DEPARTMENT OF AGRICULTURE AND FISHERIES, SOUTH AUSTRALIA

Agronomy Branch Report

FIELD CROP AGRONOMY WORKSHOP.

8/9th NOVEMBER, 1979.

Workshop Papers.

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SOUTH AUSTRALIAN DEPARTMENT OF AGRICULTURE

FIELD CROP AGRONOMY WORKSHOP

Held at Turretfield Research Centre
8 - 9th November, 1979

WORKSHOP PAPERS

March, 1980.

SOUTH AUSTRALIAN DEPARTMENT OF AGRICULTURE

FOREWORD

The Plant Services section of the Plant Industry Division has a role of co-ordinating and facilitating technical training and updating of agronomy field staff in the Regions.

With this role in view a two day workshop was conducted with the specific aim of providing a platform for the exchange of the most recent knowledge in crop agronomy. Attendance at the workshop was deliberately limited to District Agronomists and a few resource people.

The workshop was conducted at the Turretfield Research Centre where there was provision to examine some of the more recent developments in cultural techniques and to see some of the new crops and cultivars.

We would like to thank Mr. Bert Ninnes, the Manager of Turretfield Research Centre, and his staff for making these facilities available and for the manner in which they provided for the conduct of this workshop.

Our thanks goes to those resource people too who delivered papers and sat on discussion panels at the workshop.

This Branch Report is published to provide a record of the papers presented.

(Henry Day)
SENIOR AGRONOMIST
WORKSHOP CONVENOR

FIELD CROP AGRONOMY WORKSHOP

Theme:- Recent developments in Field Crop Agronomy.

Papers presented — Page

CEREAL BREEDING PROGRAMMES IN SOUTH AUSTRALIA

M.R. KRAUSE, PRINCIPAL AGRONOMIST

A. WHEAT

1. Roseworthy Agricultural College (G.J. Hollamby)

Traditional objectives have been:-

1.1 Better yields

1.2 Wide adaptation - lines tested in widely different environments.

1.3 Maintenance or improvement in milling and/or baking quality, especially in HARD and ASW wheats. No real attempt to select a SOFT or PRIME hard variety. Since 1974, major attention has been directed to -

1.4 Disease resistance - in order of priority.
- (i) Stem rust - (Puccinia graminus tritici) - Co-ordinated with the National Rust Control Programme.
- (ii) Speckled leaf blotch (Septoria tritici)
- (iii) Cereal cyst nematode (Heterodera avenae)

1.5 Parental material used in the programme are wheats of Roseworthy origin and other selected varieties widely grown and adapted to the South Australian wheat belt crossed with introduced material, mainly semidwarfs from Mexico, Turkey, Syria, Sth. America and U.S.A.

1.6 Methodology
Pedigree method considerably modified, mass selection in early generations to get disease resistant combinations before testing for yield and quality.
No summer generations used.
Harvest Index used as a selection tool.

2. Waite Agricultural Research Institute (A.J. Rathjen)

Some effort directed towards methodology research; balance to breeding improved varieties for South Australian wheat belt.

2.1 Improved yields and wide adaptation major considerations.

2.2 Acceptable milling and/or baking quality with more emphasis on HARD wheats in recent years.

2.3 Disease resistance receiving added emphasis with priority to -

(i) Take-all (Gaeamannomyces graminis)
(ii) Cereal cyst nematode
(iii) Stem rust

2.4 Parental material being used include wheats of Waite Institute and Sydney University origin in crosses with a wide range of overseas introduced material but deliberately different from that used at Roseworthy, e.g. U.S.S.R., France and Mexico.

2.5 Methodology involves a progeny test selection method; a summer generation is regularly sown; Harvest Index is not used, and disease resistance screening usually follows yield testing.

In Summary:-

Both programmes aim to develop better yielding varieties with wide adaptation and maintain or improve milling and/or baking quality.

Disease resistance is now receiving major attention in both programmes but with different emphasis.

Parental material being used is deliberately not the same so that developing material under test is genotypically quite different, and the methods being used to achieve the ultimate goals are also very different.

B. BARLEY

1. Waite Agricultural Research Institute (D. Sparrow)

1.1 The South Australian breeding programme is still strongly orientated toward good MALTING QUALITY because of

- Strong competition developing on the 2-row export market especially from Canada.
- Expected competition on the local stock-feed market from Triticale.

Four (4) promising advanced malting types WI 2549 to WI 2552 which were selected on low barley extract viscosity and a malt extract level as least comparable to Clipper are under widespread test for yield this season.

1.2 Development of lines with short stiff straw not prone to head loss by the use of semi-dwarf parental material is being pursued.

1.3 Disease resistance is receiving added attention.

(i) Cereal cyst nematode (Heterodera avenae). Good prospects for success. 3 to 5 genes for resistance, Morocco and Athenais suitable resistant parents. Laboratory screening for resistance quite satisfactory. A new feed line WI 2231 B, likely to be released shortly, has good CCN resistance from its Egyptian parent CI 3576.

(ii) Scald (Rhynchosporium secalis). Advanced backcrossed Clipper lines from Dr. S.M. Ali's programme, many with good resistance to scald from various sources, are now undergoing extensive yield and quality tests.

1.4 Greater grain dormancy than Clipper in any new release would be advantageous.

1.5 Features seen as being of importance in the future which have been or will be included in improvement programmes include -

(i) Varieties suitable to minimum tillage practices.

(ii) Varieties more responsive to Nitrogen and those which will tolerate limiting supplies of minor nutrients such as Manganese and Zinc.

(iii) Straw more palatable to livestock.

C. OATS

1. Department of Agriculture (A.R. Barr)

1.1 A breeding programme began in early 1977 designed to improve oat varieties in respect to better grain yields, improved agronomic features such as straw strength and grain holding capacity, disease resistance especially stem rust and CCN, acceptable grain quality incorporating higher protein and/or higher oil content.

1.2 F_2 nurseries of material crossed for the above characters were grown at Turretfield and Pinery in 1978.
F_3 selections were grown over summer 1978/79 and the F_4's are in single plot yield comparisons at Turretfield and Pinery this season. (1979).

1.3 F_1's of the 1978 crosses were grown over summer 1978/79 and are in F_2 nurseries at Turretfield and Pinery this season.

1.4 Crosses made have used Australian varieties with introduced lines from U.S.A. and Canada. A large range of genetic material exists in the introduced lines with good rust resistance, high protein and high oil grain, etc., Much of this parental material however has infusions of A. sterilis (wild oat) in it, as a result of which weak straw, late maturity,

poor grain of high husk percentage etc. is common, and intensive selection in cross bred populations will be necessary.

1.5 Disease resistance in oats.

1.5.1 Rusts

With the assistance of the Sydney University, surveys have been carried out over the past three seasons to identify the current oat rust flora in South Australia.

Stem rust, Puccinia graminis avenae. 9 races identified. Races 1 and 2 most prevalent.

Resistance genes Pg 1 .....Pg 14 are identified in the introduced genetic material. Some of these or combinations of two or more are effective against known races.

Crown rust, Puccinia coronata. 5 races identified.

1.5.2 Stem nematode (Ditylenchus dipsaci) Can be devastating. Both resistance and tolerance (as in CCN) appear to exist. Resistance common in European and U.K. varieties. There appears to be good resistance in some Australian varieties e.g. Moore, Dual, N.Z. Cape, Saia. Main Australian varieties are either susceptible or very susceptible. e.g. West, Swan, Avon.

1.5.3 Cereal Cyst Nematode (Heterodera avenae)

Incorporating resistance into West from A. sterilis C4658. Some screening difficulties being encountered.. Inoculation techniques being developed.

West x N.Z. Cape
West x Mortgage Lifter
} Being screened at the F_2

D. TRITICALES

1. Waite Agricultural Research Institute (C.J. Driscoll)

Objectives of the programme:-

1.1 Development of varieties with a grain suitable for stock-feed, especially pigs and poultry.
viz. High metabolizable energy.
Good protein content and balance.
(In the long term use as a human food, not necessarily as bread, is under review).

1.2 High grain yields and wide adaptation. Yields of current line about equal to Warimba.

1.3 Agronomically seeking short straw and the Armadillo head type (short compact).

1.4 Disease resistance
- Selecting for CCN resistance
- Checking advanced lines for stem rust and powdery mildew resistance.
- Susceptibility to"take-all" is a disadvantage.

1.5 Two programmes being developed:-

1.5.1 Material of directly introduced lines from Cimmyt or locally made crosses between them.
Best adapted to more favourable environmental conditions. One line T507 being considered for release.

1.5.2 Types adapted to the dry areas of light sandy soil (to replace rye) will hopefully be selected from crosses with local material. (S.A. cereal rye x S.A. wheat) x best of Cimmyt lines.
Currently growing F_1.
F_2's will be taken to Palmer, grown on light sandy soil and selected in this lower rainfall environment.

NEW CEREAL VARIETIES

T.G. HEARD, ACTING PRINCIPAL RESEARCH OFFICER (Field Crops)

I WHEAT	Tincurrin 70 W10-19	Millewa DX6 - 79	Jacup 69 W02-38
State of Origin	W.A.	Vic.	W.A.
Registered	1977	1978	1979
Pedigree	Gluclub/3/ Chile 1B/ Insignia/ Falcon	Sonora 64/ Yagui 50E// Caboto/Mex 8156 (CIMMYT)	Bencubbin/3/ Charter//Sword/ Kenya C6041/ 4/Mexico/5/ Gamenya
Type	Soft	A.S.W.	A.S.W.
Yield% Advantage S of 0	Egret + 10	Halberd + 7	Gamenya + 14
% Yield Advantage S.A.	Egret + 5	Halberd -17 9 trials (1 yr)	? 1 trial with wrong seed
Maturity (days)	Egret -5	Halberd =	Gamenya +5
Disease Resistance	-	field strains stem rust flagsmut	slight stem rust flagsmut
Possible replacement for	Egret Gluclub	Halberd	Egret Warimba
Comments			seed mix up not released.

WHEAT CONT.

	Miling 69W02-37	Banks QT 4081	Avocet WW 179	CSP44
State of origin	W.A.	QLD.	N.S.W.	N.S.W.
Registered	1979	1979	1979	?
Pedigree	as for Jacup	PWTH/ Condor Sib//2* Condor	WW119/WW15 // Egret	-
Type	Hard ASW	P. Hard	Soft	Hard
% Yield advantage S of O	Gamenya +6	Gatcher +18	Egret -2	Halberd =
% Yield advantage S.A.	Halberd -4 1 trial	Halberd -25 11 trials	Halberd -12 4 trials	Halberd -12 1 trial
Maturity (days)	Gamenya +6	Gatcher +7	Egret =	Condor =
Disease resistance	flagsmut	stem rust flagsmut	stem rust (complete)	stem rust (good)
Possible replace-ment for	Darkan Gamenya		Egret	Condor
Comments			has Kite rust resist.	will not be regis-tered in N.S.W.

WHEAT CONT.

	MKR 122/16	PF41/W4	RAC 311	M2145
State of origin	S.A.	S.A.	S.A.	N.S.W.
Registered	1980?	-	-	-
Pedigree	Mexico/ Koda// Raven	Pitic/ Festiguay	Pitic sib/ Glaive	Norinio- Brevor/ Kite sib// Kite
Type	Soft	A.S.W.	A.S.W.	Hard
% of Yield Advantage S of O	-			Halberd -8 6 trials
% Yield Advantage S.A.	Egret +18	Halberd +8 3 trials	Halberd +20	Halberd -20 1 trial
Maturity (days)	Olympic -2	Halberd =	Condor +1	Halberd +2
Disease resistance	-	C.C.N.	stem rust (slight)	stem rust (complete)
Possible replacement for	Egret	Festiguay	Halberd?	Kite?

II BARLEY

	Parwan B6671	Cutter WI 2130	Shannon 72-958	WI 2231 B	WI 2468
State of origin	VIC.	NSW/SA	TAS	S.A.	S.A.
Registered	1978	1979	1979	1980?	-
Pedigree	PI Archer/ Prior// Lenta/ 3/Research/ Lenta	Prior A/ Proctor	Proctor *4/ CI 3208 -1	Proctor/ CI 3576	Proctor/ Prior A//Proctor/ CI 3576
Type	Malting	Feed	Malting	Feed	Malting
% Yield advantage S of O	Lara +5	Clipper +12 Lara -2	Proctor +28		
% Yield advantage S.A.				Clipper +39 14 trials	Clipper +12
Maturity (days)	Lara -1	Lara -3	Proctor +1	Clipper =	Clipper -1
Disease resistance	covered smut		B.Y.D.V. covered smut some scald	some CCN tolerance some mildew and scald	slight mildew slight scald
Possible replace-ment for	Lara > 450 mm rainfall	Lara	Proctor	Weeah?	Clipper?

III OATS

	Stout	Sual	Moore
State of origin	WLD.	N.S.W.	W.A.
Registered	1977	1976	1977
Pedigree	Complex ex USA with 12 parents	complex (largely Algerian)	Fulmark/ Newton// Swan
Type	Grazing	Grazing	Grain
% Yield advantage S of O	Graze Minhafer -4 Grain Minhafer +54	Graze Algerian +10	Grain West +4 (high rainfall)
% of Yield advantage S.A.	Grain West -28	Grain West -57	Grain West +2
Maturity (days)	Minhafer -3	Algerian =	West +4
Disease resistance	all crown rust common stem rust	most crown and stem rusts	-
Possible replacement for	Saia Bentland	Algerian	West > 450 mm rainfall

IV TRITICALE

	Gro Quik	Dua AT 6	Satu AT 7	Tyalla TQ 7	T 507
State of origin	N.S.W.	N.S.W.	N.S.W.	VIC.	S.A.
Registered	-	1979	1979	1979	1980?
Pedigree	ex USA	Tcl Maya II-Armandillo S (ex CIMMYT)	As for Dua	as for Dua	Inia - Armadillo S (ex CIMMYT)
% Yield advantage	Condor -22 Vic Oxley -19 NSW	Condor =	Condor +11	Condor +16 Mallee Olympic +2 other areas	Warimba =
Maturity (days)	late	Condor -3	Condor -1	Condor -2	Warimba =
Disease resistance		S.R., L.R. flagsmut mildew tolerant to septoria	as for Dua	S.R., L.R. flagsmut	S.R., L.R. mildew C.C.N.
Replace		Gro Quik	Gro Quik	Gro Quik	Gro Quik
Comments	At T.R.C. 1979 all have leaf rust late in season.				

RECENT DEVELOPMENTS IN PLANT PROTECTION - CEREALS - S.A.

G.B. BALDWIN, SENIOR PLANT PROTECTION AGRONOMIST

If we consider today's theme of "recent-development" I think it is true to say that the developments that have taken place and will continue to take place in the next few years in the field of cereal crop protection can best be described as dynamic. Cereal crop protection problems as you are all aware are concerned with cereal diseases, cereal weed control, and cereal insect control.

Insects are mainly a problem to our cereal crops when grain is stored. True, there are some insects that are at times and in certain areas a direct threat to the growing crop, and I think particularly of cereal curculio and barley grub.

In recent years we have been made more aware of malathion resistance developing in some stored grain pests; in these instances alternative insecticides such as fenitrothion have been recommended. The lindane component of our seed dressings will change in the future as companies become more conscious of grain insect resistance to lindane. Seed dressings containing fenitrothion or carbaryl as the insecticide additive, will appear on the market.

Research has also improved our ability to deal with cereal curculio. A combination of higher seeding rate and insecticide seed dressing is now recommended if attack is expected to be severe.

We have come to recognize that the common armyworm Pseudaletia can at times occur with barley grub. Although these larvae are not easy to distinguish from barley grub, it is nevertheless essential that any insecticide used, controls both pests. Insecticide recommendation other than DDT are now available for barley grub and common army worm.

By far the most dramatic developments however have taken place in disease and weed control.

Disease organisms such as the smuts and bunts, nematodes, soil born root attacking fungi, mildews and rusts, to name a few, help make up the spectrum of problems that farmers may have to deal with. Progress has been made with smut and bunt control. Alternatives to the mercurial seed dressings have been sought and now both liquid and powder dressings of alternative compounds are available. Only 100g 7.5% WP or 200 ml 3.5% EC of the new product Furavax (methfuroxam) need be applied per 100 kg seed to control all cereal smut organisms. Growers using this product cannot use the wrong pickle. They will however, get poor results if grain coverage is poor or if they reduce the recommended use level.

It is in the control of nematodes and cereal leaf diseases however, that resistance in varieties is having the greatest influence in the future. The 1979 Oat and Barley variety recommendation fact sheets contain excellent quick ready reference tables. Farmers can now determine the resistance status of the oat or barley cultivars recommended for sowing. True the tables show up the weaknesses in varieties and one only has to look at the extent of barley leaf scale on Clipper and Weeah in 1979, to realize that many crops have senesced weeks before they should have. Kuiper, at a recent barley disease workshop, said that he had obtained a 30% increase in Clipper barley by spraying this susceptible cultivar once mid-season with Bayleton (Triadimefon). Ali on the other hand has promised us better resistance in Clipper in the future. I believe it is time the Wheat variety recommendation Fact Sheet tabulated the disease resistance status of recommended cultivars in a similar manner. Give farmers the details on the susceptibility of their varieties to Septoria, Gaeumannomyces and Heterodera. Do away with such statements as "Warigal's resistance to other important diseases such as take all and Septoria, is no better than that of other recommended varieties". The Fact Sheet conveniently avoids telling you what resistance levels the others have.

Growers in certain areas this year have sprayed post-emergent with Rubigan (fenarimol) for mildew in barley, Bayleton (triadimefon) for stem rust in wheat and with Dithane M45 (mancozeb) for Septoria control, (2 applications required). They have had serious problems with their cultivars and they have looked to a fungicide spray to help them out. If growers do not accept seed treatments in the future, or if seed treatments do not give protection for a sufficient length of time, then there will always be a demand for sprays to help in a crisis situation. Application technology may well be a limiting factor in these instances.

Application technology has certainly paved the way for C.C.N. chemical control. True problems have occurred using propane as the pressure source for Jectarow equipment. Apparently some freezing of E.D.B. (Nemadi) has also occurred. For $170 the equipment however is in the low cost bracket. Results have been outstandingly good where eelworm problems have been bad. Good arguments can now be put forward for using 5 L/hectare or using the treatment on "resistant" Festiguay types to try and achieve a nil cyst carry-over.

All would agree that biossay samples from paddocks prior to treatment have only given a guide to the seriousness of the problem. No doubt sampling techniques will improve and so too will the degree of reliability that can be placed on bio-assays in the future. Application technology will be put to the test if 10% granular terbufos (Counter) becomes available in 1981. Farmers may be required to apply 6kg of granules on/hectare at sowing time. "Handling" the 1200kg (1 ton) of Counter through a small seeds box, if a grower treats say 200 hectares for C.C.N. will I suspect present a physical problem and could also be a potential health hazard. Nevertheless, it is recognised that handling clay granular formulations of this compound is far safer than handling liquid formulations. Varieties are expected to play a more significant role in C.C.N. control in the future.

1979 results from Southern Yorke Peninsula gave us our first clue as to the susceptibility of a range of oat cultivars to tulip root.

What have been the recent developments in weed control in cereals? In many areas the boom spray has now become a very important piece of machinery and it may now travel the paddock on a number of occasions during the growing season. Some farmers are spraying 60-80' and hauling 600 gallons in their equipment, plus harrows. We must I believe begin to question application rates.

Farmers may commence spraying in the year prior to sowing using Spray Seed (R) to stop rye-grass setting seed. They may then use Spray seed (R) or Roundup (R) plus various other herbicides for controlling pasture and weed growth prior to direct drilling. These other herbicides may include dicamba, Yield (R), or diuron containing products. They may however prefer to use Hoegrass (R) and mixtures with it to handle any grass or broadleaf problem that may develop post emergent. Certainly sub clover, ryegrass and wireweed are 3 special problems that must be adequately handled in the direct drill situation.

1979 has shown us I think, that Stampede (R) has not performed as well on wild oats as expected. That Yield (R) ($150/drum) is not as economical or as effective for W.R.G. control as trifluralin. That Roundup (R) has a very useful role to play for controlling soursobs in late winter (August). 1979 has reconfirmed our view that there are some soils that are unsuited for trifluralin treatment. Their structure is such that the extra workings required and the delays in emergence that can occur with this product become critical to crop establishment.

There will I fear always be new problems. Already we hear of changing weed patterns, e.g. increases in ball mustard, and some fumitory species after trifluralin use. We have a new disease in wheat, striped rust, P. striiformis, which has the potential to destroy 100% of the crop.

I suspect that as more crop residues are retained and crop rotations shorten, then we must expect increased disease levels and perhaps insect problems. It is clear that diseases just like weeds only occur occasionally as "pure stands". There is often a complex of diseases having an effect on crop growth and vigour. Crop protection at the advisor level now more than ever before must involve giving advice which considers all the imputs e.g. cultural, varietal and chemical.

Let us hope bio-assays and spore and insect trapping may help us forecast potential problem years in the future.

GRAIN LEGUMES

M.R. KRAUSE, PRINCIPAL AGRONOMIST

The dual role of grain legumes in South Australia's cropping areas is now well established:-

(i) As a grain crop for cash sale and/or use as a livestock feed on the farm both as grain or summer stubble grazing

AND

(ii) As a crop for the maintenance and improvement of soil fertility and structure and as a "Cleaning crop" in the control of cereal root diseases.

In a normal cropping cycle, grain legumes can be included without significantly reducing the frequency of cropping to cereals. They replace rather, a pasture year in a cropping sequence or a fallow.

The two most widely grown and best adapted grain legume crops in our agricultural areas at present are field peas (Pisum sativum var. arvense) on the heavier textured neutral to alkaline soils and narrow leafed lupins (Lupins angustifolius) on the lighter neutral to acid soils.

Comments are made on recent developments with each of these crops and progress is reported on work with white lupins (Lupinus albus), chickpeas (Cicer arietinum) and field beans (Vicia faba).

1. FIELD PEAS

1.1 Agronomic work

Grain legume comparison trials in the major cereal growing areas conducted over the past two seasons (1977-78 and 1978-79) continue to point to peas as the best yielding most adaptable grain legume for the cereal areas.

In the 1978-79 trials, Pennant outyielded White Brunswick at all but one site, whilst Dundale yielded better than Early Dun in eight out of thirteen sites. This adds support to recommending Pennant and Dundale.

1.2 The Breeding Programme

The pea improvement programme initiated 3½ years ago is making steady progress:-

1.2.1 Breeding for resistance to Black Spot

The identity of the black spot disease complex in South Australia has been determined. Two Ascochyta and one Phoma species are implicated. A. pisi causes leaf and pod spot. A. pinodes, the conidial state of Mycosphaerella pinodes causes blight on leaf, stem and roots, and Phoma medicaginis var. pinodella causes foot rot. All three cause leaf, stem and pod lesions. A. pinodes is considered the most destructive and the main problem.

Sources of resistance to one or more of the black spot complex have been identified in foreign material which has been introduced from Sweden, United Kingdom and several other European and Asiatic countries. Possibly the best two lines for this purpose are:- No. 862 ex Turkey and No. 437 ex the Hindu Kush area.

Five (5) lines including the two above have been used in all crossing combinations with Dundale, Pennant and Early Dun. F_2 plants were screened in 1978. 143 were selected from many 1 000's in 1978. These have produced some 1 400 plants this year which were inoculated with all 3 pathogens. About 10 fully resistant plants and others with some resistance were selected. Many showed resistance as seedlings but some disease developed on the mature plants.

1.2.2 Breeding a new structured pea type.

The second stage of the breeding programme designed to produce an erect leafless or semi leafless type has reached the F_3 and F_4 stage with field plantings at Turretfield this season. Black spot is providing a problem in many lines.

2. LUPINS

2.1 Narrow leafed lupins - Lupinus angustifolius

- Marri was generally superior to Uniharvest, the variety it is designed to replace, in 1978-79 trials, when damage from grey leaf spot was minimal. There is now probably sufficient evidence in South Australia to recommend Marri in place of Uniharvest, and to drop the latter from recommendations and seed build up.

- Illyarrie, the recently released grey leaf spot resistant variety designed to replace Unicrop is in trials this season to compare its performance with Unicrop. Until two seasons of results are available Illyarrie cannot be recommended to replace Unicrop.

- As a matter of interest Marri and Unicrop yielded similarly in the 1978-79 yield trial comparisons. Agronomic trials conducted in the South East last season gave the following results:-

  (i) A seeding rate trial conducted at four sites gave a progressive yield response as rates were increased from 50 to 70 to 105 kg/ha at <u>each</u> site.

  (ii) A seeding time trial (4 times from mid May to late June) generally gave best yields at the early June sowing. The results confirmed previous contentions that early seedings are best, provided moisture levels are adequate.

2.2 <u>White lupins - Lupinus albus</u>

The current variety Ultra, with a few exceptions, continues to yield unimpressively in South Australian trials. Its future for commercial production must therefore be in doubt. In one comparison in 1978-79 Hamburg (newly released and later than Ultra) yielded better. Promising improved albus material ex Dr. Rex Oram, C.S.I.R.O. Canberra is "in the pipeline".

Two lines introduced from U.S.S.R. looked promising in the 1978-79 trials. As a general observation, white lupins mature slowly after flowering. This is a disadvantage, and early seeding would seem to become even more important.

3. <u>CHICKPEAS</u>

The 1978-79 season yield trial results were again disappointing. Chickpeas were invariably lower yielding than peas at <u>all</u> sites. Best yields in comparison to peas are in the more favourable sites and contrary to expectations or perhaps pious hope, the gap between pea and chickpea yields widens as environmental conditions become less favourable.

The chief problems with the chickpea lines currently under test appear to be:-

(i) Late maturity.
(ii) Disease - Fusarium, Botrytis and Sclerotinia.
(iii) Lodging in taller varieties.

If the results of the 1979-80 trials are no more promising than those of the last two seasons, there would seem little justification to continue work with these lines.

However, two avenues for further work are:-

3.1 About 100 lines were collected from Icardia in the Middle East in 1977 by Mr. E.J. Crawford. They were put through quarantine in 1978 and are in seed multiplication selection rows at Turretfield this season.

With considerable genetic diversity amongst them the testing of selected lines under South Australian conditions is justified.

3.2 As lines bred for adaption to Australian conditions, emerge from the breeding programme at Wagga, N.S.W. they should be tested here.

A new line 56296B received from Wagga last season gave promising yields in two trials in 1978-79. It is an early line, erect growing with good seed quality.

4. FIELD BEANS

Work has been restricted on field beans since disease problems (Viruses plus Ascochyta fabae) necessitated placing quarantine restrictions on field bean introductions and emphasised the need for seed build up of disease free lines.

One such line, No. 59, is being proposed for release by the Waite Institute and basic seed of this line is being produced at Two Wells this season (1979-80).

In addition, 100 lines also introduced by Mr. E.J. Crawford from the Middle East in 1977 and grown under quarantine in 1978, are also in seed increase selection rows at Turretfield this season.

OIL SEED RAPE

T.G. HEARD, ACTING PRINCIPAL RESEARCH OFFICER (FIELD CROPS)

The information presented herein stems largely from the recent (31/10-1/11) workshop of Australian Rapeseed Agronomists and Breeders (ARAB) held in Horsham, Victoria.

The area sown to rapeseed in Australia is probably of the order of 55 000 ha made up as follows.

N.S.W.	26 000	(5 000 in 1978)
S.A.	13 000	
Vic.	6 000	
W.A.	?	possibly 10 000

While Australia is a very small producer by world standards we have one distinction in that our quality requirement in relation to erucic acid is the most stringent in the world.

nil tolerance in margarine.
5% tolerance in salad oils.

At the same time it is recognised that practically all the rapeseed grown in the western world has very low levels of E.A.

DISEASES

Blackleg. This is by far the most important rapeseed disease in Australia and is gaining an importance in Europe and Canada. There is growing awareness that blackleg like many other diseases such as wheat rust consists of a wide range of races and varieties released in one state should be widely tested to gain information on their resistance in other areas. The rapeseed breeder in Western Australia spreads infected stubble from all over W.A. onto his breeding nursery to ensure that his lines are subjected to a wide range of possible races of the disease.

An interstate blackleg trial is planned for 1980 with a range of material including several overseas varieties of known blackleg resistance and advanced Australian crossbreds to be sown at several sites. One of the sites will be in the Mundulla area with another probably in the mid north.

Where rapeseed is sown in Canada in areas which have not previously grown this crop the recommendation is to apply a fungicide to the seed. This eliminates any initial seed borne infection and is believed to curtail the movement of the disease into the new area by as much as 3-4 years.

White Rust. While probably the second most observed disease in this state it is considered relatively minor and is a problem only on Brassica campestris.

Sclerotinia. This is of major importance in Canada, has led to yield losses up to 30% in N.S.W. and could well increase in this state. Care should be taken not to grow rapeseed immediately after sunflowers, lupins and any other crops which might be a host to this disease.

AGRONOMY

There was considerable discussion at the ARAB workshop on the relatively minor research programme on the agronomy of rapeseed. It may be that even that which has been carried out to date will need to be repeated using Australian varieties when these become widely available.

Minimum Tillage. This is seen as an area in which work is necessary. Some work at Rutherglen indicates similar yields following conventional and minimum tillage. Some reports of weeds problems but no representative available to comment on W.A. experience.

Harvesting. This is seen as probably the major problem area in rapeseed growing. There is general opinion that windrowing is the best form of insurance particularly in heavy crops. The Victorian Department of Agriculture has carried out limited desiccation experiments and obtained yields similar to those following windrowing. A trial will be initiated at Turretfield this season (1979) comparing direct heading, windrowing, desiccation and glue spraying.

BREEDING

There are major programmes currently in operation in:-

N.S.W. Department of Agriculture - Wagga
Vic. " " " - Werribee
W.A. " " " - Perth

C.S.I.R.O. has a small programme in Canberra which if it continues will concentrate on later, higher rainfall areas.

The University of Western Australia wishes to initiate a programme.

The major objectives of the existing programmes is the production of adapted varieties incorporating tolerance to blackleg from Japanese or European lines, zero erucic acid from Canadians, zero glucosinolates from Bronowski.

The W.A. Department of Agriculture has released two blackleg tolerant varieties. The Victorian Department of Agriculture may release one variety in 1980 as may the N.S.W. Department of Agriculture. There could be sufficient seed of the latter line to sow 4 000 ha but the former will be in relatively short supply.

The S.A. Department of Agriculture will once again co-operate in the interstate variety trial programme in 1980 with anticipated entries from each of the breeding programmes sown at 4-5 sites in this state.

Possible Rapeseed Varieties in 1980:-

Tower (Canada) B. napus
double zero, midseason, lodges badly
no blackleg tolerance

Midas (Canada) B. napus
low E.A., midseason
slight blackleg tolerance

Wesreo (W.A.) B. napus
low E.A., 10 days later than Tower
good blackleg tolerance

Wesway (W.A.) B. napus
low E.A., 2 days earlier than Tower
good blackleg tolerance - may lodge

RR22 (Vic.) B. napus
double zero, 5 days earlier than Tower
slight blackleg tolerance

BL C1 (N.S.W.) B. campestris
low E.A., 12 days earlier than Tower
good blackleg tolerance

SUNFLOWER

P.J. MOWATT, DISTRICT AGRONOMIST, MID SOUTH EAST

Area - around 10 - 11 000 hectares for 1979-80 in South East. Experience and understanding of crop requirements, and the improvement in livestock economy suggests the area will continue to be in the 10-15 000 hectare range, rather than much higher areas.

Rotation - with irrigation, either one in a 5 year continuous crop situation, or a 3-4 year mono-crop.

- dryland, maximum two consecutive years, otherwise fertility, weed, non-wetting sand problems arise quickly.

Cultivars - hybrids becoming more acceptable, despite $5-6/hectare extra seed cost. Easier management and yield potential are main factors. Major problem is frequent new cultivars from commercial seed breeding companies, often available before local testing. Also, several synthetic cultivars released this year with no explanation of just what are synthetic sunflower.

South East Oilseed Committee discussing this issue with companies.

Sowing - (1) Plant spacing is now recognised as important for dryland crops. Even spacing ensures that all plants develop, and the crop average is better. Thus precision sowing machines are being used more widely. One limitation is that present machines are not robust and lack soil penetration ability.

(2) Most sunflower is sown into coarse, sandy topsoils. There is increasing appreciation of press wheels to help moisture retention, and compaction around the seed. This piece of equipment is being adapted to all sowing machines.

Soil pH - large areas of the heath sand over clay soils in the Lower South-East have low pH levels - down to 4.5. Below 5.2, a molybdenum deficiency is induced in sunflower. Immediate and longer term remedies are being tried and assessed:- 140 g/ha sodium molybdate as a foliar spray, or 280 g/ha as a soil incorporated fertilizer; or agricultural lime at 2 000 kg/ha aiming to raise soil pH above 5.2

Minimum tillage - at the very early stages of this management system, but it has possible application for both light and heavy soils.

Birds - the feathered type. A ten fold increase in six years - a subjective comment from experience.

Increasing number of bird species attacking sunflower e.g.:- cockatoos, finches, magpies, crows etc.; then increasing bird population as the environment favours them.

No realistic control at present.

Industry Contact - The Lower South-East Oilseed Committee (a voluntary farmer group with unofficial ties to the United Farmers and Stockowners) has drawn sunflower producers into a cohesive group; has developed good relations with seed, transport and buying companies; and is being a useful extension medium.

RULES FOR THE PRODUCTION OF CERTIFIED CROP SEEDS

K.G. BOYCE and N.R. MATZ, SEEDS PRODUCTION SECTION

1. Introduction

The purpose of the crop seed certification scheme is to produce and identify a supply of true to variety seed of high viability, free of harmful weeds and harmful disease organisms.

Farmers may apply for the certification of crops in the scheme. Fields and seed are only eligible if they surpass the minimum technical standards of the scheme outlined in these rules.

The Department of Agriculture may refuse certification services to growers who have previously failed to abide by conditions governing certification, including failure to pay for services previously rendered.

2. General Functioning of the Scheme

2.1 Varieties and classes of seed

Only recommended varieties are eligible for certification. Pre-basic seed must be planted to produce Basic seed. Basic seed must be planted to produce Certified seed.

2.2 Closing date for applications

Closing date for applications for certified seed is 30th September. Late applications may be accepted provided to do so does not involve the Department of Agriculture in extra travelling and the grower pays double fees.

2.3 Fees for certification

2.3.1 Minimum fee for any service

The minimum fee for any service is.....

2.3.2 Field establishment supervision

..... cents per hectare payable by grower. Maximum fee .....

2.3.3 Field certification supervision

..... cents per hectare payable by grower. Late applications ..... per hectare.

2.3.4 Sampling, sealing, laboratory and plot testing

..... cents per sack. Payable by cleaner.

2.4 Identification of registered areas

All properties producing certified seed are allocated registered numbers. These are retained by the property when it changes ownership.

All seed growers wishing to produce certified crop seed are required to submit a plan of their properties, this is redrawn to standard size, paddocks lettered and a photocopy given to the grower.

After this has been done, future application for certification services need only quote the letter designated to the paddock concerned. Should fence-lines be altered, plans are redrawn and copies distributed as before.

Failure by growers to supply an adequate plan of their property is regarded as sufficient reason by the Department of Agriculture to refuse inspection.

2.5 How does a buyer recognise certified seed?

Certified seed of all classes carries an official tag and seal. The tag gives details of the variety, the crop from which the seed was harvested and the official analytical number, the last digit of which refers to the season of harvest.

Seed which does not carry the official tag (with all details complete) and a seal, is not certified seed regardless of its origin.

2.6 Plot testing of seed

2.6.1 Testing of stock seed (pre-control)

To check that breeders or basic seed lots are true to name and as a result of maintenance over a period of years, the cultivar is not showing any "shift" in expression of its distinguishing characters. Objective measurements of individual spaced plants are made in comparison with authentic seed.

2.6.2 Testing of certified seeds (post-control)

To check that particular certified seed lots are true to varietal name and not mixed with other varieties or otherwise altered during multiplication. These tests are done post-certification.

2.7 Special circumstances

It is possible to produce seed of high quality using procedures not outlined in normal certification rules. If a grower desires to produce certified seed outside conditions covered by the rules, he must make application no later than the normal closing date and indicate full details of the circumstances and proposed procedures.

If in the opinion of the Department of Agriculture these conditions are adequate to produce certified seed, permission will be granted.

3. Field Standards

3.1 Cropping history

There must be a time interval between crops of different varieties or certified crops and uncertified crops. Successive crops of the same variety may be grown on the same field without any time intervals provided satisfactory purity is maintained and freedom from disease is maintained. (Refer Appendicies - Certification Standards).

3.2 Establishment supervision

Establishment of some crops must be supervised if the crop is to be eligible for later certification.

Growers must apply for seed crop establishment supervision of crops before the area to be sown is ploughed or cultivated. Application forms are available from any office of the Department of Agriculture, and should be lodged one week before the date they plan to commence cultivation.

Establishment supervision of fields may involve the following:-

3.2.1 Pre-cultivation inspection

This inspection is made before ploughing to check for the presence of inseparable other plant species.

3.2.2 Sowing machinery inspection

To check cleanliness to ensure that no contamination of crop takes place due to dirty seeding equipment.

3.2.3 Supervision of sowing

In some cases the actual sowing operation is supervised by an authorized officer of the Department of Agriculture. This applies particularly to basic seed crops. Growers must notify their district certification officer before proceeding to sow any certified crop for which supervision is required. Failure to notify may result in automatic rejection of the paddock concerned.

3.2.4 Collection of tags and seals from stock seed

The bags containing stock seed must be sealed. The seal must be broken by the district certification officer who will collect the tags and seals. Under some circumstances the grower may be authorized to break the seal to proceed with sowing. Tags will then be collected later.

3.2.5 Seedling inspection

This is done to determine presence or otherwise of existing plants of the same crop species, usually instead of pre-planting inspection.

3.3 Isolation

Certified crops shall be isolated from uncertified crops of another variety by a defined barrier or space sufficient to prevent mixture during harvesting. (Refer Appendicies - Certification Standards).

3.4 Freedom from weeds

Crops containing declared dangerous or noxious weeds will be refused certification. Crops containing other weeds, the seeds of which are difficult to separate in cleaning, will also be refused certification.

3.5 Freedom from diseases

Crops may be rejected when they contain more than the prescribed number of plants or ears infected with certain seed-borne diseases. (Refer Appendicies - Certification Standards).

3.6 Freedom from rogues

Crops showing more than trace amounts of rogues and plants of distinguishable genetic variants, including off-types, will be refused certification. (Refer Appendicies - Certification Standards).

3.7 Inspection for certification

Inspection of seed crops are made as soon as convenient following receipt of applications. If a crop is harvested before inspection it automatically becomes ineligible for certification.

Crops failing to meet required standards are rejected from certification at inspection and the grower notified.

If a grower considers that the cause of rejection can be corrected, he can make the correction and re-apply for inspection for which an additional fee of ..... cents per hectare is payable.

4. Harvesting of Certified Crop Seed

4.1 Growers must exercise care

Harvesting must be done in a manner that will prevent any contamination of certified seed. If in the opinion of the seed certification officer insufficient care has been taken, he will reject the seed from certification.

4.2 Notification of intention to commence harvesting

Growers must notify the district seed certification officer of their intention to commence harvesting certified paddocks. Failure to advise may result in disqualification of any seed produced. Advice can be either by telephone or letter. Growers should, when advising, nominate how they wish to identify their seed, and if tags are required, order their estimated requirements allowing a few extra to be sure of not running short.

4.3 Inspection of harvesting machinery for cleanliness

When producing basic seed, growers must arrange before commencement of harvest to have all harvesting equipment inspected by a seed certification officer and approved for cleanliness.

4.4 Identification of seed in paddock

Sacks or other containers of certified seed must be identified before leaving the paddock. All seed from a paddock must be identified by the same method. Growers may nominate to identify by either of the following methods.

4.4.1 Growers may obtain from a seed certification officer uncleaned seed labels

These should be ordered when advice is given to commence harvest. They show species, variety and registered number of the crop. One portion of the label tears off and is placed inside the bag or container and the rest must be securely affixed to the outside. If the labels are sown to the bag it is preferable to sew them in the centre rather than on an ear where they are more prone to damage during normal handling. On no account can labels issued to a particular crop be used for any other crops, even if it is of the same variety. All labels are numbered in sequence and those not used must be returned to the seed certification officer.

4.4.2 The growers may stencil sacks with the registered crop number

This should be placed as near as practicable to the top to enable identification of stacked seed.

4.5 Declaration by grower

When seed is delivered to a seed cleaner the grower must complete a declaration declaring the identity and authenticity of the seed. This must be made on the correct form which is obtainable from a seed certification officer or any authorized seed cleaner. Unless this declaration is completed, the seed loses further eligibility to certification. A separate declaration must be lodged for each load of seed to be delivered to a cleaning shed.

4.6 Containers for uncleaned seed

Failure to comply with rules regarding seed containers may cause further loss of certification eligibility.

4.6.1 Sacks

New sacks must be used. These may be re-used by growers providing that:-

* Before being used initially sacks are clearly stencilled with the grower's registered number.

* Sacks may only be re-used for packing the same species and variety of crops as previously handled.

* Prior permission for re-use of sacks has been given by a seed certification officer. This is normally done only following inspection of sacks.

4.6.2 Bulk handling

Certified seed may only be bulk handled from harvester to the seed cleaners using the following procedures:-

* Seed bins or containers must be inspected and approved by a seed certification officer. Containers must be sound and be equipped with an attachment to hold and protect an identification tag, e.g. trailer registration disc holder with perspex cover.

* Containers must be provided with lids or covers at all times.

* Bulk containers when in use must carry an identification tag. These may be obtained from a seed certification officer.

* When seed is delivered to a cleaning shed seed growers must sign a declaration for each load, irrespective of the number of bins or containers involved.

* Upon deliveries, if seed is transferred from one container to another, identification tags must be placed on all bins or containers. It is the seed grower's responsibility to obtain tags required.

* A new identification tag must be used for each load of handled seed.

4.7 Special requirements for harvesting basic class seeds

Harvesting machinery must be inspected by a seed certification officer for cleanliness and approved before harvesting can commence. Before harvested seed can be removed from the paddocks bags or containers must be sealed by a seed certification officer. Growers wishing to move unsealed bags to a shed on the property must first obtain permission to do so from the seed certification officer. Seed moved without authority may automatically lose certification eligibility.

5. Processing of Certified Crop Seed

5.1 Who is eligible to clean certified seed?

5.1.1 Growers

Growers may clean their own seed providing standards required for certified seed are maintained. The seed certification officer must be satisfied that the machinery and methods used are adequate to safeguard the seeds genetic and physical purity.

5.1.2 Authorized cleaners

There are two classes of cleaners authorized by the Department of Agriculture to clean certified seeds.

Either may be disqualified if they do not satisfy the seed certification officer that they have taken adequate measures to protect the identity of certified seed.

* Approved cleaners

Those considered to have the necessary equipment to clean seed (subject to supervision of the Department of Agriculture) in such a manner as to ensure that varietal purity and physical purity are maintained.

* Accredited cleaners

Those who have demonstrated by previous performance that they have the necessary equipment, organization and staff to clean certified seeds, in a manner as to ensure that varietal purity and physical purity are maintained.

Accredited cleaners may be disqualified unless premises are clean, well organized and under the direct control of the owner or other permanently responsible person nominated by the owner.

5.2 Uncleaned seed samples

Following delivery of uncleaned seed to a cleaner a representative sample of the lot is drawn by a seed certification officer. Under some circumstances a cleaner or other person may be authorized to draw the samples. If cleaning of any lot of certified seed is commenced before this sample is drawn, the lot may be rejected automatically from certification.

5.3 Bulking together uncleaned seed lots

Bulking of two or more small lines of uncleaned seed during processing to produce larger individual lines may be allowed.

This will only be done in respect to seed from the same registered property sown with the same stock seed which are in the opinion of the inspecting officer near identical in all other respects.

Growers wishing to bulk seed from different paddocks must make application for permission to do so when applying for certification inspection. Seed bulked without written prior permission may be automatically rejected from certification.

5.4 Cleaning Basic Seeds

A seed certification officer must thoroughly inspect all machinery to be used before cleaning is commenced and be sure that there can be no contamination from dirty machinery.

All seed of these classes is normally processed only in the presence of a seed certification officer.

Seeds of these classes arrives in sealed containers which must not be opened until the seed certification officer has approved cleanliness of all machinery.

After a line of seed has been cleaned, the seed certification officer samples the seed and supervises the labelling and sealing.

5.5 Sampling and Sealing Cleaned Seed

5.5.1 Maximum size of certified seed lines

The maximum lot size of certified seed which can be represented by a sample is 20 000 kg. Lines larger than this must be treated, and sampled as two or more separate lots.

5.5.2 Approved cleaners

Seed certification officers sample seed and supervise the attachment of seals and labels to bags. The sealed seed is then held until laboratory tests show seed to have exceeded minimum standards. An analytical number is then allotted and stickers containing the analysis are attached to the labels by the cleaning plant operator who is subject to supervision by the seed certification officer.

5.5.3 Accredited cleaners

During cleaning an accredited cleaner's authorized sampler samples each bag as it is packed and immediately labels and seals it.

Seed is then held under bond by the cleaner until laboratory tests show seed to have exceeded minimum standards. An analytical number is allotted and stickers containing the analysis are attached on all tags. Until this is done certification is not complete.

5.6 Check Sampling of Certified Seeds

Check samples from lines of certified seed are drawn by seed certification officers. Cleaners need not delay despatch of any lots of seed until this sampling has been done, but must when requested, inform the seed certification officer where the consignment has been sent.

Should a check sample analyses of a line of seed fail to meet the same standards (within tolerance as defined by I.S.T.A. rules) as the official sample drawn by the accredited cleaner, the seed may be rejected from certification. If the seed certification officer has reason to suspect that an accredited cleaner has not drawn the original sample correctly, this is regarded as sufficient reason to reject the cleaner from the certification scheme.

5.7 Resampling of Certified Seed

Occasionally when a lot has been rejected for certification a grower or cleaner will ask for another sample to be drawn.

This can only be done for one of the following reasons:-

* The lot has been recleaned or otherwise treated.

* There is a very good reason to doubt the authenticity of the previous sample or analyses.

* Due to sufficient time elapsing, or due to any other circumstances, it is reasonable to expect germination to have altered.

5.8 Seed Cleaner's Declaration

Following completion of cleaning a line of certified seed, approved and accredited cleaners must sign a declaration that they have:-

* Kept the seed separate and unmixed during processing.

* The line is uniform throughout, has been sampled according to certification requirements, and that they agree to hold seed under bond until it is officially released.

5.9 Accredited Seed Cleaner's Record

Accredited cleaners must keep an accurate record of the origin, weights and disposal of all certified seed they process. Appropriate record forms are available from the Seed Section Headquarters for this purpose if required.

These particulars are to be made available to the Department of Agriculture upon request.

Should a cleaner fail to keep records or if the figures do not satisfy the Department of Agriculture, disqualification from the certification scheme may result.

5.10 Equipment Issued to Accredited Seed Cleaners

Equipment considered necessary to quickly and effectively carry out certification procedures is issued to accredited seed cleaners. It remains the property of the South Australian Department of Agriculture. Its loss or damage is the complete responsibility of the cleaner to whom it was issued.

The following is issued:-

* Multi section sleeve-type seed sampler
* Bucket-type sampler
* Record sheets
* Growers' declaration book
* Cleaners declaration book
* Supply of pre-labelled and addressed calico sample bags for:-

  ** Uncleaned samples - buff coloured tags
  ** Official cleaned samples - red coloured tags

5.11 Packing and Branding Certified Seeds

New sacks must be used.

It is recommended that the cleaner's pack in the standard size and weight sacks adopted by the Seed Industry Association. However, packages of any weight may be recognised for certification.

If a cleaner does not allocate his own reference number and brand it on all bags, then the registered area number must be branded on all bags.

5.12 Repacking Certified Seeds

Certified seeds may be repackaged into containers of any size but to retain designation as certified seed, the following requirements must be met:-

5.12.1 Packages unsealed, weighed and repackaged subject to supervision by a seed certification officer.

5.12.2 A complete record of weights, number of packages and the serial numbers of labels must be kept.

5.12.3 At the discretion of the seed certification officer, each seed lot repackaged may be resampled, re-analysed and a new analytical number allocated. Normally this will only be done if more than twelve months has elapsed since the previous laboratory analysis.

5.12.4 Seed repackaged without authority or supervision by a seed certification officer cannot be branded or described as certified seed. Such seed may however, be marked as "Packaged from Certified Seed reference Analytical number...."

5.13 Blending of Certified Seed

Mechanical blending of lines of certified seed may be carried out if permission to blend specific lines of seed has been obtained from a seed certification officer. Permission will be granted if equipment to be used will produce a satisfactory uniform blend.

Blended seed is sampled and tested and a new analytical certificate issued (this involves payment of further sealing fees).

5.14 Temporary Storage of Cleaned Seed Before Final Bagging

Under some circumstances it is desirable to store cleaned seed immediately following cleaning in temporary containers. Cleaners may store in bulk containers or repack seed in the same sacks as used for paddock bagging.

Any cleaner wishing to carry out either of these procedures must obtain prior approval from the seed certification officer.

6. Testing and Release of Certified Crop Seed

6.1 Seed Examination

The official sample, which is taken following processing and packing is subject to a laboratory analyses. This is conducted to measure freedom from weed seeds, freedom from seed-borne diseases and germination. The following weed seeds are prohibited. Crop seed containing these seeds will be rejected:-

Botanical Name	Common Name
Acroptilon repens	Creeping knapweed
Adonis microcarpa	Small fruited pheasant's eye
Alhagi pseudalhagi	Camel-thorn
Allium triquetrum	Three-cornered garlic
Allium vineale	Field garlic
Alternanthera philoxeroides	Alligator weed
Alternanthera pungens	Khaki-weed
Ambrosia psilostachya	Perennial ragweed
Amsinckia spp.	Yellow burr-weed
Asphodelus fistulosus	Onion weed
Cannabis sativa	Indian hemp
Cardaria draba	Hoary cress
Carduus pycnocephalus	Slender thistle
Carduus tenuiflorus	Winged slender thistle
Carthamus lanatus	Saffron thistle
Cenchrus pauciflorus	Innocent weed
Chondrilla juncea	Skeleton weed
Cirsium arvense	Perennial thistle
Cirsium vulgare	Spear thistle
Convolvulus arvensis	Field bindweed
Cuscuta spp.	Dodder
Cynara cardunculus	Wild artichoke
Diplotaxis tenuifolia	Lincoln weed
Echium lycopsis	Salvation jane
Echium vulgare	Vipers bugloss
Eichhornia crassipes	Water hyacinth
Elodea spp.	Elodea
Emex australis	Three-corner jack
Euphorbia terracina	False caper
Hirschfeldia incana	Buchan weed
Homeria spp.	Cape tulip
Iva axillaris	Poverty weed
Lycium ferocissimum	African boxthorn
Marrubium vulgare	Horehound
Nasella trichotoma	Serrated tussock

Botanical Name	Common Name
Opuntia spp.	Prickly pear
Oxalis pes-caprae	Soursob
Parthenium hysterophorus	Parthenium weed
Peganum harmala	African rue
Pennisetum macrourum	African feathergrass
Pentzia suffruticosa	Calomba daisy
Picnomon acarna	Soldier thistle
Pistia stratiotes	Water lettuce
Prosopis juliflora	Mesquite
Reseda lutea	Cut-leaf mignonette
Rubus spp.	Blackberry
Sagittaria graminea	Arrow-head
Salvinia spp.	Salvinia
Senecio jacobaea	Ragwort
Senecio pterophorus	African daisy
Sida leprosa var. hederacea	Alkali sida
Silene vulgaris	Bladder campion
Silybum marianum	Variegated thistle
Solanum elaeagnifolium	Silver-leaf nightshade
Sorghum halepense	Johnson grass
Toxicodendrum radicans	Poison ivy
Tribulus terrestris	Caltrop
Ulex europaeus	Gorse or furze
Xanthium californicum	Californian burr
Xanthium pungens	Noogoora burr
Xanthium spinosum	Bathurst burr

The following weed seeds are restricted in certified seeds. Particulars of the weed seeds must be marked on the outside of the parcel containing the seeds or on a label attached to the parcel.

Botanical Name	Common Name
Ambrosia spp.	Ragweed
Argemone mexicana	Mexican poppy
Avena fatua/ludoviciana	Wild oat
Brassica tournefortii	Wild turnip
Carrichtera annua	Wards weed
Centaurea calcitrapa	Star thistle
Centaurea solstitialis	St. Barnaby's thistle
Citrullus colocynthis	Colocynth
Conium spp.	Hemlock
Datura spp.	Thornapple
Echium italicum	Italian bugloss

Botanical Name	Common Name
Euphorbia esula	Leafy spurge
Euphorbia marginate	Snow-on-the-mountain
Foeniculum vulgare	Fennel
Heliotropium europaeum	Common heliotrope
Hypericum perforatum	St. John's wort
Lavandula staechas	Topped lavender
Melianthus major	Cape honey-flower
Melilotus indica	King Island melilot
Neslia paniculata	Ball mustard
Onopordum spp.	Thistles
Orobanche spp.	Broom rape
Polygonum convolvulus	Black bindweed
Raphanus raphanistrum	Wild radish
Rapistrum rugosum	Turnip weed
Reseda luteola	Wild mignonette
Rumex argiocarpus	Sorrel
Rumex spp.	Docks
Salpichroa organifolia	Pampas, Lily-of-the-valley
Salvia reflexa	Mintweed
Sinapis arvensis	Charlock
Sisymbrium spp.	Mustards
Solanum rostratum	Buffalo burr
Xanthium spp.	

6.1.1 Certificate of Analyses

Following completion of testing each lot, a certificate giving full details is forwarded to the grower and the seed cleaner. Any persons may obtain copies free of charge upon request to the Department of Agriculture.

continued in part 2