



DEPARTMENT OF AGRICULTURE, SOUTH AUSTRALIA

Agronomy Branch Report

MINOR AGRICULTURAL CROPS

IN SOUTH AUSTRALIA

By Officers of the

Agronomy Branch

Report No. 17

March, 1970.

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These notes have been prepared for the Agronomy Branch Conference, Adelaide, 1970. They cover crops which have been grown in South Australia, and some which are under consideration for future use.

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BUCKWHEAT

C. Phillips

Buckwheat is an annual, height from 2-5 ft. The seedling does not tiller and the plant has a single main stem with many fine branches.

The grain of buckwheat is used in Continental food recipes, for the production of pancake flour and groats. Buckwheat approximates to cereal grain in nutritional value. The grain of buckwheat has a high fibre content. When used for feeding to dairy cattle the seed hull is removed, leaving a kernel with high feed value, 29.7% protein and 7.4% crude fibre. Buckwheat midlings are used in rations for bacon production.

Agronomic Requirements:

Buckwheat is suited to a cool moist climate. Light well drained soils are preferred. A good cultivated seedbed is recommended. There is generally little trouble from weed competition. Seed can be sown or broadcast at 24-60 lbs. per acre.

The seed can germinate in a fairly dry seedbed, but the seedlings and younger plants are susceptible to drought and high temperatures, the flowers failing to set seed under such conditions.

Under conditions in the U.S.A. buckwheat will produce flowers when the plants are quite small and will continue to produce flowers until the opening frosts.

The crop is ready to harvest when the majority of seeds are ripe - the production and ripening of the seed being staggered during the plant's growth.

If the seed is uniformly ripe, the crop can be successfully harvested with a combine harvester. In crops which have ripened unevenly it is necessary to cut the crop with a binder to mature in the stook before threshing.

Growing Buckwheat in South Australia:

Adelaide Botanic Garden has indicated that in their experience two crops of buckwheat (Fagopyrum esculentum),

can be produced per year. Under South Australian conditions the growing period of the seed crop is about sixteen weeks.

Seeding in May results in a crop maturing in September. This can be followed by a further seeding in September producing a second crop in January.

Species of Buckwheat:

There are three cultivated species of buckwheat. Common buckwheat (Fagopyrum esculentum), Tartary buckwheat (Fagopyrum tartaricum) and Notch seeded buckwheat (Fagopyrum emarginatum). The first two mentioned are grown in the U.S.A. and the latter species is hardier and is more popular in the cooler mountain districts, as in parts of Asia where common buckwheat fails.

Previous South Australian Experience:

During the 1950's buckwheat was grown in small hand sown plots at the Adelaide Botanic Garden and at the Parafield Agronomy Plant Introduction Centre. Buckwheat seed has been supplied from Adelaide Botanic Garden to a Queensland grower for a small trial plot.

Canadian Production:

In 1968 and 1969 approximately 80,000 acres were sown, yielding approximately 1.6 million bushels.

Interest is increasing in buckwheat as an alternative crop, especially in Manitoba area. There is evidence of increasing attention from their exporting customers, mainly Japan.

Buckwheat in U.S.A.:

Decline in buckwheat production mainly because of a lower consumption of starchy foods and a declining taste for buckwheat cakes.

The average yield in the U.S.A. was 19.6 bushels per acre during the early 1950's.

In the U.S.A. 75% of the crop is used as stock feed and 15-18% milled into flour and groats. Approxi-

mately 6-8% retained for seed. Several thousand acres harvested green for extracting rutin.

Medicinal Use of Buckwheat:

During the 1950's buckwheat was used as a source of the drug, rutin, in the U.S.A. This yellow crystalline powder is a glycoside which was effective in a variety of hemorrhagic conditions.

Rutin Extraction:

Tartary, tetra tartaricum and emarginatum (Japanese buckwheat) give highest rutin yield.

Cut during blossoming with forage harvester 4-6" above ground. Drying of the green cut is done on or near the farm. A high temperature direct fired alfalfa drier is suitable. After cleaning the leaf is separated by vibrating through mesh screen. Approximately 10 tons of green chop yield one ton of dried leaf meal ready for processing.

References:

1. U.S.A. Tech. Bull., Oct. 55, 1132, Rutin content buckwheat.
2. U.S.D.A. Fmrs. Bull. 2095, Buckwheat culture.

CANARY SEED

F.C. Gross

Botanical Name: Phalaris canariensis

This is an annual, tufted grass which grows 3 to 4 ft. in height. The stems are erect, stiff and smooth. Leaves are green, hairless, flat, long and tapered to a fine point. The seed head is spike-like and rather short and rounded.

Phalaris canariensis, as suggested by the common name, canary seed, is grown as a crop for seed for feeding to cage birds.

Soil Requirements:

Water retentive loams and clay loams are required to successfully grow this crop.

Rainfall:

A minimum average annual rainfall of 18 inches is required for the commercial growing of canary seed. Similar climatic conditions are required as for late maturing varieties of wheat, e.g. Pinnacle.

Soil Preparation:

The same as for wheat. The best crops in 1969 were grown on fallow. Rotational requirements are the same as for wheat, that is the crop must be preceded by good legume pasture.

Seeding:

Sow in May or early June with 15-20 lbs. of seed per acre, according to condition of seedbed and time of seeding.

Fertilisers:

Superphosphate at 1-2 cwts. per acre, according to rotation.

Nitrogenous fertiliser required, according to level of soil fertility, and subject to experiment. A $\frac{1}{2}$ cwt. of sulphate of ammonia per acre could be applied at seeding and a side dressing of sulphate of ammonia or urea applied in the early spring.

Weed Control:

This crop is not competitive with weeds. Once established, canary seed is tolerant of herbicides used at rates up to 1 lb. 2,4-D acid equivalent per acre.

Grazing:

Early sown and vigorously growing crops of canary seed can be grazed during the growing period if desired and if necessary treated as a grazing crop. The stand should be allowed to root firmly before grazing is commenced, generally 6-8 weeks after germination when the crop should be 6-8 inches high. Grazing should cease before the seedheads commence to develop in the leaf sheath. Canary seed stubble has useful grazing value.

Varieties:

In Queensland the strains or varieties grown are Super Mammoth, Nunbank, Webster and Standard.

Difference in strains is in the seed size and the shape and size of the seed head. Standard is the best yielder but has the smallest seed. Super Mammoth has the largest seed but is a lower yielder. Large seed is in demand and is preferred by overseas buyers.

Irrigation:

The crop can be irrigated using irrigation water to supplement rainfall. It is doubtful if canary seed would be economic as a full irrigation crop.

Harvesting:

Under South Australian conditions, harvesting takes place sometime between late December and early February.

The crop is straight headed with conventional cereal harvesting machinery. Attention must be given to thresher drum set to avoid grain damage and over-threshing. Screens and wind draught need special care to obtain a good sample and avoid loss of seed.

The canary seed crop is very susceptible to shedding and wind damage so must be harvested as soon as the crop is ripe. The seed ripens unevenly.

The dust associated with harvesting can cause severe skin irritation.

Yields:

When canary seed was grown in this State in the 1930's, yields of $\frac{1}{4}$ to $\frac{1}{2}$ ton of seed per acre were obtained. Because of some crops failing, state production averaged more like $\frac{1}{5}$ ton per acre.

Good crops grown this year (1969-70 harvest) yielded $\frac{1}{3}$ ton seed per acre. Yields of up to 1 ton of seed per acre have been recorded in Queensland.

Pests & Diseases:

Lucerne flea and red legged earth mite can damage the seedling crop. Climbing cut worm is a threat from flowering to when the crop ripens. Powdery mildew is the only recorded disease affecting canary seed.

Marketing:

Because of the specific use of the product, i.e. bird seed, Australian demand is limited.

Export demand fluctuates according to the production in Mediterranean countries, the main suppliers of seed to European markets. Seed is marketed through normal commercial channels, i.e. seed firms and fodder processors.

Prices:

The current price of canary seed seems to be \$120 to \$135 per ton. In recent years the price has varied from \$54 to \$220 per ton.

Production:

Australian: 1,600 to 2,500 tons (peak 40,000 tons in 1956).

Export: No statistical records.

South Australian: Considering the past 10 years, 18 tons were produced in 1957, 17 tons in 1962 and an estimated 70 tons in 1969. The greatest amount of canary seed produced in this State was 600 tons in 1939.

Experience in S.A.:

Canary seed was grown in the Lower and Mid North as an alternative crop to wheat during the 1930's. Production then declined from the peak of 600 tons from 3,200 acres in 1939 to 9 tons from 58 acres in 1947. Very little has been grown since that time until a revival of interest in the crop as an alternative crop to wheat this year (1969-70).

Potential for the Crop:

If markets are available at a price in excess of \$100 per ton, canary seed has a potential as a cash crop for the Lower North districts of Freeling north to Farrell Flat (18" rain and over); Yorke Peninsula, Yorke Valley and similar districts; South East, the Tatiara, Millicent area or Keppoch-Padthaway, where irrigation is available.

For reliable annual production, the potential for canary seed growing lies mainly in the heavy soil, higher rainfall districts of the Lower North and Mid North.

CASTOR BEAN

K.G. Boyce

Botanical Features:

Botanical Name: Ricinus communis L.

Growth Form: Shrub 3-5 ft. tall, usually annual.

Nature of saleable product: Bean

Agronomic Requirements:

Soils: Any soil except very heavy clay.

Temperature: Soil temperature of 58°F. to germinate.

Moisture: Needs 3-3½ ft. of irrigation without rain.

Fertilisers: Soils high in N are not suitable as this produces excessive vegetative growth. Normally up to ½ bag of super-phosphate and 20-40 lbs. N/acre are required.

Growing Season: Summer - November to April.

Frost: Does not tolerate frost.

Equipment: Modified "All-crop" type headers required for harvest.

Current S.A. Production: Nil

Current Australian Production: Very small, if at all.

Current Market Position:

Australia - oil is imported for Australian needs.

Prospects for S.A.:

Previous experience in S.A.: Experimental plantings near Morgan in 1965-66 showed that the plant will grow satisfactorily in that environment.

Possible localities: Irrigation areas.

References:

"Castor Beans" - Pavy, T., W.A. Dept. of Ag. Bull.
2853, 1961.

"Castor Bean Research in N.S.W." - N.S.W. Ag. Gaz.
67: 29, Jan. 1956

"Castor Bean in more Trial Plantings" - Qusld. Ag.
J. 86: 225, April, 1960.

CHICORY

R.C. Hagerstrom

Botanical Features:

Botanical Name: Cichorium intybus

Growth Form: Parsnip-like plant

Nature of Saleable Product: Root (dug in mid-winter, cut into cubes, dried in a kiln, then sent away for processing.)

Agronomic Requirements:

Soils: Deep, friable, moisture retentive, i.e. peats.

Temperature: Not specifically known, but similar to parsnip's requirements.

Moisture: (Irrigation) - essential to maximise yields and stabilise production.

Fertilisers: Heavy feeder, especially N, P and K. Needs similar to those of potato crop.

Growing Season: Planted in October, harvested May, June, July.

Frost: Susceptible to frost in early growth stages.

Equipment Required:

- (a) Normal cultivation equipment.
- (b) Onion or vegetable seeder.
- (c) Inter-row sprayer for weed and insect control.
- (d) Rotary hoe or slasher to remove tops.
- (e) Modified potato digger, elevator and bulk trailer.
- (f) Washing machine.
- (g) Cutter to dice or cube roots.
- (h) Drying kiln.

Special Features: Processing - dried at 140°F, until moisture content to 12%, then bagged and despatched.

Current S.A. Production: Not known, but estimated at 30 acres x 15 tons (green)/acre = 100 tons dried.

Current Australian Production: Limited to two areas - Phillip Island (south of Melbourne) and Rendelsham.

Current Market Position: Price per ton unknown - therefore returns unknown. All sold either to merchants, e.g. D.J. Fowler or Bushels for blending with coffee beans to be sold in powder or essence form.

The Chicory Marketing Board handles the crop in Victoria. It is believed that up to \$50,000 worth is imported in most years, especially from Poland.

Prospects for S.A.:

- (a) Previous S.A. experience - There were many growers in Rendelsham district until fire destroyed kilns in 1955. There was only one operating in district in 1969 (Mr. N. Hart). Enterprise lost favour due to high labour requirements and high cost of production - no irrigation to stabilise production.
- (b) Possible expansion - There may be very limited scope for expansion at Rendelsham and on other peaty soils, but only after markets and/or contracts teed up.
- (c) Total potential area - Seemingly up to say, 100 acres - depends on prices, how much is being imported, mechanisation of handling and weed control.

References:

P. Fairbrother's report to Senior Agricultural Adviser, 12/8/65

"S.E. Times", Millicent of 31/7/59

N. Hart, Rendelsham - visit with D. Crawford, P. Barrow in May, 1969

Letters from G. Num, Rendelsham to Board of Trade re imports.

COTTON

K.G. Boyce

Botanical Features:

Botanical Name: Gossypium hirsutum (American Upland type).

Growth Form: Woody shrub, 3-5 ft. high, annual or pseudo-perennial.

Nature of Saleable Product: Cotton lint, linters, cotton seed.

Agronomic Requirements:

Soils: Moderately fertile deep loams or clay loams of good structure and well drained.

Temperature: Generally the limiting factor. Soil temperature must be above 70°F. for good establishment.

Moisture: Must be irrigated under South Australian conditions.

Fertiliser: 2 bags super plus 60 lbs. N at hilling up time, with further nitrogen (up to 100 lbs. N) as split dressings later in the season.

Growing Season: Late November to mid-April.

Frost: Cotton is frost susceptible. The growing season must be frost-free.

Equipment: Expensive equipment applicable only to this crop must be purchased - large capital investment.

Current S.A. Production: Nil

Current Australian Production: Approximately 150,000 bales in 1969.

Production in 000's. lb. (unginned cotton)

	<u>N.S.W.</u>	<u>Qld.</u>	<u>W.A.</u>
1966-67	79,159	11,800	29,400
1967-68	170,064	18,718	25,954

Current Market Position:

Australia: Fulfilling Australian requirements for the types of cotton grown here.

Export: Some export is possible but at a lower price. World Parity price depressed by over-production.

Prospects for S.A.:

Previous S.A. Experience: Experimental and semi-commercial plantings have shown that cotton could be grown on the Upper Murray River and at a yield comparable with those of New South Wales.

Possible Localities: Upper Murray irrigation areas.

Total Potential Area: Potentially irrigable land on the Murray River.

References:

"A guide to cotton growing" - Irrigation Research and Extension Committee, Irrigation Research Station, Griffith, N.S.W.

Ryan, J.G., 1963 - "Cotton in New South Wales", N.S.W. Ag. Gaz. 74 (3) 144.

"The cotton problem" - C.S.I.R.O. Rural Research 46, March, 1964, p.28.

Basinski, J., 1962 - "Cotton growing in Australia - a technical and scientific survey", C.S.I.R.O.

Cardozier, V.R., 1957 "Growing Cotton", McGraw-Hill, N.Y.

FLAX

F.C. Gross

Botanical Name: Cultivated species, Linum usitatissimum

Flax is a single stemmed annual growing to a height of up to 36", and braching only in the upper part when flowering. All varieties are normally self-pollinated, but about 5-10% may be pollinated from adjacent plants.

Flax is grown for fibre. The fibre is extracted from the stems and used for making various types of linen products. The seed of flax is virtually a by-product of the crop. Linseed oil is extracted from the seed, the residue of which is linseed meal, a high protein stock food.

Soil Requirements:

Loam soils with good drainage and retentive of moisture grow the most satisfactory crops of flax.

Climate:

Minimum average annual rainfall of 22" with cool and late spring conditions are required to obtain payable yields and reasonable quality in flax. Irrigation, where available, could be used to supplement spring rainfall.

Fertiliser:

Superphosphate (1-2 cwt. per acre) and zinc. Nitrogen influences the quality of straw, so must be used with care.

Growing Season:

Fibre flax is sown sometime between mid-May and mid-June or in late districts in August. The crop is ready for harvesting when the seed pods or bolls have turned to a golden-brownish color which normally occurs in November and December.

Sowing:

The crop gives best results following pasture, broken up in the early autumn and worked down to a firm seedbed. The seeding rate is 70 lbs. of seed per acre. Weed control is achieved with cultural methods and the use of pre-emergent and highly selective herbicides.

Harvesting Equipment:

Pulling machines are used to pull the stems out of the soil and bind them into sheaves for transfer to the processing mill. In "cheap" labour countries flax is hand pulled. In Australia the crop was cut and sheaved with a binder before the advent of the flax puller.

Processing:

From the field the flax straw is transferred to a mill for deseeding, retting (dew retting or water retting) and scutching. These processes extract the fibres from the stem and prepare the fibre for the further processes of spinning and weaving.

Varieties & Yields:

The principal varieties of flax grown in Australia were Liral Crown and Concurrent, which were developed to suit Australian conditions. Average yields of 2 tons per acre were obtained and with good crops as high as 3 tons per acre.

S.A. Production:

Flax was first grown commercially in South Australia in the 1860's and 1870's. To overcome war time shortages and set up as a project by the Commonwealth Government, flax became an important cash crop for high rainfall districts in the 1940's and early 1950's.

In 1940, 73 tons grown; 1941, 10,600 tons, declining in 1957 to 3,077 tons when Commonwealth Government support was withdrawn and the industry went out of existence.

Australian Production:

No fibre flax has been grown in Australian since the 1950's.

Prospects for S.A. & Australia:

There is no chance of the flax industry being re-instated in Australia unless because of population pressure world production falls short of demand. This is most unlikely this century, particularly with the increasing use of artificial fibres and pastics. If grown again in S.A., the Lower South East has proved the only area suitable for the economic production of flax.

Reference:

"Flax Cultivation & Experiments" (R.C. Scott,
O. Bowden & K.A. Pike)

GRAIN SORGHUM

K.G. Boyce

Botanical Features:

Botanical Name: Sorghum vulgare

Growth Form: Typical grass type cereal up to 5 ft. high. Annual.

Nature of Saleable Product: Seed

Agronomic Requirements:

Soils: Any soil type from sand to heavy clay.

Temperature: At least 65^oF. for germination and establishment.

Moisture: Irrigation needed.

Fertilisers: 1-1½ bags superphosphate, 120-180 lbs. N/acre.

Growing Season: Upper Murray - mid-October to mid-April. Lower South East - mid-November to mid-April.

Frost: Not tolerant to frost.

Equipment: Cereal equipment.

Current S.A. Production: 150-200 tons.

Current Australian Production:

Production in '000 bushels

	<u>N.S.W.</u>	<u>Vic.</u>	<u>Qld.</u>	<u>W.A.</u>	<u>N.T.</u>
1966-67	1,527	4	10,172	Not available	8
1967-68	1,580	18	8,939	45	Not available

Current Market Position:

Australia: Increasing competition from cereals for stock feed concentrates.

Export: Expanding market to Japan.

Prospects for S.A.:

Previous S.A. Experience: Experimental plantings since 1963. First commercial production 1966.

Possible Localities: Irrigated areas of Upper Murray and Lower South East.

References:

Boyce, K.G., 1968 - "Grain Sorghum - a new irrigation crop?", S.A. Dept. of Agriculture Leaflet No. 3875

Boyce, K.G., 1969 - "Hybrid Grain Sorghum varieties for South Australia", S.A. J. of Ag. 73, 90-91

HOPS

N.M. Brooks

Botanical Name: Humulus lupulus

Growth Form:

Perennial, growing from a rootstock, selected shoots are trellised.

Agronomic Requirements:

Deep, well drained soils are required on a site that is well sheltered from winds which damage the fruiting laterals.

For reliable yields irrigation is needed during the most active growing period (January to March).

Heavy dressings of organic manure, potash, and split dressings of sulphate of ammonia during the growing period are required. Superphosphate is used with leguminous cover crop.

Harvesting:

Mainly by hand; with modern machines quality is not affected. The inflorescence is a cone-like catkin - it forms the hops of commerce which are marketed in bales (approximately 240 lbs.) after curing.

Production & Quality:

In hops quality is based on alpha resin content and aroma. Tasmania provides about 60% of Australian requirements, Victoria the remainder and Western Australia a little for local use.

Prospects:

Hops are a labour intensive crop and require investment in trellising and curing facilities (kilns).

New varieties now available (bred in Victoria by C. & U.B.) have a higher alpha resin content - 9-10% as against 4-5% of older varieties - this means breweries can cut down on total weight used.

Tasmania experienced a glut last season, and is now picking (March, 1970) a very good crop. The United Kingdom and Continent faced with a surplus, have already explored export potential to Australia.

South Australian breweries will buy less this year - hops can be kept under refrigeration for 12-18 months at 40-48° F. Only other users commercially are bakehouses.

References:

Personal Communication - S.A. Brewing Co.
Manual of Aust. Agric.

LINSEED

K.G. Boyce

Botanical Features:

Botanical Name: Linum usitatissimum

Growth Form: Single primary stem and few to many secondary branches 12-48" high.
Annual.

Nature of Saleable Product: Seed.

Agronomic Requirements:

Soils: Lighter soils preferable but will grow on any soil type.

Temperature: Prefers spring temperatures to winter for boll formation.

Moisture: Very drought tolerant but responds well to good moisture supply.

Fertilisers: Similar to wheat in cereal growing country.

Growing Season: Winter-spring to early summer.

Frost: Boll formation seriously affected by frost.

Equipment: Cereal equipment.

Special Features: The seed is crushed for the oil content.

Current S.A. Production:

1966-67: 188 tons
1967-68: 72 tons

Current Australian Production:

	<u>Production in Tons</u>				
	<u>N.S.W.</u>	<u>Vic.</u>	<u>Qld.</u>	<u>S.A.</u>	<u>W.A.</u>
1966-67	3,265	2,319	7,338	188	634
1967-68	925	804	6,571	72	2,083

Current Market Position:

Australia: Saturated market in Australia. Most of production is under contract to Oilseed Crushers.

Export: Some export potential to Japan.

Prospects for S.A.:

Previous S.A. Experience: Steady production of about 1,500 acres per year for some years in the South East. Experimental plantings of linseed in Mid North and Kangaroo Island since 1950. Variety trials at Clay Wells (near Millicent) 1964 to 1966.

Possible Localities: Wetter areas of wheat belt - over 17" rainfall. Lower South East.

Reference:

"Linseed Growing in Queensland", Qld. J. Ag. 88: 670
1962

MAIZE

C. Phillips

Botanical Features:

Botanical Name: Zea mays, family Graminae

Growth Form: Summer growing annual, generally
5 feet to 10 feet high.

Nature of Saleable Product: Seed

Uses: Grain for stock, production of starch,
cornflour and breakfast foods. The im-
mature plant utilised for grazing, green
forage or silage.

Agronomic Requirements:

Soils: Requires fertile soils of good structure.

Moisture: Requires an abundance of moisture,
irrigation necessary for satisfactory
yields in the absence of adequate sum-
mer rains.

Temperature: Yield affected by severe heat waves
and frost. Requires soil temperature of
65° to 70° F. for germination and estab-
lishment.

Fertilisers: Nitrogen and phosphorus required,
depending on soil type and fertility.

Varieties: Almost 90% of maize grown in Aust-
ralia are the hybrid varieties.

Seeding: For grain seeding rate of 6 to 12 lbs.
per acre in rows 30" to 54" apart.
Sowing depth of 1" to 3" depending on
soil type and moisture conditions.

Harvesting: Special modern harvesting equipment
necessary.

Storage: Moisture control very important, re-
quiring special type silo storage with
temperature and moisture control.

Australian Production:

Production in Australia mainly from Atherton Tablelands, south east Queensland and northern N.S.W.

In 1966-67 Australia produced 7,491,000 bushels of maize of which N.S.W. produced 2,471,000 bushels and Queensland 4,948,000 bushels. The average yield for Australia in the five year period ended 1966-67 was 32.3 bushels per acre. The average yield in the U.S.A. for the same period was 72.1 bushels per acre.

The average wholesale price of maize in the Melbourne market in 1966-67 was \$2.28 per bushel (bushel weight 56 lbs.).

Exports:

Australia exported 474,000 bushels to Japan in 1962-63. Total exports in 1966-67 was 80,000 bushels (drought in Queensland affected production).

MILLETS

F.C. Gross

The millets include a number of species of annual grasses with small seeds which are used as quick growing summer fodders or harvested for grain.

Species:

Panicum miliaceum - Millet, panic or Proso millet.

Echinochloa frumentacea - Japanese millet

Setaria italica - Italian or foxtail millet

Pennisetum typhoideum - Pearl or bulrush millet.

Numerous varieties exist within most of these species. The commonest are:-

Panicum miliaceum - White, red French, hog and Proso millets

Setaria italica - Hungarian, dwarf Setaria, Siberian, white and yellow, Manchurian, giant Setaria or liberty millet.

Echinochloa frumetacea - Japanese millet.

Soil Requirements:

Any soil. The millets respond to fertility but of the summer growing crops make best use of soils of low to moderate fertility.

Climate:

These are warm climate or summer growing crops, therefore require a reliable summer rainfall. Where summer rainfall is not reliable the millets can only be grown successfully with irrigation. These crops are sensitive to frost.

Cultural:

Well prepared soil and a fine, firm seedbed is required for millet. The crop is sown in late spring or early summer at seeding rates from 6-15 lbs. of seed per acre, according to soil conditions and whether dry grown or irrigated.

Fertiliser:

Superphosphate normally at 1 cwt. per acre and nitrogenous fertiliser according to requirement.

Harvesting:

Grain millet is harvested with a cereal header or all-crop harvester. Yields average 17 bushels per acre in Queensland. Crops have yielded as much as 75 bushels per acre. The fodder millets can be grazed, cut and fed as green forage, cut for hay or cut for silage.

Uses:

The millets which can be harvested as grain are panic millet or Proso millet. *Setaria* Japanese millet is harvested for seed in the irrigation areas of southern New South Wales and in Queensland. Millets are harvested for grain in Queensland.

All the millets can be used for fodder purposes. However, the variety which is used generally for fodder purposes is Japanese millet (*Echinochloa frumentacea*). Millet grain is used for bird seed. In parts of Asia and Africa the millet grain is used for human food.

Production:

Australia:

Grain millet 22,431 tons annually

Broom millet 715 tons annually

South Australia:

Fodder purposes only.

Prospects for South Australia:

Australian requirements for seed and grain millet seem to be fully met by Queensland and New South Wales production where conditions are more favourable for the growing of millets.

If a demand did arise in the future millet crops could be grown in S.A. with irrigation if water was available in River Murray areas or in the central South East.

Millet has found a place as a fodder crop under irrigation or dry grown, mainly in the dairying districts of South Australia.

Reference:

Queensland Journal of Agriculture, July, 1965.

MUSTARD

C. Phillips

Mustard belongs to the Brassica family, and has some of the characteristics of turnip, rape and related species.

It is quick growing. Under ideal conditions it may germinate in less than four days and will mature in 110-120 days. At maturity it is 3 ft. to 6 ft. high, depending on variety and class of land.

There are two main varieties, white and brown mustard.

White mustard is taller than brown and has a thicker stem which is hollow and slightly hairy. The pods are in a cluster near the top of the stem.

The stem of brown mustard tends to be more solid, shorter and hairy. The seed pods are dispersed and not clustered to the same extent as white. The flowers of both are bright yellow and at first glance resemble those of wild turnip. Seeds of both varieties are hot to the taste, brown being the hotter. Neither brown nor white will cross with any other species.

Soil Type:

The ideal is medium, free working loam of high fertility. Mustard tends to ripen unevenly so soil should be as even as possible.

Cultivation:

The seedbed should be firm and fine, but not powdery. Fallow should be made before winter and worked down in the spring for seeding.

6-8 lbs. seed per acre is used. Seed should be sown through small seeds box. Germination may be damaged if seed is mixed with superphosphate.

Superphosphate applied at the rate of 1-1½ cwt. per acre.

The seed should be sown ½ to 1 inch deep.

Harvesting:

If sown in September-October the crop is ready to harvest in January-February.

Mustard is a difficult crop to harvest, and wind-rowing prior to header harvesting may be necessary.

If reaped with a harvester the stage of reaping is important because heating will occur if reaped too soon.

With brown mustard the crop should be reaped when fawn in colour, and no sap remains in the straw. With white mustard the crop should be amber and the seed yellow.

Bags should be only half filled and left to stand for several days. The moisture content should be less than 12% or heating may result.

Mustard Growing in South Australia:

Mustard seed can be processed into the highly esteemed condiment "mustard" for table eating.

Figures available from the Bureau of Census and Statistics show that mustard in the South East of South Australia yielded approximately 7 cwt. per acre.

Large acreages of mustard were grown in South Australia after World War II to alleviate a shortage, but production from two crops was sufficient to supply Australia's requirements for approximately 20 years.

There was a small quantity of mustard grown in the South East of South Australia in 1969.

Reckitt & Coleman Limited, manufacturers, process seed in Sydney.

Current Market Position:

Australia imported 6,550 centils of mustard seed valued at \$68,000 in 1968-69.

References:

1. Dept. of Agric., S.A. notes, 1960.
2. Information from Reckitt & Coleman Ltd.

OILSEED RAPE

P.M. Barrow

Botanical Features:

Two species of oilseed rape are grown, Polish type (Brassica campestris) and Argentinian (B. napus). The Polish types are earlier maturing and are the ones being mainly grown in Australia.

Oilseed rape is similar in growth form to fodder rape, growing to a height of $1\frac{1}{2}$ to 3 feet, and producing seed from which edible oil is extracted, leaving a protein -rich meal used for stock feed.

Agronomic Requirements:

Soil Type: Rape will grow on a variety of soil types. Subsoil with good moisture holding capacity is a distinct advantage.

Temperature: Oilseed rape is regarded as a "cool season" crop in Canada. Seedlings can be damaged by very severe frost.

Moisture: The crop is slightly less drought tolerant than linseed. Current Victorian production is confined to areas with greater than 22" rainfall. Reasonable yields could be expected down to about 16" rainfall, however. Long fallow is advantageous in wheat growing areas.

It is doubtful whether the use of irrigation would be economic.

Growing Season: Autumn sowing has been recommended in Victoria, but some early spring sown crops were successful in Victoria in 1969. The recommended varieties are "spring" types and do not require a cold season before flowering.

Date of harvest in South Australia is not known, probably in January-February.

Pollination: Rape is cross pollinated. This normally occurs by wind action but the presence of bees is an advantage.

Weed Control: Rape is very susceptible to 2,4-D herbicides. Careful seedbed preparation is therefore desirable. A good stand of rape crowds out most weeds, but does not check wild oats. Avadex and Carbyne can be used with rape.

Varieties: The recommended varieties in Victoria are Arlo and Target which are both Canadian varieties of B. campestris.

Seeding: Seed is sown at 4-5 lbs. per acre in 7" rows, 1" deep, using bran as a carrier - $\frac{1}{4}$ lb. bran to 1 lb. of seed. Seeding rate for Argentine varieties is 7-10 lbs./acre.

Harvesting: Losses can occur through shattering before harvest, especially under hot dry conditions. The recommended varieties are somewhat shatter resistant.

Seed can be direct headed as soon as fully ripe or can be swathed just as the seeds start to turn brown. Seed should not be stored at moisture levels higher than 10.5%.

Current S.A. Production:

Probably nil. There may have been a small area sown in 1969.

Current Australian Production:

1968-69:	480 tons
1969-70:	5,000 tons (estimate)

Current Market Position:

Large quantities of rape seed oil (over 1 million gallons) and other cheap oils which are interchangeable are imported into Australia each year. The main use of this imported oil is for the grocery trade (cooking).

A duty of up to 40c. per gallon has been introduced on imported oils, and this will give a boost to local production. The current price being offered for oilseed rape is \$100 per ton.

There are prospects for export markets at much lower prices.

Prospects for South Australia:

In the higher rainfall areas yields of 1,000-2,000 lbs./acre should be obtained. This would make rape a profitable crop.

Lower yields must be expected from wheat belt areas, but the crop may still be a worthwhile substitute for wheat on limited areas of better class land.

Markets would have to be assured before seeding. A new oil extraction plant is to be set up in Geelong. This company could take up to 5,000 tons of S.A. grown rape for the Melbourne city market.

References:

Patton, C.T. (1969) - Private Communication - Vict. D. of A. experience

Downey, R.K. & Bolton, J.L. (1961) - Canada Dept. of Ag. Publication No. 1021.

PEANUT OR GROUNDNUT

K.G. Boyce

Botanical Features:

Botanical Name: Arachis hypogaea L.

Growth Form: Herbaceous bush form - similar to potato. Annual.

Nature of Saleable Product: Seed pods produced underground.

Agronomic Requirements:

Soils: Light to heavy soils of good depth and structure and drainage.

Temperature: Require summer temperatures for establishment and growth.

Moisture: Irrigation needed in S.A.

Fertiliser: If nodulation ineffective then 100-150 lb. N/acre with 2-3 bags superphosphate/acre.

Growing Season: Summer - November to April.

Frost: Intolerant to moderate frost.

Equipment: Special drills and harvesters required.

Current S.A. Production: Nil.

Current Market Position:

Australia: Market saturation from Queensland, New South Wales and the Northern Territory.

Production in Tons:

	<u>N.S.W.</u>	<u>Qld.</u>	<u>N.T.</u>
1966-67:	260	41,098	-
1967-68:	196	30,110	2

Prospects for S.A.:

Previous Experience in S.A.: Small plots successful on the Upper Murray River near Morgan.

Possible Localities: Irrigation areas.

References:

"Groundnut Cultivation in Israel" - World Crops 18:68, June, 1966.

"Annual Field Crops; Groundnut" - Field Crop Abst., 19: 202, Aug. 1966

POPPY SEED

C. Phillips

Botanical Name: Papaver somniferum (Opium poppy)

Growth Form:

Upright annual with bristly hairs and milky juice.

Nature of Saleable Product:

Seed.

Agronomic Requirements:

Soils: Wide range of soil types, similar as for cereal crops.

Temperature: Adapted to winter-spring climate of southern Australia.

Moisture: Natural rainfall but irrigation would be needed in years of a dry finish.

Current S.A. Production: Nil

Previous S.A. Experience:

Opium poppy was grown experimentally by the S.A. Department of Agriculture in 1960 at the Parndana, Kybybolite and Berri Centres. Only at Berri was a successful crop grown. However, the company in England which tested the alkaloid content stated that the yield of alkaloid was not high enough to be a commercial enterprise where poppy seed was grown on such an intensive system as at Berri Experimental Orchard. Trial work was discontinued.

Current Australian Production:

Tasmania is currently growing poppy seed commercially. The March, 1970 harvest will be distributed to Australian customers.

Current Market Position:

Australia in previous years imported most of its requirements from Holland and Turkey. Poppy seed is used extensively in the bakery trade as a topping on bread and pastry, imparting a flavour as well as decorating. All seed is de-natured before entering Australia to comply with the Drugs Act.

Opium poppy can only be grown under approval from the Commonwealth Government. It is an offence to grow opium poppy under the Drugs Act. Penalties up to \$500 can result from breaches of this Act.

Considerable quantities of poppy seed are used by the bakery and allied trades, an approximate figure distributed by one Adelaide merchant is 85 to 100 tons, which is retailed at 28 cents per lb. for Australian No. 1 grade poppy seed.

References:

S.A. Dept. of Agric. files

Estimates supplied by Waters Trading Company.

SAFFLOWER

K.G. Boyce

Botanical Features:

Botanical Name: Carthamus tinctorius L.

Growth Form: Similar to Saffron thistle. Winter annual 2-5 ft. tall.

Nature of Saleable Product: Seed.

Agronomic Requirements:

Soils: Need to be deep loams, neutral and well drained.

Temperature: 40-60°F for germination.

Moisture: Needs 16-18 inches of available water per acre, i.e. 20-25 inches of rainfall under dryland. Safflower is very sensitive to excess water.

Fertilisers: As for cereals.

Growing Season: From June to November.

Frost: Resistant to frost down to 20°F.

Equipment: Cereal machinery.

Special Features: The seed is crushed for oil content of 30-37%. Seed yields generally too low to be economic enterprise.

Current S.A. Production: Nil

Current Australian Production: Production in 000's bushels

	<u>N.S.W.</u>	<u>Vic.</u>	<u>Qld.</u>	<u>W.A.</u>
1966-67	72	7	1,290	-
1967-68	59	1	815	2

Current Market Position:

Australia: Producing most of Australia's needs. Marketing restricted by margarine quotas.

Exports: Little possibility due to world over-production.

Prospects for S.A.:

Previous S.A. Experience: Grown experimentally since 1950. Some grower experience.

Possible Localities: Wetter areas of the wheat belts.

References:

- "Safflower: New interest in", World Farming, June, 1964
- "Safflower Growing in Queensland", Qld. J. Ag., 89 : 148, 1963
- "Safflower Trials in the Victorian Wheat Belt", V.L. Hore, Vic. J. Ag. 58: 407, 1960
- "Safflower Trials in Australia", B. Horowitz & C.R. Kleinig, C.S.I.R.O. Divn. of Plant Ind. Tech. Paper No. 11, 1958

SESAME

K.G. Boyce

Botanical Features:

Botanical Name: Sesamum indicum

Growth Form: Single stem growing up to 7 ft. with pods and flowers all the way up.
Annual.

Nature of Saleable Product: Seed and oil.

Agronomic Requirements:

Soils: Most soil types except heavy clays.

Temperature: Needs late spring temperatures for germination - above 60° F.

Moisture: Irrigation needed in S.A. - 24-30 inches of water.

Fertilisers: Both superphosphate and nitrogen fertilisers needed in S.A.

Growing Season: Summer (November to April).

Frost: Will not tolerate frost.

Equipment: Cereal machinery considered adequate for harvesting.

Special Features: Most varieties have free seed shattering properties making timing of harvest difficult. Oil is highly prized for non-rancid qualities and seed for the baking trade.

Current S.A. Production: Nil

Current Australian Production: Nil

Current Market Position:

Australia: There is some demand for seed in the baking trade.

Prospects for S.A.:

Previous S.A. Experience: Small plots of shattering types at Morgan in 1964-65. The crop will grow under irrigation in this environment.

Possible Localities: Under irrigation on Upper Murray River.

References:

"Modern Methods for Sesame", World Farming, 4: 1962, pp. 19-45.

"Sesame Production", Farmers Bull. U.S.D.A. No. 2119

SOYA BEAN

P.M. Barrow

Botanical Features:

The soya bean (Glycine max) is a summer-growing annual legume, growing to a height of 2-4 feet with limited branching of the stems. Flowers are produced along the length of the stems, resulting in the production of clusters of bean pods, each holding about four seeds the size of field peas or slightly larger.

Soya beans are used in very many ways. The main uses in Australia are for oil production (industrial and edible) and stock food production.

Agronomic Requirements:

Soil Type: Soya beans are grown on a wide range of soils. Deep well drained loams or sandy loams are best.

Temperature: Soya bean is a summer crop. Extremes of temperature are harmful. Hot dry weather during flowering can prevent seed set.

Moisture: Irrigation would be required for successful production in any part of South Australia.

Growing Season: The soya bean is sensitive to day length, and hence time of planting. Varieties are classified according to their day length requirement, and the choice of varieties for any one district is critical. Well adapted varieties would be sown in November-early December, and reaped in April-May.

Varieties: Further research would be required to select suitable varieties for South Australia. Previous trials were based on older imported varieties. Some of the latest overseas varieties are now proving successful in N.S.W. and Queensland. Some breeding work is under way.

Seeding: Soya beans can be grown as a row crop or a solid stand. Australian plantings have been in 7-28" rows. Best results have been at 14". Seed is sown at about 40 lbs./acre at about 2" depth.

Inoculation is essential. Yields have increased quite dramatically since the introduction of the new strain of Rhizobium, CB 1089.

Weed Control: Fairly good information should be available interstate on weed control under Australian conditions. The herbicides Trifluralin, Planavin, Lorox (Linuron) and Amiben are used.

Pollination: Soya beans are closely self-pollinated.

Harvesting: The crop is direct headed as soon as ripe.

Current S.A. Production:

Nil.

Current Australian Production:

Queensland grows about 5,000 acres of soya bean as a dryland crop. N.S.W. grew 1,400 acres under irrigation in 1968-69, but it was estimated that this would increase to 11-12,000 acres in 1969-70. Average yields have been about 10 bushels per acre, but this will increase greatly under irrigation. In N.S.W. yields of 65 bushels/acre have been obtained in trials and commercial yields of 40 bushels/acre are common.

Current Market Position:

There is reported to be a ready market for soya beans for stock food manufacturers in Melbourne and Adelaide.

Up to 8,000 tons of soya bean oil is imported annually, and a ready market should develop up to this level as oil extraction facilities increase.

The current price paid to growers is \$2.40 per bushel in capital cities.

There is only very limited potential for exports.

Prospects for South Australia:

Experiments were carried out in the Upper Murray region in the early 60's. The best yields obtained were 26 bushels/acre. A yield of 40 bushels/acre would be necessary to produce worthwhile profits under irrigation. Yield improvement could be expected in S.A. from better varieties, the use of the improved Rhizobium strain, and general improvement in agronomic techniques.

Several years of research would be needed before large scale commercial production could be attempted. The South East offers the best prospects for this crop, but these are still considered to be fairly marginal.

SUNFLOWER

K.G. Boyce

Botanical Features:

Botanical Name: Helianthus annuus

Growth Form: Herbaceous annual up to 6 ft. in height.

Nature of Saleable Product: Seed.

Agronomic Requirements:

Soils: Adapted to a wide range of soils.

Temperature: Summer temperatures.

Moisture: Although relatively drought tolerant, irrigation will be needed in S.A.

Fertiliser: 1-1½ bags superphosphate plus 20-40 lbs. N/acre.

Growing Season: Summer - November to April.

Frost: Relatively frost tolerant.

Equipment: Modified cereal equipment.

Current S.A. Production: Nil

Current Australian Production:

	<u>Production in Tons</u>		
	<u>N.S.W.</u>	<u>Qld.</u>	<u>Vic.</u>
1966-67	240	3,338	72
1967-68	157	1,683	11

Current Market Position:

Australia: Small demand for birdseed - little for oil as is inferior to safflower and peanut oil.

Export: Nil

Prospects for S.A.:

Previous S.A. Experience: Some farmer experience
with small plantings.

Possible Localities: Irrigation areas.

References:

"Sunflower Growing in N.S.W.", N.S.W. Ag. Gaz. 68: 27
Jan. 57

"Growing Millet and Sunflower in Queensland", J. Ag.
Qld. 91(6) 342-355, 1965

TOBACCO

C. Phillips

Botanical Features:

Botanical Name: Nicotiana tabacum, family Solanaceae

Growth Form: Summer growing annual, up to 6 feet in height, carrying 20 to 30 leaves alternatively.

Nature of Saleable Product: The flue cured tobacco leaf is packed into hessian bales approximately 150 to 160 lbs. weight.

Agronomic Requirements:

Soil & Environment: Temperate to tropical climate, frost free period of five months and deep friable soils which must be well drained.

It is susceptible to wind damage, is adversely affected by extremely low levels of humidity and by extreme heat. It requires a uniform level of temperature during the growing period October to March (average temperature during the three summer months 70° to 72° F). A tobacco crop can be rendered completely valueless by a heavy frost or by a severe hail-storm, the leaf is the only commercially-valuable part of the plant.

Moisture: Irrigation required.

Planting: Seed is sown in seedbeds, 1 ounce per 100 square yards, seedlings transplanted when 6" high to the field, approximately 6,000 plants to the acre in rows 3½ ft. to 4 ft. apart.

Harvesting: The leaves are picked as they mature, from the bottom upwards. There may be up to 6 pickings from each plant. The leaves are fastened by twine onto short sticks and built into a flue-curing barn, which is heated by furnaces or oil heaters. The curing process takes from 4 to 7 days.

Current S.A. Production: Nil

Australian Production: Australian crops are grown in the eastern states, production centres include Mareeba, Bundaburg and Beerwah in Queensland; Ashford, Myrtleford and Gumbower in Victoria.

	<u>N.S.W.</u>	<u>Vic.</u>	<u>Old.</u>	<u>S.A.</u>	<u>W.A.</u>	<u>Tas.</u>	<u>Aust.</u>
<u>1938-39:</u>							
Area (acres)	697	4,262	3,842	77	1,055	134	10,067
Production '000 lbs.	471	1,603	2,173	17	741	104	5,109
<u>1966-67:</u>							
Area (acres)	1,794	8,455	12,134	-	-	-	22,383
Production '000 lbs.	2,133	10,953	14,819	-	-	-	27,905

Marketing: The Australian Tobacco Board, constituted under the Tobacco Marketing Act, 1965-66, administers the marketing of an annual quota of 26 million pounds (green weight) to be sold under an agreed grade and price. The average minimum price for the 1968 season was 109 cents per lb.

Imports & Exports: The value of Australian grown tobacco on the 1966-67 crop was approximately 30 million dollars. In the same year 27 million dollars' worth of tobacco and products were imported, which included 27 million pounds of unmanufactured tobacco valued at \$20.6 million.

Exports of tobacco and products 1966-67 were valued at \$2.363,000 including Australian produce of \$1.534,000.

Tobacco Growing in New Areas: An Australia-wide Tobacco Stabilisation Scheme was introduced during the 1964-65 season, and in Victoria tobacco growers were allocated quotas on the basis of their previous production. It therefore can be assumed that possibilities for tobacco growing in new areas are remote.

Under the present Tobacco Stabilisation Scheme it is difficult for any new grower to sell tobacco.

Shortage of experienced tobacco workers would also be a severe handicap to an intending new grower. In a good crop some 120,000 leaves per acre would have to be picked. It has been estimated that approximately 400 to 500 man hours per acre is absorbed in growing a satisfactory tobacco crop.

The average yield per acre in Victoria in 1966-67 was 1,208 lbs., and the price per lb. varied around \$1.10.

Reference:

Victorian Dept. Agric. - "Notes for tobacco growers, 1969"
Bureau of Census & Statistics Year Book, 1968
Manual of Australian Agriculture