign and local cultivars of herbage grasses and legumes, turf grasses, flowers and vegetables.

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 three years of storage indicate that germination of all species at all warehouses is beginning to decline. Moisture content of some lines, particularly grasses in the Lower South East reached high figures in the late winter-early spring period. Significant fluctuations in moisture content were also recorded in lucerne and medic seed in northern warehouses.

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. Responses in Paragosa gama medic were forwarded to the Germination Committee of ISTA to help establish rules for the germination of this species.

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

It is apparent that in all species permeability 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 of 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

Following the drought year of 1977/78, 1978/79 has been a year of almost record seed production. A total of 3 481 tonnes of certified seed was released for sale.

A record production of Jemalong medic was achieved 835 tonnes and Harbinger medic 312 tonnes. Trikkala sub clover production is steadily increasing with 56 tonnes. Clare sub clover production is steady at around 200 tonnes, Hunter River lucerne production (612 tonnes) was similar to last season. CUF-101 lucerne production was 38 tonnes.

Prices

Despite a big harvest, prices remained bouyant for most lines of seed. Export sales again accounted for the majority of the seed production. Carryover of seed was limited to Jemalong medic, Snail medic and Clare sub clover.

Mt. Barker sub clover

Contamination by other sub clover strains are an increasing problem in Mt. Barker seed stands throughout Australia. It was decided to reconstitute the variety. 120 lines were sown at Northfield. These lines included seed from W.A., Vic., N.S.W. as well as South Australian lines. These lines were assessed regularly and the remaining plants were harvested to provide Breeders seed.

Breeders Currie cockspoot

These plants have been maintained and seed was harvested during February.

Certification Programme

Total seed lines and area

855 lines assessed under certification for the season, 81 were rejected. This compared with 93 rejections for a total of 537 lines for 1977/78.

Total area inspected to produce certified seed was 16,311 ha compared with 7,414 the previous season.

O.E.C.D. Certification

The demand for this service is increasing both for material being multiplied for direct reshipment and local seed being exported requiring O.E.C.D. tags.

In all a total of 36 lines consiting of 3,702 sacks were involved with a combined weight of 127,089 kg.

Plot Testing

All annuals were sown during the year including wheat and barley for the first time.

Medic species

101 certified lines were tested and all met certified standards.

Subterranean species

70 certified lines were tested and all met certified standards.

Cereals

Wheat

67 lines were tested and all were true to type.

Barley

50 lines were tested. One line of "Approved" Ketch was found to be Clipper.

Oats

23 lines of certified oats were sown and found to all inside certified standards.

Lupins

18 lines of lupins were sown and were all satisfactory.

Pre-certification testing of Hunter River lucernes

During 1979 55 lines of lucerne were accepted as being Hunter River. Another 48 lines were sown and are under observation.

Grow-on testing (annuals.)

Just 6 lines were tested during the year 3 certified which were subsequently released certified seed and 3 uncertified seed.

Seed Testing Laboratory

Last season the Seed Testing Laboratory processed 7 575 seed samples for export, quarantine and domestic purposes. In all 10 500 individual tests were carried out including routine purity and germination analyses prohibited and restricted weed seed identification, fluorescence tests for varietal strain, and tetrazolium testing to determine seed viability.

These samples consisted of

Imported Quarantine	72
Uncertified	1 533
Certified	785
O.I.C.	247
B.I.C.	24
Departmental	4 914

Other projects included the completion of weed seed specimen collections, which were distributed to all S.A. seed cleaners and relevant Departmental Officers. The updating and revision of the reference seed collection was commenced and it is hoped to fully extend and complete this work next season, with the addition of seed specimens from C.S.I.R.O. Canberra and other States.

Experimental work for I.S.T.A. in the form of surveys and the usual referee tests for purity and germination were continued. In addition Referee tests within Australia mainly involving the tropical grasses and legumes were carried out.

A South Australian analyst attended the Australian Seed Testing Workshop held at the Queensland Department of Primary Industry in Brisbane Sept. 1978. A Queensland analyst earlier in the year attended the I.S.T.A. Seed Testing Workshop in Wageningen Holland, and this was an excellent opportunity to discuss present and new techniques in Seed Testing methods and more important seedling interpretation according to I.S.T.A. rules. Uniformity in these two areas is very important as the volume of seed moving in International trade is increasing every year.

Again we hosted visits from International Students from Roseworthy and public school students. Displays and specimens were prepared in conjunction with the Seed Production section and U.F.&G., for the annual Paskeville field day. Work in preparation for a Seed Cleaners school was commenced and it is hoped to hold this day early next season.

Extension Programmes

Seed Industry Newsletter

Six issues of the Seed Industry Newsletter were published during the year and continues to be widely read both within the state as well as interstate and

overseas. 600 copies are distributed of each issue. The Newsletter is produced in co-operation of Seed Industry Association of Australia (Southern Division) and United Farmers and Graziers (Seed Section).

Field Days

The Seed Production section was represented with the Seed Industry Association and Seed Section of United Farmers and Graziers at the Agricultural Field Days held at Cleve Aut. 1978.

Seed Industry Working Party

The Working Party maintained an active program of liaison between sections of the seed industry and the Department. The main areas of discussion were on development of the lucerne seed industry, buildup and promotion of Departmental medic and lucerne cultivars, formation of a Foundation Seed Program to facilitate basic seed supply and facilitating passage of new seeds legislation.

Seeds Act 1979

On 15th March, 1979 a new Seeds Act was passed by the S.A. Parliament. Dr. Boyce was the Departmental representative involved in discussions on this matter.

Conferences, etc.

Seminar on the production of basic seed - Waite Agricultural Research Institute, September 21, 1978 - K.G. Boyce, G.E. Cooper, C.A. Schubert, I.H. Simons, E.S. Hogg, P.D. Smith, C.M. Williams.

Australian Seed Industry Advisory Committee meeting, Canberra, 18 February, 1979 - K.G. Boyce. Australian Seeds Committee meeting Canberra, 18-21 February 1979 - K.G. Boyce.

Consulation with International Centre for Agricultural Research in the Dry Areas, Aleppo, Syria, on seed production, processing and storage - 21 April to May 5, 1979 - K.G. Boyce.

Annual Meeting of National Designated Authorities responsible for the O.E.C.D. schemes for the varietal certification of seed moving in International trade - official Australian delegate, Paris, France; 7-11 May, 1979 - K.G. Boyce.

Study tour of commercial seed trade, and research, certification and seed testing in Europe, United Kingdom and United States of America. 14 May to 9 July, 1979 - K.G. Boyce.

Publications

K.G. BOYCE (1978) - Ed. Proceedings of "Seminar on the production of basic seed held at Waite Agricultural Research Institute, Glen Osmond, S.A. on September 21, 1978.

K.G. BOYCE (1979) "The development of seed related activities in ICARDA" Report to the Director-General of ICARDA, Beirut, Lebanon.

K.G. BOYCE (1979) Report to Standing Committee on Agriculture. Proceedings of Annual and Advisory Group meetings of representatives of the national designated authorities responsible for the OECD schemes for the varietal certification of seed moving in international trade. Paris, France, 9 to 11 May, 1979.

WEEDS RESEARCH SECTION

SECTION LEADER:

P.M. Kloot, M. Ag. Sc

RESEARCH OFFICERS:

A.N. Holmes, B. Sc. M.Env Studies
(to 26/1/79)

A.F. Hobbs, B. Ag. Sc. (from 30/1/79)

WEEDS RESEARCH
AGRONOMIST:

D.I. Murrie, R.D.A. - Seconded from
Plant Protection Section

FIELD ASSISTANT

D. Carter

WEEDS RESEARCH SECTION

The last year has been mixed for the Weed Research Section. During the year, a position supported by CESG funds became available and Holmes was appointed. He had the makings of a fine research officer but he resigned in January to accept a permanent position in the Victorian Public Service which was reclassified upwards specifically to attract him. Hobbs was appointed in his place, but the position was abolished on June 30 as a result of the drastic cut-back in CESG funding which resulted from the Federal Government mini-budget in June. The appointment of staff to the Section is urgently required, as our research programme in particular, cannot be developed due to the staff shortage.

In spite of the staff position, the Section has been able to make some satisfactory progress. Some research work was completed, some investigations started and the Herbicide Evaluation Scheme considerably expanded. More detail is given in the body of the report.

STAFF

Further to the opening comments above, Holmes was appointed November 7 1978 and resigned January 26 1979. Hobbs was appointed vice Holmes January 30 1979 and the position abolished June 30 1979.

During the year, Kloot was reclassified to the AS3 range.

RESEARCH ACTIVITIES

The main projects continue to be those associated with the part-time Ph.D. studies of Kloot. Unfortunately because of excessive delays in the biometry section, the results from the 1978 season have not been processed. The Census of Alien Plants which is to be computer-stored is also affected and no progress has been made in the last twelve months.

Observations of pasture plots at Winulta receiving different management treatments show a very rapid swing to weedy pastures where medic is not sown and/or superphosphate is not applied annually. The trends are not so apparent in a similar experiment at Avon, but may show more clearly after another year.

The programme of studies in progress is as follows:

- C4/A15 Factors affecting the composition of medic pastures.
- C4/A15 Long term management effects on pasture composition.
- C4/A17 The composition of pastures in the Lower North.
- C5/A15 Comparative phenological studies of alien plants.

Other research activities of the section were:

Control of soldier thistle in crops and pasture (Murrie)

- (a) This work has been completed. The work established that the period of germination is restricted to a narrow period following the autumn rains.
- (b) That early application of amine MCPA was selective in medic pastures.
- (c) that for every 5-6 weeks that spraying is delayed from the ideal period (i.e. two weeks after the emergence of the cotyledons) the rate of herbicide application should be doubled viz:-

Up to 2 weeks after cotyledon emergence - 750 mL/ha
from 3-8 weeks after cotyledon emergence - 1.0 L to 1.5 L/ha
from 9-14 weeks after cotyledon emergence - 2.0 L to 3.0 L/ha

- (d) that once the flowering stem emerges, ester 2,4-D at 2.0-3.0 L/ha is the most effective control. This treatment is not selective in crops or pasture.

Effect of soil pH on herbicide activity (Hobbs, Kloot)

A glasshouse experiment was conducted in which four natural soils of pH 6.0 - 8.5 were used. Wheat and mustard were sown and sprayed at the correct growth stage with either flowable powder or wettable powder formulations of diuron. Visual assessments showed greater phytotoxicity to both species with flowable formulation and an increase in phytotoxicity with increasing pH. The data is being analysed.

Control of bracken with asulam (Murrie)

Observations on long-term effects of adding distillate to asulam to increase efficacy are being continued. As a result of this work being carried out in conjunction with May & Baker Ltd., the recommended rates of application have been reduced, thereby cutting costs and the period of application resulting in reliable control extended.

Other

Weeds research of the Agronomy Branch carried out by regional Plant Protection Advisers and other Research Officers is under the general 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

Advice on weed management is constantly sought by other Departmental Officers either for research projects or for extension problems. This is given to the best of the resources available.

Information on weed control in new crops in the south east has been constantly sought. The multiplicity of crops and the small areas involved raise doubts as to the priority of such requests as literature searches are time consuming.

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 about weeds and their control from overseas and interstate have been handled.

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

A survey on yellow burr weed being carried out by the Riverland Region was drawn up with participation from the Section. Technical advice has been tendered to various Departmental committees and others in connection with the controversy about releasing biological control agents for salvation jane. The introduction of *Polygonum argyrocoleon* in lucerne seed from California has also been considered and advice has been given to the Agronomy Branch Quarantine Committee.

Herbicide Registration

The technical assessment of herbicide labels submitted for registration and the evaluation of herbicide clearances through the Technical Committee on Agricultural Chemicals is an important contribution of the Section made through the Principal Officer - Agricultural Chemicals (B.D. Robinson).

The previously noted trend of a decrease in registrations has been sharply reversed whilst the increase in TCAC clearances continues.

Year ended June 30	1976	1977	1978	1979
Registration assessed	121	95	87	118
TCAC submissions reviewed	11	15	18	25

Herbicide Evaluation Scheme

The first year of the scheme in 1978 was completed most successfully. Reports of observations on the plots were issued to the respective companies.

The second year of the scheme in 1978 saw a huge expansion in services provided and company participation. The scheme was provided in cereals again at Turretfield and also on a malle soil at Two Wells. Grain legumes were provided at Turretfield. The Department offered a service whereby for an increased fee (\$100 per strip) the Department would carry out all work required and provide a report at the conclusion of the season. Most companies have availed themselves of this service and so the workload has increased greatly. Whereas in 1978 106 strips were involved, in 1979 318 strips in total have been sold.

The scheme has been applauded by industry and by other State Departments.

Our results will be acceptable to Victoria and probably Southern N.S.W. and Western Australia. To facilitate this acceptance, cereal cultivars grown interstate but which are not important here have been included e.g. Olympic wheat. There is every indication that the scheme will continue on at the same level, at least, for the foreseeable future.

The day to day running of the scheme has been carried out by Murrie assisted by Carter and the smooth operation and successful execution are a tribute to their devoted work.

Education

The Section continues to have heavy responsibilities in this field. Kloot, is the Departmental Convenor of the Weed Officer's Certificate run by the Department of Further Education and giving most of the lectures whilst Murrie is responsible for most of the tutoring in the external studies course. Some further revision and rearrangements of the courses were carried out during the year. The future appointment of an Education or Training Officer by the Pest Plant Commission to take over the management of the course is keenly anticipated.

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. They also run a session in Agriculture II at the Waite Institute in which practical demonstrations on herbicide selectivity are given to the students.

Committees and Conferences

Kloot was responsible for editing the two volumes of papers for the SADAF Branch Conference held in April 1979. Murrie continues to represent this State on the

Inter-Government Liaison Committee on Water Hyacinth. This Committee did not meet during the twelve months under review but handled matters by correspondence as required. Kloot continues to be Chairman of Australian Weeds Committee. Some other meetings were addressed during the year and are listed below.

The meetings and conferences attended during the year were as follows:

1978

- September 7 Address to Weed Science Society of South Australia - "Welcome stranger - a reappraisal of the introduction of plants" (Kloot).
- September 13 Seminar to Agronomy Department, Waite Institute Adelaide - "Studies in the alien flora of South Australia - a progress report" (Kloot).
- September 27 Address to Australian Systematic Botany Society Adelaide - "Alleged aliens and inferred indigines - a reappraisal of the origin of selected species in the South Australian flora" (Kloot).

1979

- February 15-16 Seminar - Management of Aquatic Weeds - Canberra (Murrie).
- April 3-5 Agronomy Branch Conference - Adelaide (Kloot, Hobbs, Murrie).
- May 1-2 Pest Plant Commission Conference - Adelaide (Kloot, Hobbs, Murrie).
- June 26-28 Australian Weeds Committee - Melbourne (Kloot).

Publications

- Kloot, P.M. (1978) Ryegrasses. Dept. Agric. & Fish. S. Austral, Agron. Branch Report No. 98 8 pp.
- Kloot, P.M. (1979) Annual Pastures of the lower north SADAF Agron. Conference 1979 pp. 118-120.
- Kloot, P.M. and Murrie, D.I. (1979) The SADAF herbicide evaluation scheme SADAF Agron. Conference 1979 pp. 259-260.
- Murrie, D.I. (1979) Aquatic weeds of danger to South Australian water resources. SADAF Agron. Conference 1979 pp. 266-267