



DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

Agronomy Branch Report

Agricultural Research in the South-East of South
Australia and Adjacent Areas of Victoria

CROP PRODUCTION

P. M. BARROW

Report No. 10

October, 1969

AGRICULTURAL RESEARCH IN THE SOUTH-EAST
OF SOUTH AUSTRALIA AND ADJACENT AREAS OF VICTORIA

CROP PRODUCTION

P. M. BARROW Principal Agronomist

AGRONOMY BRANCH REPORT

October, 1969

FOREWORD

The following paper was prepared as a background paper for the Workshop held at Naracoorte on 14th to 16th October, 1969 to discuss the problems of the agricultural areas of South Eastern South Australian and adjacent areas of Victoria, and to pinpoint the research needed to overcome these problems.

This workshop was attended by Officers of the South Australian and Victorian Departments of Agriculture, the South Australian Department of Lands, C.S.I.R.O. Division of Soils, C.S.I.R.O. Division of Nutritional Biochemistry, the Waite Agricultural Research Institute, and the Victorian Soil Conservation Authority.

A final list of research requirements, as determined by the workshop, is also included.

AGRICULTURAL RESEARCH IN THE SOUTH-EAST OF SOUTH AUSTRALIA AND
ADJACENT AREAS OF VICTORIA

WORKSHOP

CROP PRODUCTION

Excluding areas devoted to forests, approximately 3% of the total area of holdings in the workshop area is used for crop production each year. There is a potential for very great increase in this percentage, and such an increase, together with considerable diversification of the range of crops grown, is evident at the present time.

Climatic and land conditions over much of the area are suitable for crop production, and the realization of the very great potential of the underground water resources for irrigation (Holmes, 1969) have focused much recent attention on this.

Cereal production is still by far the most important crop enterprise, but a number of other crops are also grown. Some important developments in new crop production have taken place since the publication of the CSIRO booklet on the region.

CEREAL PRODUCTION

The only part of the region in which cereal production is fully established as a major farming enterprise is on the Frances-Goroke Plain. This area, which is part of the Wimmera soil zone, is used mainly for wheat production, with lesser areas being sown to barley and oats.

Wheat and barley are grown in regular cropping rotations on only scattered properties in other parts of the region, but there is undoubtedly considerable scope for expansion, particularly on the rendzina soils.

Oats are grown throughout the region for grazing, and for the production of feed grain for local use, mainly as part of a pasture renovation programme.

Current Research

Cereals research is being conducted in the area by officers of the Victorian Department of Agriculture stationed at Horsham, and by officers of the South Australian Department working from Adelaide. Workers from these centres and Hamilton are also doing work just outside the workshop area which is relevant to the region.

Wheat variety trials are being conducted at Wolseley, Horsham, and Hamilton, outside the region, and wheat, barley, and oat trials have been conducted in recent years at Millicent, Gymbowan, and west of Goroke.

Irrigated cereal trials are being conducted at Kongal, just north of the workshop area, and at Struan. These include trials on wheat, oats, and barley varieties, time of seeding, the use of nitrogen fertilizers, and seeding rates. Yields of over 100 bushels per acre have been obtained with both wheat and barley in irrigated plots, indicating the large potential for this form of production. The Mexican semi-dwarf variety WW15, a red wheat, has been a consistently high yielder in these trials.

Important research on cereal eelworm control in wheat is being done by Victorian officers at Horsham. This involves three lines of attack:

- (a) The use of rotations, fertilizers, and other cultural measures.
- (b) The use of chemicals. Promising results have been obtained with two new nematocides.
- (c) Plant breeding to transfer eelworm resistance from cereal rye to wheat.

Research on rotations, pasture ley establishment, and timing of cultural operations, especially following, is being carried on at Horsham. This work will have application to the Goroke-Frances area to some extent.

Fertilizer trials are being conducted on rates and forms of nitrogen and phosphorus near Goroke by officers at Horsham.

A series of 10 experiments as parts of the National Soil Fertility Programme is being conducted in the Wimmera region, involving the use of nitrogen, phosphorus, potassium, and sulphur, in an attempt to correlate field responses to these nutrients with soil analysis figures. This work is being conducted jointly by the Victorian Department of Agriculture and the Soils Division of CSIRO. One of the 10 sites is in the workshop area at Gymbowan.

Research Needs

(a) Variety research - There is a great need to define the cereal variety requirements for the region, especially for those areas where cereals are not now grown extensively but where expansion could occur in the future, both with and without irrigation.

Satisfactory variety recommendations can be made for the Frances-Goroke area, but it is felt that the current recommendations for the remainder of the region, while being the best which can be made from the existing commercial varieties, fall far short of the ultimate grain yield potential of the region.

There is a need for definition of grain quality requirements. In wheat the main requirements at present are for biscuit wheat (e.g. Pinnacle) and for soft (filler) bread wheat (e.g. Heron). There is undoubtedly also scope for the production of very high-yielding feed type wheats in the region, and a definition of national policy on this matter is urgently needed.

With barley a similar problem exists. Current production is confined to malting varieties not well adapted to the region. There is scope for improvement in malting barley yield, and great potential for the production of very high-yielding feed type barleys. Markets for feed barleys undoubtedly exist, and it is inefficient to be using lower-yielding malting varieties for this purpose.

Intensive variety testing, and probably variety breeding programmes, by resident research staff are required to overcome these problems.

(b) Integration of cropping with pasture production - Little is known of how cereal crop production can best be fitted in with existing pastoral pursuits in the region. Questions of rotations with pastures, desirable sequences of crops, time and method of cultivation, time of sowing and methods of reestablishing pastures need to be considered.

Detailed field experimentation may not be necessary to get all the required information, but investigations of existing practices backed up with some field trials are essential.

In the Frances-Goroke area the question of optimum cropping frequency is now a problem. Medic pastures can build soil fertility levels which are above optimum for dryland crop production, and the narrowing of rotations is not always practicable, especially under the current wheat marketing restrictions.

(c) Fertilizer requirements - If there is to be continued expansion of cereal production in the region, more research will be needed into prediction techniques for fertilizer requirements. Current recommendations are based largely on older experimental work and on farmer experience. The extension of existing cereal fertilizer research programmes into the region would largely overcome this problem, although much intensification of nitrogen fertilizer investigations would be required.

(d) Cereal eelworm - The cereal cyst eelworm (*Heterodera avenae*) appears to be developing as a potentially serious problem in cereals on the heavy soils in the Frances-Goroke area.

Current work on breeding for resistance should be continued, and expanded to include oats and barley.

The use of pesticides for field control is promising, and this work should be continued.

Work on environmental and cultural factors affecting eelworm buildup and crop damage being conducted by Banyer should be expanded, as the use of cultural practices for the control of this problem still appears to be an essential method of control of this disease.

GRAIN SORGHUM

Grain sorghum trials were started by Boyce at Kybybolite in 1965, and this research programme has continued up to the present time. Boyce has investigated varieties, time of sowing, row spacing, seeding rates, weed control, fertilizer requirements and water requirements.

As a result of this work grain sorghum production on a limited commercial scale commenced in the region in 1967. The area sown is still less than 200 acres, but there is potential for expansion of this crop under irrigation, and it is felt that limited research should be continued to service this expansion.

In particular there is a need to look at new varieties which can be sown much earlier in the season. With such varieties, dryland production in some parts of the region may be feasible.

OILSEED CROPS

At the present time oilseed crop production is confined to a limited area of dryland linseed production. Linseed has been grown under contract to processing firms in Melbourne, and the area is currently about 700 acres per year, although it has been much higher than this in the past.

Research on flax production, started during the war years, has been of assistance to linseed growers. Some more recent variety testing work near Millicent has enabled satisfactory recommendations to be made for this crop.

There is little scope for increased production of linseed due to diminishing markets for linseed oil, and further immediate research is not warranted.

There is, however, some scope for production of other oilseed crops, in the area, the ones most worthy of attention being oilseed rape and soy bean.

Commercial rapeseed production in Victoria commenced in 1968, and it is estimated that 5,000 tons may be produced this year. Rape requires a rainfall in excess of 22 inches per year and although none has yet been grown in the workshop area there is no reason why it should not be grown.

Some field experiments on rapeseed varieties, cultural methods and times of sowing are being done by Patton near Lake Bolac, and this work would have some application to the region now under consideration. There is a need for additional field research into this crop and some preliminary work may be started at Struan in 1970.

No research has been done on soy bean production in the workshop region, but there is a good potential market for soy bean in Melbourne and Adelaide and some preliminary research is warranted to evaluate the potential of this crop.

Recent advances have been made in New South Wales and Queensland in the selection of soy bean varieties for Australian conditions and in the use of the correct Rhizobium cultures for effective nodulation.

This recent work should be followed up, and consideration is being given to this project in the formulation of plans for the new irrigation research area at Struan.

WINE GRAPE PRODUCTION

Quality red wines produced in the Coonawarra area on terra rossa soils are well known throughout the Commonwealth. In the last few years the increasing popularity of table wines has brought increased prices for wine grapes and an expansion of the area sown to vines.

In the Padthaway area, about 50 miles north of Coonawarra, 250 acres of vines have been planted recently on terra rossa and red-brown earth soils. Early indications are that wine production in this area will be as successful as at Coonawarra, and expansion of plantings is taking place.

A survey of vine plantings in the area by Moss earlier this year showed that at Coonawarra the area now sown to vines is 900 acres, owned by 14 companies. Anticipated new plantings were to be 320 acres in 1969, and at least 300 acres in 1970. It is expected that this rate of expansion will continue for some time. The total potential first class vineyard area at Coonawarra is 3,500-4,000 acres.

At Padthaway four individual companies have purchased land, and other land transactions are taking place. The area planted at present is 250 acres. A further 250 acres were to be planted this year, followed by annual plantings of at least 300 acres for some years. There is an estimated potential of 20,000 acres of first class vineyard land at Padthaway.

Numerous other pockets of terra rossa soils exist in the region and some of these would be suitable for wine grape production. A small area of vines is being established at Glen Roy, and consideration has been given to the potential of the Woakwine Range area.

Main Production Problems

(a) Weed control - Existing weed control recommendations for vineyards generally are hard to apply in this area. This applies especially to new plantings on old pasture land. Even plants like Phalaris tuberosa and to a lesser extent

(b) Nutrition - The nutrition of vines on these soils is largely an unknown quantity. Seeliger is carrying out some work on this problem, especially on phosphorus requirements. There is a need for a continuation of this work.

(c) Frost - Some frost losses occur in vines in the area about on year in four. Very serious losses have occurred from time to time.

Frost control is practised by the use of cultural techniques and by the use of special sprinkler installations. The design of sprinkler systems for frost control is mainly empirical and there is a need for some research on this problem, especially with regard to spacing of sprinklers and rates of water application.

POTATOES

Up to the time of publication of the CSIRO booklet on the workshop region potato acreage had been declining steadily over a period of 10 years, from about 1,700 acres to about 700 acres. Since then, however, there has been a dramatic increase in area in the South Australian portion of the region, rising to about 1,000 acres in 1968-69, and an expected 1,400-1,500 acres this year.

The decline in acreage was due to the withdrawal from the industry of a number of small part-time growers. The recent increase is due to an influx of experienced large scale growers from the traditional potato growing areas around Adelaide and interstate.

Because of the favourable conditions and the relatively low cost of production under fully mechanized conditions, it is expected that production will continue to increase but the view has been expressed by Mattingley that there are risks associated with increased production in the area unless this comes about as a replacement of potato acreage in other districts.

Production is confined mainly to solodic and swamp soils, and irrigation is used on all crops.

Main Research Needs

(a) Variety testing - Trial work on new varieties must be continued.

(b) Dry matter content of potatoes - Potatoes grown in the area are generally low in total solids. The most serious effect of this problem is that high moisture content potatoes are unsuitable for processing. Research is needed into irrigation practices, fertilizer application, and varieties to correct this difficulty.

(c) Physiological disorders - There is a tendency for some varieties, notably Sebago to develop internal brown fleck, a physiological condition usually associated with faulty irrigation practices.

'Nutritional leafroll' is also quite widespread in occurrence on those soils with high water tables (Howles, 1968: personal communication).

PROCESSED VEGETABLES

During the last three years two large interstate companies have been investigating the prospects for the development of a frozen vegetable processing industry in the Mt. Gambier-Millicent area. Extensive field investigations have been carried out, mainly with peas, and at the present time one company is establishing a plant at Millicent and there is the possibility of the other company becoming established also.

Studies have shown a decided consumer trend towards the use of processed vegetables (Hall, 1968) and there is every prospect of this industry becoming of great importance in the region.

The main crop is peas, and this crop has reached full scale commercial development this year, with plantings of at least 2,500 acres on approximately 50 properties. Crops are grown under contract, mostly without irrigation, although the availability of irrigation water is desirable.

Little extra labour and equipment are required by growers because the processing companies carry out harvesting operations. The crop is said to be fully compatible with grazing enterprises, with little or not loss in stock carrying capacity when up to 1/5 of the area of any property is sown to peas.

Because of the range of soil types and climatic conditions in the workshop area a wide spread of planting dates is possible. Sowing takes place from May to December, and harvesting runs from the end of October through till February.

The range of vegetable crops to be grown will undoubtedly be extended. Experiments have been conducted with French beans, and this crop will be grown commercially on a small scale this season.

Other crops which are likely to be introduced are potatoes (for the production of crisps or Frozen French Fries), sweet corn, Brassicas, and to a lesser extent root vegetables and other bean species.

This region enjoys advantages over other vegetable producing areas in Australia. Many of the soil types of the region are suitable for vegetable production, and with the availability of adequate irrigation water, there is a large potential for expansion. It is anticipated that the pea crop alone will reach 15,000-20,000 acres within five years.

Field research to date has been conducted by the processing companies with some assistance from officers of the Horticulture and Soils Branches of the South Australian Department of Agriculture, and has been confined mainly to the bare essentials for the development of the industry.

Much additional information is required, and it is considered that future research needs cannot be handled entirely by the private processing companies.

Main Problems

(a) Nutrition - Because of the wide range of soil types being utilized, the prediction of fertilizer requirements is difficult, and much field experimentation and soil analysis work is required to give adequate advice to growers. It is considered that this work could well become a responsibility of the Department of Agriculture.

A nutritional disorder probably due to a deficiency of manganese or iron has shown up in some pea crops. Research will be required to solve this problem and other similar problems which will undoubtedly occur as the industry develops.

(b) Weeds - The severity of the weed problem varies with the soil type. It is a severe problem on the volcanic soils and the peats.

Processed vegetable crops are low value crops in comparison with other horticultural crops, and expenditure on herbicides is a critical cost factor. Both the processors and the Department of Agriculture are involved in some research, but much more is required.

(c) Crop varieties - Current variety research is being very adequately done by the processing companies. A great deal of variety testing will be required in the future as the range of crops increases.

(d) Pests and diseases - The only major pest encountered so far is *Heliothis* in peas, and field research is required to find a control chemical to replace DDT which, although effective, creates residue problems.

Undoubtedly, numerous other pest and disease problems will occur, necessitating attention from agronomists as the need arises.

PASTURE SEED PRODUCTION

The development of specialized seed production is mentioned only briefly in the CSIRO publication on the region. Prior to 1962, seed production was carried on as a part of the normal pasture production programme by certain graziers. This enterprise has developed since 1962, however, as a specialized industry and must be considered under crop production.

Until the last two years specialized seed production has occurred almost entirely under irrigation, the development of irrigation resources providing the main stimulus for the growth of the industry.

Over the last two years there has also been a significant development of specialized seed production under dryland conditions, particularly in the southern portion of the region where rainfall is higher and more assured.

The total acreage devoted to seed production varied from year to year but has been in excess of 25,000 acres in some years.

The list of seed crops which are being produced in the region is as follows:

Barrel medic -	1 cultivar
Cocksfoot -	2 cultivars
Gama medic -	1 cultivar
Lucerne -	5 cultivars
Phalaris tuberosa	3 cultivars
Perennial ryegrass -	1 cultivar
Strand medic -	1 cultivar
Strawberry clover -	2 cultivars
Subterranean clover -	5 cultivars
Tall fescue -	1 cultivar

Main Agricultural Problems

(a) Weed control - Weed growth has developed as a major problem in pasture seed crops because of the competitive effects on seed yield, and also because of seed purity requirements under the seed certification regulations.

Research has been undertaken by Higgs, and later by Kloot on weed control by the use of herbicides, and although reasonable recommendations can be made to growers in most cases, there are still problems as yet unsolved. A continuation of this research is also essential, because of the rapid increase in the number of herbicides available.

(b) Nutrition - Some research has been done to determine best rates and times of application of fertilizers. The nitrogen nutrition of grass seed crops is of particular importance and some work will have to be continued in this field, particularly on the questions of timing of applications in relation to water availability and the growth pattern of particular crops.

(c) Cultural techniques - Much of the earlier irrigated seed production was done with row-cropping techniques. There is now a swing away from row-cropping, but additional research is required on this aspect. Other factors such as seeding rates, time of seeding and timing of irrigation have been investigated, but will require further work for any new seed crops introduced.

(d) Harvesting - With most seed crops, heavy losses can occur through the use of incorrect harvesting techniques. In crops where shattering of seed occurs, the timing of harvest is of critical importance.

Continued research is needed into the problems of correct types of equipment, correct use of equipment, and timing of operations to avoid harvest losses.

(e) New crops - There is scope for the development of new seed crops, particularly of pasture cultivars of overseas origin, to be produced for re-export under the provisions of the O.E.C.D. seed certification scheme. Development research will be required for the successful introduction of these new crops.

(f) Pollination

OTHER MINOR CROPS

It would be pointless to give an exhaustive list of other crops which are grown or could be grown in the area.

Generally speaking markets are the main factors which will determine the future of crops such as fresh vegetables, fruit, chicory, drug crops, etc. Many crops could be grown under the conditions that exist in the area, but market research will be required to determine the likelihood of profitable expansion or introduction. Such market research on agricultural products which are now imported may be worthwhile. This would then have to be followed up by technical studies, in the field, to determine the yield levels that can be obtained.

ACKNOWLEDGEMENT

I wish to acknowledge the major contribution made by colleagues in the Horticulture, Soils and Agronomy Branches of the Department of Agriculture, and officers of the Victorian Department of Agriculture, in providing much of the information contained in this paper.

REFERENCES

HALL, E. G. (1968) - Production and marketing of fruit and vegetables. CSIRO Food Pres. Quart. 28: 33

HOLMES, J. W. (1969) - Water use by plants and water budget. The Hydrological Society of South Australia. First Water Resources Symposium.

APPENDIX

List of crop production research requirements determined by the workshop at Naracoorte 14th-16th October, 1969:-

Cereal Production:

1. The recognised intensive cereal growing area of Frances and Goroke districts is being serviced by continuing research into varieties and fertilizers within the district. Rotation and eelworm control work in adjacent areas is applicable to these districts. There is need to initiate a plant breeding programme to incorporate eelworm resistance into Barley and Oats in addition to the wheat breeding programme.
2. In the rest of the region there appears to be a potential for expanding cereal production but this is likely to be limited by wheat quotas in the immediate future.

Research is needed in the following areas.

- (a) Definition of suitable soils for cereal production.
- (b) Production of better adapted varieties.
- (c) Investigation of disease problems.
- (d) Irrigation.
- (e) Establishing suitable crop and pasture sequences.
- (f) Role of minimum tillage practices in cereal production.
- (g) Relative value of grazing cereals (Wheat, Oats and Barley) and pasture for provision of winter grazing.
- (h) Value of higher seeding rates and fertilizers for improving output of winter herbage from cereal crops.

Grain Sorghum Production:

Suitable techniques for producing 100-120 bushel crops have been evolved from current research programme. Research into varieties which germinate at lower temperatures enabling early seeding and consequently earlier harvesting is the most urgent future research need.

Oil Seed Crops:

Research programmes in progress in Victoria are thought to be capable of meeting immediate needs as far as Oil Seed Rape is concerned.

Soya beans is a crop which is thought to have potential but research into varieties, time of seeding, row spacing, weed control, and rhizobium requirements is needed.

Wine Grape Production:

Research has been rather scanty to date but with rapid increases in plantings research is needed into -

1. Weed control peculiar to the region e. g. Control of Lucerne and Phalaris in newly planted areas.
2. Types of trellis and planting distances.
3. Frost control procedures.
4. Clone selections for locally adopted lines for both red and white wine producing varieties.
5. Fertilizer and irrigation practices in relation to quality of wine produced.

POTATO PRODUCTION

Research is needed into.

1. Variety.
2. Problem of low dry-matter content of tubers.
3. Methods of identifying nutritional leaf roll from virus leaf roll. An investigation into the true nature of nutritional leaf roll is needed.
4. Aphid ecology in relation to virus leaf roll transmission.
5. Potential of district for seed potato production and the production of potatoes for processing.
6. Defining attainable limits within district of the quality attributes of starch content and keeping quality.

PROCESSED VEGETABLES

Lack of research has led to crop failures due to iron and maganese deficiencies and nematode attack in peas.

Research is needed to define the problems which will be encountered on each of the potential crops grown on the major soil types of the Mt. Gambier and Millicent districts.