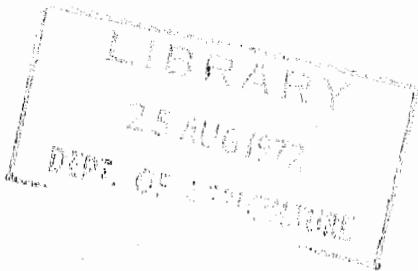


DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

# Agronomy Branch Report

ANNUAL REPORT 1970 - 71



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### Agronomy Branch

#### A. SEASON REPORT & PRODUCTION TRENDS:

Rainfall was variable and below average from April to July, 1970, except in the normally assured areas of the State where light to moderate falls produced useful totals. Above average rainfall was recorded for August and September but this was followed by dry conditions in October accompanied by some damaging winds and severe frosts over the eastern portion of the State. Further rains in November and December were too late to relieve the position.

The variable seasonal conditions resulted in drought in the Murray Mallee and on Eastern and Upper Eyre Peninsula, and a reasonable season over the remainder of the State. Ninety-nine producers were granted carry-on finance under the Primary Producers Emergency Assistance Act.

The production of wheat, barley and oats in the 1970-71 season was 29.0 million bushels of wheat at an average of 14.60 bushels per acre, 32.7 million bushels of barley at an average of 19.10 bushels per acre and 8.4 million bushels of oats at an average of 17.50 bushels per acre. The total production of wheat, barley and oats was 71.2 million bushels, the lowest since 1967-68 when production was 42.6 million bushels.

The yields of field peas and cereal rye were also affected by the poor seasonal conditions.

Oil seed rape was grown on a commercial basis for the first time in the State. Extremely variable yields were obtained.

Pasture production varied in a similar manner to cereal crops. In the more favoured areas growth was at least average but in the areas that were dry until August there was little or no growth. The dry conditions of October closed the annual pasture season quickly and prevented the usual flush of growth which provides pasture hay. Perennial pastures benefited from the late seasonal rains.

The total volume of pasture seed certified was less than the previous season due to lower production of Mt. Barker subterranean clover and Australian phalaris. On the other hand the production of Clare subterranean clover, Demeter

fescue, Medea perennial ryegrass, Du Puits and Siro Peruvian lucerne, Currie cocksfoot and Seedmaster and Sirocco phalaris have all shown increases in production.

B. DEVELOPMENT IN INDUSTRY:

1. Increased Sowings of Alternative Crops

Following the introduction of wheat quotas in 1969-70 the acreage sown to wheat has been reduced substantially (from 3.3 million acres in 1969-70 to 2.7 million acres in 1971-72).

Producers have turned to alternative crops and other enterprises. Barley has accounted for the reduction in wheat acreages in that it has increased from 1.5 million acres in 1969-70 to 2.1 million acres in 1971-72. The area sown to field peas has also increased and oil seed rape is now being grown commercially. Some interest is also developing in the production of lupins and canary seed. Consideration is being given to the organised marketing of oats.

2. Agricultural Chemicals

Improved standards in terms of efficacy and safety of use for insecticides, herbicides, fungicides and nematicides has demanded increasing attention by officers in all fields covered by the Agronomy Branch during the year.

There now exists close liaison with a wide section of the chemical industry and this joint effort has enabled a wide range of new chemicals to be made available to the farming community.

The technical work checking research results supplied by industry and matching these against Departmental field results in relation to the safe and efficient use of new chemicals is co-ordinated throughout Australia by the Technical Committee on Agricultural Chemicals. The Principal Agronomist has been appointed the Departmental representative on that Committee.

C. RESEARCH ACTIVITIES:

1. Introduction

The majority of the research personnel working in the Agronomy Branch are stationed at the Northfield Research Laboratories from where they conduct their research projects throughout the State in conjunction with Departmental research centres and on private properties.

Six years ago, the work commenced from Northfield and the experience of the Agronomy group is now very considerable.

During the year under review a great deal of attention has been given by the group to the improvement of research equipment, much of which needs to be highly mobile to service research plots throughout the State.

The Cereal Research and Plant Breeding Sections now have seeding and harvesting equipment adequate for their needs. The Pasture Establishment Section is developing an elaborate experimental machine for sowing pastures in a great variety of ways to enable accurate comparisons between various establishment techniques.

## 2. Wheat Agronomy

The wheat agronomy programme was mainly concerned with the evaluation of yield and quality of a record number of 74 wheat varieties compared with 55 last year. The increased number of lines was the result of participation, in conjunction with the other states, of uniform trials.

Over all the trials Halberd again proved its outstanding yielding ability with a 13% average superiority over the standard FAQ variety Heron.

Testing of durum varieties was also expanded during 1970-71. The standard variety Dural was outyielded by the newer varieties by as much as 23% in some cases. The successful cultivation of durum varieties in plots has given impetus to farmers to sow small commercial acreages during the 1971-72 season.

Trials examining the optimum seeding rate for wheat have continued at a large number of sites.

Testing the efficacy of a number of fungicides for the control of both loose smut and bunt have continued. The systemic fungicides Vitavax(R) and Benlate(R), at rates as low as  $\frac{1}{2}$  oz. per bushel, continued to give excellent control of loose smut. These two fungicides, together with a non-systemic material also gave good control of bunt. This work is particularly important because there is some indication that the basic fungicides at present in use are breaking down on the protection afforded and they may cause residue problems.

### 3. Barley Agronomy

The barley research programme is a continuing one and relatively little change has taken place during the year under review.

A total of 17 malting type barleys from local, interstate and overseas breeders were tested in variety trials. The recommended varieties, Clipper and Ketch, were again outstanding.

Feed type barley varieties were also tested over a wide range of sites. Of the 15 varieties tested two out-yielded Clipper by more than 15%. A most significant attribute of one of these varieties was that it appears to be resistant to eelworm (Heterodera avenae).

Fungicides have been examined for their efficacy for loose smut and powdery mildew control. As with wheat Vitavax (R) has proved satisfactory for the control of loose smut. Powdery mildew, because of the seasonal conditions, was not sufficiently prevalent to enable an effective evaluation of fungicides to be made. However, useful data on the phytotoxicity and fungicide residues has been obtained.

Seeding rate trials using Clipper and Ketch carried out at three widely separated sites has confirmed that the appropriate seeding rates for these varieties are similar to those made for the older varieties previously grown in South Australia.

### 4. Plant Introduction

A vigorous plant introduction programme has been maintained for almost twenty years. This has covered a very wide range of species of grasses and legumes which have been tested for adaptation to South Australian conditions.

The emphasis at the moment is on the acquisition of a wide range of material from the annual Medicago species and the perennial Medicago species. Material of both species are being examined for possible use in their present form and as parental material for plant breeding programmes.

In the case of the annual species of Medicago a total of 556 introductions were examined, these were classified on the basis of 36 distinct morphological and 22 distinct agronomic characteristics. The observations are recorded for pro-

cessing by computer. Several introductions were made from northern Greece as a possible source for breeding varieties with a lesser degree of barrel seededness.

In the case of the perennial Medicago species, a total of 807 introductions, representing 18 species, had been obtained. Of these approximately 500 have been planted in quarantine facilities provided on loan by the Waite Agricultural Research Institute and C.S.I.R.O. Division of Nutritional Biochemistry.

After initial classification interesting and promising new introductions are examined in sward trials in appropriate regions of South Australia. Current work of this nature consists of the examination of a range of annual Medicago and Trifolium species on some problem hard setting red-brown earth soils where some introductions are showing considerable promise.

In the perennial Medicago group a number of lucerne varieties are being examined in swards for their suitability for use in the Lower South East of South Australia on two soil types and on a red-brown earth soil at Turretfield Research Centre. These trials are continuing.

As a result of earlier selection and sward testing work it has been possible to register a new variety of lucerne, Paravivo. Paravivo is a selection from Africa which has in trials proved to be at least equal to African in production and longer lived. Seed stocks are currently being built up in anticipation of the release of this variety as a commercial cultivar during 1971-72.

A selection of purple clover (Trifolium purpureum) has been registered under the variety name, Paratta. This selection has shown considerable promise on Kangaroo Island as a lowoestrogen alternative to subterranean clover. It has performed very well and shown competitive ability against Yarloop sub. clover, the variety which has been most widely used on the wetter situations on Kangaroo Island. Seed stocks are being built up in anticipation of the release of this cultivar during 1971-72.

## 5. Plant Breeding

Plant breeders working in the Agronomy Branch are dealing mainly with Medicago truncatula and closely related annual species of Medicago tornata and Medicago littoralis. Their aim is the observation of new cultivars incorporating improvements in winter yields of herbage, improvements in the yield

of seed and pods and the adaptability to a wide range of environments within the Australian wheat belt. The ability of these species to regenerate is also receiving attention.

The development of field techniques and equipment occupied a great deal of effort during the initial years of this breeding programme. This work has involved mechanisation and site selection programmes.

Testing of the cultivation, sowing, harvesting and threshing equipment developed in the mechanisation programme was completed with the establishment of sward experiments at Northfield and Mindarie in 1971. These experiments involve evaluation of 1,300 plots of 64 entries, principally of the barrel medic group.

The site selection study involved a four year sowing programme using six cultivars sown in the major South Australian wheat belt medic growing regions.

Primary selection sites have been chosen as a result of this work and 6,000 small swards of  $F_2$  breeding progeny were established at the opening of the 1971 season.

During 1970-71 nursery production of seed of several hundred barrel medic introductions and  $F_2$  stages of hybrids was accomplished for future field evaluation. Seed was produced of  $F_1$  hybrids and new introductions in the glasshouse.

While much of the hybrid material will be tested as families, single seed descent pedigree will be used in some parts of this programme.

Attention is now also being given to seeking resistance or tolerance to major insect pests. Both the traditional ones, red legged earth mite and lucerne flea, and the newer and possibly most important *Sitona* weevil. Hairy foliage has proved no barrier to the latter insect and screening of the entire collection of the barrel medic introductions has been commenced for resistance to this insect.

The lucerne breeding programme is at a much earlier stage than the annual medic programme outlined above. Objectives include improvement in waterlogging tolerance and disease and pest resistance. Problems of screening parental material for its seed producing ability in the field are being studied in co-operation with the C.S.I.R.O. Division of Tropical Pastures.

## 6. Seed Production Research

Rapid and reliable multiplication of improved new cultivars is necessary to enable optimum utilisation of new varieties arising from plant breeding programmes. Many difficulties have been encountered in the past in getting new bred varieties into widespread use and research into developing more reliable and rapid methods of multiplying new cultivars has been under way for some years.

In grass seed multiplication nitrogenous fertilisation is rather important and a number of experiments have been conducted in which various applications of nitrogen have been applied to the cultivars Currie cocksfoot and Demeter fescue. These nitrogen treatments have been in factorial combination with a variety of defoliation treatments. These experiments have led to the conclusion that it is possible to take some grazing from seed producing areas providing that when this is done additional nitrogen is applied. Precise recommendations for optimum grazing and optimum nitrogen applications are not yet possible. It is anticipated that experiments in progress, together with those of earlier years, when considered following the 1971-72 harvest will be sufficient to provide the necessary commercial recommendations for this aspect of seed production.

A major investigation, continued and further developed during 1970-71, concerned the estimation of the optimum time to harvest grass seed crops. The particular cultivars examined were Demeter tall fescue, Sirocco phalaris and Australian phalaris.

A number of smaller investigations have been undertaken related to the development of the export trade in seed. These have been time-of-sowing trials in the case of marrow stemmed kale, and a simple seed yield trial in the case of a collection of western European herbage plant cultivars.

## 7. Pasture Establishment Investigations

Equipment to enable comprehensive experiments concerned with pasture establishment over a very wide range of conditions has been developed during the year. The equipment, which consists of an extensively modified rear engined tractor, has a variety of seed and fertiliser boxes and a range of tynd and disc-type attachments. It has been successfully tested in the field and will be used next autumn for field trials.



Laboratory studies concerned with comparing the ability of the annual Medicago cultivars Paragosa, Harbinger and Jemalong to establish under a variety of environmental conditions normally encountered in the field at the break of the season, have been made using the Osmotic-germinator apparatus. Current indications are that the superior ability of Paragosa to establish under favourable moisture conditions is due to the fact that it germinates at least 8 hours and often more than this before the other two cultivars.

Growth cabinet studies have been commenced on the germination and early growth of Australian phalaris, both in conditions of adequate nutrition and using soils which have proved difficult to get satisfactory growth of phalaris seedlings.

#### 8. The Environmental Limitations of Pasture Growth

This work which has continued in the South East of the State has indicated that greatly increased yields of herbage can be obtained during the winter months in this region, providing that large quantities of nitrogen are applied to dense swards. Current indications are that the potential productivity of dense swards of the subterranean clover cultivar Woogenellup is at least as great as production obtained from Wimmera ryegrass (Lolium rigidum). Results to date indicate that production over a normal seven months growing season in this region should reach a level of 20,000 kilograms per hectare of dry matter.

Growth rates of herbage were shown to be directly proportional to light intensity. The conversion rate of light energy into organically bound energy was shown to be in the region of 2.4%, an efficiency which compares favourably with the best figures recorded for temperate regions. The increased production of dry matter due to applications of nitrogen was about 17 kilograms for every kilogram of applied nitrogen. Studies of the levels of nitrate and ammonia nitrogen in the soils used for these field experiments has indicated that while reasonable levels of available nitrogen are present for a short period after the commencement of the wet season, these rapidly reduce to a very low level indeed, thereby seriously retarding the growth of plants in the absence of applied nitrogen.

#### 9. Utilisation of Dryland Lucerne Pastures

The study of the influence of a range of stocking rates and grazing systems on the output of wool and liveweight changes of the grazing animals from lucerne based pastures in the deep sandy soil region of the Upper South East of South Australia was completed during the year.

The experiment covered the seasons from 1967-70 inclusive. During this time a wide range of seasonal conditions was encountered including a severe drought.

The trial has shown that if a vigorous lucerne component is maintained in these pastures, animal production 50-100% above production attained in the absence of lucerne can be sustained.

Conclusions from this applied research programme have contributed significantly to the increased acceptance and improved utilisation of dryland lucerne pastures in this region.

## 10. Entomology

### (a) Pasture cockchafer

During the year the Entomology Research Section has continued studies of the damage caused to pastures by the pasture cockchafer (Aphodius tasmaniae). This work aims to establish simple measurements that a farmer can make to tell him whether the level of infestation is sufficient to justify the use of insecticides.

### (b) Sitona weevil

This relatively new insect pest which has spread very rapidly throughout the improved pasture areas of the State is causing great concern, particularly because it feeds heavily on medic species interfering with nodulation.

The Entomology Section is gathering resources to undertake major studies of this pest. Preliminary work has begun on its general biology.

### (c) Pea weevil

Field trials have successfully shown that indosulfan is cheaper to use and more effective for the control of this pest than DDT. These results culminate several years' studies in the field involving a wide range of insecticides and is a part of the Department's continuing programme to remove the need to use DDT in agriculture.

### (d) Mass rearing techniques

Successful laboratory methods for rearing Heliothis have been developed and the Section has now turned its

attention to the production of an artificial medium for culturing Persectania larvae in the laboratory.

## 11. Plant Pathology

The leader of the Plant Pathology Section, Dr. Banyer, resigned during the year after having established this group on a sound research basis. His excellent knowledge of South Australian agricultural practice enabled him to work with equal confidence in the field. His cereal nematode investigations had Australian-wide recognition.

Field work on barley resistance to eelworm was commenced by Dr. Banyer during 1970 when 500 varieties were screened. Twenty selected varieties are now the subject of further investigations at three sites this year. The original sites have been oversown with commercial wheat, barley and oat varieties to assess the effect of growing a relatively resistant variety on the yield of these cereals.

Investigations have begun on the incidence and severity of leaf pathogens of barley in South Australia. Surveying techniques are being developed first which will enable large areas to be sampled more efficiently.

## 12. Weed Control

During the past year experimental work on the economic control of soursob (Oxalis pes-caprae) has progressed to a very satisfactory stage. Two herbicides which can be used in cereal crops are in the final stages of assessment. Diuron, which has mainly been used to date in South Australia as a soil sterilant is one of these. Research has shown that it can be used selectively in cereals for soursob control, provided certain limitations are not exceeded. The other herbicide has not been developed to the market stage but the company holding its patent has been working closely with the Departmental research workers and it is hoped that it will soon be registered for use. Soursob is a very serious weed of cereals and pastures in many agricultural areas of the State, and if these new findings can be put into practice, they will do much to lift the economic burden caused by the competitive and poisonous effects of this weed.

Long term trials for the control of the perennial weed, silver leaved night-shade (Solanum elaeagnifolium) are continuing. It is hoped that the seriousness of this weed, current knowledge of its control and research in progress can shortly be reviewed throughout Australia so that the work

being conducted here will be fully co-ordinated with the work proceeding interstate.

The first releases of the rust (Puccinia chondrillinum) a fungus pathogen of skeleton weed (Chondrilla juncea), were made towards the end of August, in co-operation with the C.S.I.R.O. and the Plant Pathology Department at the Waite Institute. This rust, which will only affect skeleton weed, was recently isolated in Europe, and while it is not expected to eradicate this serious weed, it may at least reduce its vigor and make other control measures more effective. Releases were made under controlled conditions near Parilla and Karoonda. It has already been shown that it is possible to establish the disease on the weed in the field, and trials are now continuing to determine the best methods of release, the persistence of the fungus, and its effects on reducing the density of skeleton weed.

Research work defining the ecological limits and the requirements for germination of pheasant's eye (Adonis spp.) is continuing, but little success has been achieved in determining a selective economic control in pastures.

During the past 12 months, recommendations for the control of weeds affecting the pasture legume seed crop industry have been up-dated, based on field research. Excellent publications have been distributed to seed growers with these recommendations.

More attention is now being given to low cost economic controls of weeds in dryland pastures, and the use of low rates of the hormone-type herbicides, followed by controlled grazing is being examined.

#### D. EXTENSION SERVICES:

The extension staff of the Agronomy Branch has provided an extensive information service on all aspects of agronomy to primary producer organisations, industry, members of the general public, to the Government and to Government and Local Government departments.

Increasing use is being made of all available media. The mass media (press, radio and television), have been used extensively to inform the public in general, producers and other interested parties of the current situation in agronomic matters of interest and importance.

Group activity, mainly with Agricultural Bureaux, at meetings, conferences, farmers' schools, field days and demonstrations, was again of very great importance, particularly to officers stationed in country districts. Their work in this field has been supported by technical specialists when necessary.

The great bulk of the person-to-person work of the extension group was carried out by district agricultural advisers and field officers working with them. This involves farm visits, office, postal and telephone enquiries and occupies a considerable amount of district officers' time.

In order to better service the needs of producers, an additional agricultural adviser's district has been created in the Murray Mallee region. This is the second additional district set up in the past 3 years, making 12 agricultural advisers' districts servicing the State. These districts are based at Pt. Lincoln, Cleve, Minnipa, Kadina, Jamestown, Nuriootpa, Adelaide, Murray Bridge, Loxton, Lameroo, Keith and Mt. Gambier.

Plans are in hand to appoint two assistant district agricultural advisers to Jamestown and Pt. Lincoln, which will supplement present staff in these districts and provide valuable training for the young officers.

In order to better plan and co-ordinate extension education activities a more formal system of programme planning of extension work is being introduced by the Branch.

With changing market outlooks for the agricultural products the Branch has developed a policy to increase production efficiency, promote product quality and to look at cultural requirements and economic aspects involved in the growing of alternate agronomic crops.

To meet new needs in agricultural extension, providing additional training continues to be an objective of this Branch. During the year further officers attended in-service training schools. One extension officer this year completed the post-diplomate diploma in rural extension at Hawkesbury Agricultural College. One attended a 7 week Farm Management course in Western Australia, and another attended the Short Course in Extension at Brisbane University. There are plans in hand to provide district officers with training in Farm Management aspects within the Branch, so that officers can efficiently meet the increasing demands for this type of service to producers.

Extra ordinary duties are continuing to occupy a considerable amount of some officers' time. One agricultural adviser in Head Office is involved in reports on applicants for finance under the Rural Advances Guarantee Act, 1963. He has also been involved in inspections and reports for the South Eastern Drainage Board. The Senior Agricultural Adviser is a member of the Primary Producers' Assistance Advisory Committee, Wheat Quota Advisory Committee, the Commonwealth Consultative Committee on Drought, and the Bushfire Research Committee.

### Extension Work in Weed Control

Weed control officers have continued to conduct formal weed control training courses for adult night classes and for correspondence students as required under the terms of the Weeds Act, 1956-69. The demand for this course has begun to fall off after its seventh year.

Specialised extension services for weed control in country areas are at the lowest ebb for 15 years, as all country based positions for such officers are currently vacant.

The two annual publications, "Herbicides for Weed Control, 1971-72" and the Cereal Weed Control Chart, have again been produced and improved.

A continual service to the general public on matters regarding plant identification and weed control is being maintained.

### E. DIAGNOSTIC SERVICES:

A large part of the work of the Agronomy Branch is involved in the identification of pasture and cereal pests, nutritional diseases and the identification of weeds and weed seeds. While much of this work is done on the spot, for example, 10-15 weed queries requiring identification and recommendations for control are dealt with daily in Head Office alone, a great deal of laboratory work is also carried out, particularly by the Plant Pathology and Entomology Section.

Eighty-three diseased field crop specimens were submitted to the Plant Pathology Section for diagnosis. Many of these came from district agricultural advisers anxious to establish the cause of the field disorders.

The incidence of bunt on wheat was abnormally high in some areas of the Mid North during harvest. The plant pathology diagnostic service isolated the bunt fungi (Tilletia foetida) and was able to show that some forms were resistant to the commonly used fungicide, hexachlorobenzine. Seed cleaners have been alerted and new fungicides will now have to be used in these areas.

Besides the normal insect identification service to the public, the Entomology Section provided a diagnostic service to the grain handling authorities in relation to resistant strains of insects which cause damage to stored grain. A 25-fold resistance factor to maldison has been established requiring the use of new insecticides such as dichlervos and improved hygiene in silos.

Locusts and grasshoppers have been particularly active during the year and continuous field surveys have been conducted to identify the species involved and the extent of infestations in the marginal areas.

#### F. SEED CERTIFICATION:

The seed certification programme has been maintained at approximately the same level as in the immediate past year. The major development in the year under review has been the acceptance of Australia as a member of the O.E.C.D. Certification Scheme for herbage seed moving in international trade.

For a number of years the South Australian Seed Certification Scheme has been progressively modified in anticipation of eventual acceptance of Australia as a member of this international scheme. The South Australian seed certification staff will be responsible on behalf of the Commonwealth to implement the scheme in South Australia.

A particular development necessitated by this scheme is the growing of random lots of certified seeds in plots to assess their trueness to type under field conditions.

It is anticipated that in the initial stages of membership of this certification scheme, Australia will be producing foreign varieties for export under the scheme rather than being actively involved in producing seed of varieties selected or bred in Australia.

Some of the foreign cultivars have already been established. Given favourable conditions for the remainder of the season some seed should be exported from the coming 1971-72 seed harvest with O.E.C.D. labels.

Mr. E.D. Higgs, Senior Research Officer (Pastures), and Officer-in-Charge of Seed Certification in South Australia, was selected to attend the O.E.C.D. Certification Scheme's Annual Meeting held in Paris at the beginning of 1971 as Australia's first delegate.

G. REGULATORY WORK IN WEED CONTROL:

Noxious weed control in South Australia is basically administered by local government authorities who have employed trained inspectors subsidised by this Department. Officers in the Weed Section have also worked closely with the inspectors in the field, providing the necessary technical staff.

These control measures have now entered a very difficult phase because of the financial problems in the rural communities. Farmers are finding it more difficult to treat weed problems, such as African daisy, skeleton weed and Noogoora burr. In turn, local government is facing severe financial problems and a number have already dispensed with the services of their inspector. This has also coincided with the resignation of four weed control specialists within the Department which has brought technical assistance to councils almost to a halt.

To face these problems a detailed study has been made which has enabled an entirely new scheme, based on weed control boards, to be proposed. This scheme is currently being considered by the Government.

During the year a weed control spray unit became operational for the first time. It is designed to help local government deal with outbreaks of serious noxious weed which need urgent attention and to deal with outbreaks of serious weeds such as mesquite in pastoral areas. Trained staff is not yet available to fully man the unit but already it has been used to good effect in northern pastoral areas.