AGRICULTURE IN SOUTH AUSTRALIA —The Lower North

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AGRICULTURE IN SOUTH AUSTRALIA

The Lower North

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THIS district consists of the undulating country running from Gawler to north of Clare, together with the flats on either side of ranges, the Adelaide Plains on the west and the upper portion of the Murray Plains to the east. The area is made up of Counties Light, Gawler, Eyre and the south-eastern part of County Stanley.

Since the bulk of the district has an average annual rainfall of 16-19in. and comparatively reliable seasons, it is one of the more climatically favoured cereal growing areas in the State. Extremes of rainfall vary between 10in. and 26in.

The soil pattern between the ranges is predominantly red-brown earth, and the flats of the Adelaide and Murray Plains are mainly mallee soils.

The cuthor examines a lush annual legume pasture, the basis of big production increases in the district.

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DISTRICT PRODUCTION

This is essentially a mixed farming area, and although most of the production comes from cereals and sheep, there are also valuable sideline pig, poultry and dairy units.

In general, the smaller farms are of necessity the most diversified. Parts of the district are intensively farmed to horticultural crops, especially in the Barossa and the Clare-Watervale areas, which together make a major contribution to South Australia's important wine industry.

HOLDINGS AND FARM SIZE

Because of rainfall differences and diversity of farm enterprises, property size is variable.

In County Light, the average holding is listed as approximately 350 acres. However, within this there would be 400-500 producers intensively farming in horticulture, as well as with dairy, pig and poultry units.

There are many mixed farms in the Lower North. On this property cows are grazing dryland lucerne and sheep are in the background.

This would mean the average mixed cereal farm is around 450 acres, with larger, more specialized cereal farms ranging from 700-1,200 acres.

It is considered that the most economically worked cereal/sheep unit is 750-800 acres or more. However there are some larger grazing properties in the less arable hills.

County Gawler on the Adelaide Plains is primarily a cereal growing area, with the average sized holding around 600 acres. In the higher rainfall, south-eastern part adjoining Gawler, there is a greater number of smaller mixed farms. Further west, farms are larger, mostly about 700-1,200 acres. This is generally considered to be an efficient unit.

County Eyre is mainly a pastoral area, with agricultural land adjoining the Eudunda Range. During initial settlement, properties were found to be too small in this lower rainfall area and for efficiency, there has been a continued trend towards fewer, but larger holdings.

In the cereal lands adjoining the ranges, properties are 1,000-1,200 acres. Many of these are run in conjunction with blocks of eastern marginal grazing country, which are used mainly for grazing and "catch" cropping.

The eastern half is a pastoral area comprising mainly larger station properties, with some irrigation along the river.

This County extends into the ranges on the western side and these provide rough hill grazing. Around Keyneton, Truro and Eudunda, the farms are small and used for a more intensive mixed agriculture.

County Stanley is the second largest wheat producing County in the State. This agricultural district includes the

south eastern part of County Stanley—of which the eastern section is a predominantly wheat/sheep area—but in the higher rainfall hills around Clare, sheep grazing and mixed farming are the main enterprises.

Properties in the flatter red-brown earth area average 800-1,000 acres, while in the hill country, farms vary from 50-200 acres in the more intensively settled horticultural and dairying areas, to large sheep grazing properties in the fringe hills.

TOTAL PRODUCTION AND AVERAGE YIELDS

Average annual production of all cereal grains in this district during the period 1952-1962 was approximately 7,000,000 bushels of grain and it carried an average 1,163,000 sheep.

During this period the peak grain year was 1961-1962 with 11,640,000 bushels and the poorest year was during the drought in 1959.

Sheep numbers have steadily increased with normal seasonal fluctuations and in March 1962, sheep numbers were just under 1,400,000.

In the last 10 years, the district has produced about 11.5 per cent of the State's cereal production, and carried nearly 9 per cent of the sheep population.

It is the main field pea area in the State, and being a mixed farming area has high numbers of pigs and poultry.

Wheat

Wheat is the main crop grown here—the district produces more than 12.5 per cent of the State's harvest. Most of this cereal is grown in the red-brown earth zone from Gawler to Hilltown and on the mallee soils of County Gawler.

Although the red-brown earth zone has a more favoured rainfall, the average yields are not high. This is due mainly to low soil fertility and lack of good legume pastures between crops. In areas of higher than 18in. average annual rainfall, the trend has been to fallow less.

Average yields in bushels per acre have been:—

County Light 20.06.
County Gawler 23.6.
Part of County Stanley 22.8.
County Eyre 14.6.

Much of County Eyre is marginal for cropping because of the low rainfall and high drought frequency.

The main varieties grown at present are Dirk (including the similar Raven), Insignia 49, Heron, Gabo, Claymore and Pinnacle in the later areas.

Barley

District barley production since 1950 has represented a little less than 10 per cent of the State's harvest. More than half of this comes from County Gawler the fourth largest barley producing County in South Australia. Here, the average annual production in the five years to 1961-62 was 1½ million bushels and a harvest of 2,828,000 bushels was reaped in 1960-61.

Barley is normally grown on worked up pasture land, although in the red-brown earth country it is commonly grown on wheat stubble. The mallee soils appear to be better suited to this crop than the red-brown earths, but the quality of the grain is only fair—mainly No. 3 grade.

Prior is the most popular variety, but Maltworthy and Noyep are also grown in some areas. Because of Prior's inherent straw weakness and to avoid wind damage, more and more crops of this variety are artificially lodged by rolling before harvest.

Oats

The district produces about 12 per cent of the State's oat grain production, but only 50-60 per cent of the area sown is harvested.

Oat crops are important to the rotations applied locally. As well, they provide a source of grain, grazing and hay for livestock—grain has proved its worth as a drought reserve.

A large percentage of crops is grazed while still green; after this they are left for reaping.

Rolling a barley crop at Turretfield Research Centre. Crops, especially Prior barley, can be saved from wind damage by rolling before harvest.

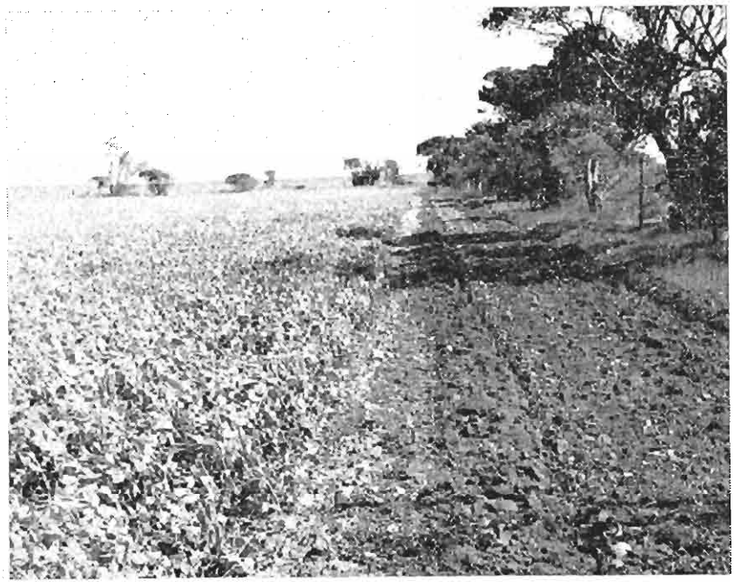
Oats are generally sown on wheat or barley stubble and while many crops are "trashed in", better results are obtained from sowing on a well prepared seed bed.

On the heavier red soils, a popular development is to sow 30-40 lb. of oats with subterranean clover seed as a grazing crop; this increases feed production from first year pastures. The crop is also oversown into lucerne stands to increase winter production.

In recent years, there has been a further development: increasing areas of oats are being sown in the semi-arable hills and are being grazed as mature or "standing feed" crops, in conjunction with volunteer pasture for late summer-autumn feed.

Avon is the main variety grown, and because of its high yielding ability has replaced the varieties Early Kherson, New Zealand Cape and Orient.

This mob of sheep has been grazing a standing oat crop on a hill paddock at Turretfield Research Centre. Note how they have reduced the crop to a stubble.



A pea crop protected by a fire-break at Angle Vale.

A mob of sheep grazing highly productive subterranean clover pastures at Steelton. Pastures such as these have lifted cereal yields and more than doubled wool production on some properties in the red-brown earth zone

Field Peas

Due to higher prices and more efficient growing methods during the past 15 years, there has been a big increase in field pea production.

Peas are mainly grown in the favoured cereal areas because of the longer season required for the best yields. In these areas, they are the only legume cash crop and, at the same time, serve a very useful purpose in the crop rotations.

Of the total South Australian field pea crop, the district produces approximately 45 per cent. About ⅔ of this is grown in County Light, and most of the balance in the Hundreds of Alma and Mudla Wirra in County Gawler.

Peas normally follow a wheat crop and best results are obtained with early sowing and high rates of superphosphate.

Because of fungus diseases, peas should not be grown on the same paddock more than once every five years. And as regards insect pests, Heliothis is the most serious and spraying, usually by aircraft, is standard practice.

Early Dun is the main variety because it appears better suited to the heavier soils. White Brunswick is grown successfully on the lighter soils and some of the Black Earths.

Sheep and Wool

Although sheep numbers have varied from year to year, with seasonal fluctuations, overall they have increased by about 25 per cent. By 1962, there were almost 1,400,000 sheep in the district—about 9 per cent of the State's sheep population.

The main breed is the Merino, and of these about ⅔ are ewes and ⅓ wethers, but these proportions vary greatly from district to district.

Prime lamb production is more common in the medic pasture areas. In County Gawler 70 per cent of the ewes are mated to British Breed rams, compared with 25-30 per cent in County Light and less than 20 per cent in County Stanley.

The way is open to greatly increasing sheep numbers on the red-brown earth soils with better clover pastures. There are properties with highly productive subterranean clovers which are producing more than double the district average wool production per acre.

Cattle

Total cattle numbers in 1962 stood at 45,000 of which nearly 25,000 were dairy cattle. Most of the dairying is carried on in the Barossa and Clare-Watervale hills areas, the Hundred of Gilbert and the Hundreds of Mudla Wirra and Alma in County Gawler.

Beef cattle are grazed in conjunction with sheep in the hill country and on some cereal farms.

Horticulture

The main horticultural areas are the Barossa Valley district—where there are some 16,000 acres of vines, fruit trees and vegetables—and the Clare Watervale district with approximately 3,500 acres of vines and fruit trees.

In the Barossa district, horticulture is mainly confined to the alluvial soils of the valley and the deeper soils on the rises. Vines and trees in the Clare-Watervale area are mainly on the undulating deeper calcareous soils and alluvial valleys. Only odd areas are irrigated and the water comes either from underground or surface storage.

Each year growers market about 30,000 tons of wine grapes, 4,000 tons of tree fruits and market gardeners in the Barossa Valley produce about 3,000 tons of vegetables.

Pigs

Being mainly a mixed farming district, pigs are an important sideline production. Numbers fluctuate according to prices, but they have been increasing markedly in the last ten years. In 1960-61 and 1961-62, numbers reached 26,600 and 30,000 respectively—or almost ⅕ of the State's pig numbers.

The trend is to create larger units which are more efficient on cereal farms, and to cut down on the number of enterprises on these farms.

Poultry

As with pigs, poultry are an important sideline unit on the mixed farms, and the district produces somewhere in the vicinity of 35 per cent of the State's egg production.

Units vary in size, but on a diversified farm with more than one sideline, the average unit would carry 400 birds; on the cereal-sheep farm with poultry as the main or single sideline, the average unit would be up to 800 birds. In Counties Light and Gawler more than 60 per cent of the farms have poultry units of 200 birds or more.

There are of course more specialised units in the area carrying more than 2,000 birds.

LAND USE ZONES

For purposes of discussing agriculture in this region it is convenient to divide the area into 4 zones.

- Red-brown earth zone.
- Mallee soil zone.
- Range country.
- Black soil zone.

Red-Brown Earth Zone

Most of the undulating arable soils in County Light and the eastern part of County Stanley are red-brown earths.

These soils vary considerably. Some are more friable; others are harder setting soils which are mainly poorly structured and have a high erosion risk. The shallower hard setting soils are noted for burning off or quick finishing characteristics.

The red-brown earth zone lies within better rainfall areas of the north, and because the soils are heavier, cultivation problems occur during years of high winter rainfall.

The river flats of the Gilbert-Light and other creeks provide excellent growing conditions for dryland lucerne, in fact most of the district's lucerne seed is produced here.

This zone was heavily cropped in the early 1900's, and the strain of supporting a fallow-wheat rotation for many years has taken its toll by depleting the soils of nitrogen and organic matter.

Very great soil variations can occur within paddocks in the red-brown earth zone.

At the same time continuous cultivation broke down the natural soil structure, leaving the soils difficult to work and with hard setting characteristics; in places it has been seriously affected by erosion.

However, in the past 20 years, there has been a gradual rebuilding programme—thousands of acres have been contour banked—cropping was decreased considerably from the late 1940's and land was left out to pasture for longer periods.

The natural growth of clovers over much of the area is inadequate to rebuild fertility, but where subterranean clover pastures have been established, the worn out wheat lands have been restored in a remarkable fashion. There have been striking examples where the rapid rises in soil fertility obtained have resulted in big increases in cereal yields and wool production.

Local graziers have seen these changes and are now using big quantities of subterranean clover seed. In 1964 an estimated 100,000 acres were sown to clover pastures.

This has tended to alter the basic rotation pattern from fallow-wheat-pasture to more of a pattern of fallow-wheat-pasture-pasture, or even 3-4 pasture years and then 2-3 crops. In better rainfall areas there has been a reduction in the area fallowed, with rotations comprising three years of crop.

Mallee Soils Zone

The bulk of County Gawler and the Murray Plains in County Eyre are mallee soils—predominantly loamy mallee and sandy mallee.

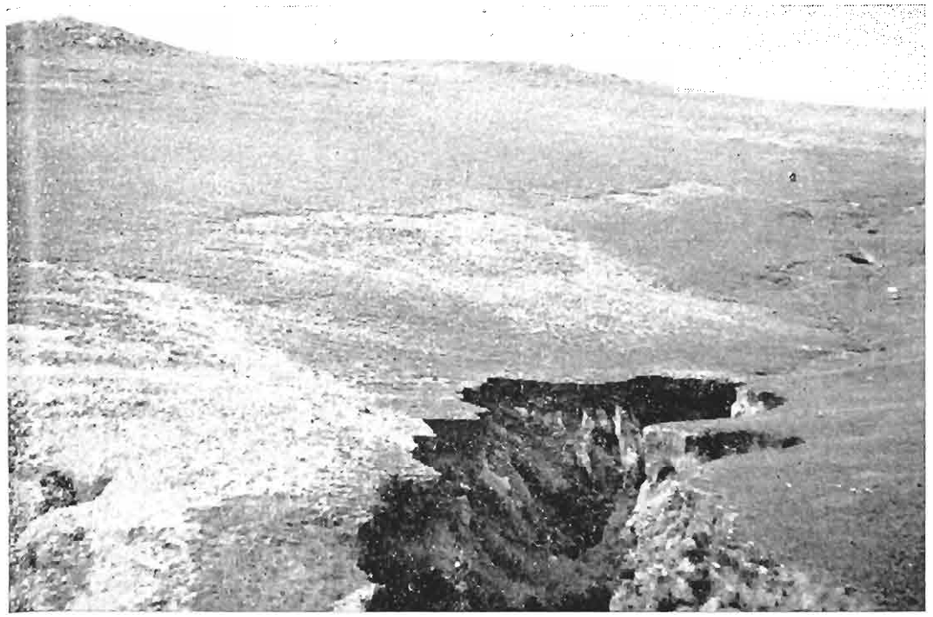
However, some loamy red-brown earths occur on the broad flats of the Adelaide Plains and near the ranges of the Murray Plains.

Some of this zone on the Murray Plains borders on the pastoral country and is marginal for cropping; much of this is regarded as "catch" cropping country and is worked up and sown in years of good autumn rainfall.

The better rainfall mallee soil areas have the biggest areas sown to both wheat and barley. Natural growth of barrel medic has lifted soil fertility in the last 20 years and given big increases in wheat and barley yields.

Range Country

Throughout the northern agricultural areas there are extensive areas of steep hills which run roughly north and south dividing the red-brown earth wheat zone.



If the lower rainfall hills are overgrazed and ground cover is removed, the slopes erode and take a long time to recover.

These are made up of:—

(*a*) THE LOWER RAINFALL HILLS, with parts of the Mt. Lofty Ranges, the Eudunda Range, the Kapunda Hills and the Peters Hill range and other scattered hills in cereal areas.

These hills are in the 14-19in. rainfall region and are predominantly red-brown earths and stony rises; some calcareous soils also occur.

It is a large area and the hills are rough, with relatively low carrying capacity. If they are overgrazed and ground cover is removed, the slopes erode and take a long time to recover.

Because of the steepness of some of the hills and the rocky nature, particularly on the upper slopes, very little improvement has taken place. The main problem they present comes from the short growing, quickly closing season and the volunteer annual species of poor feed value.

Nevertheless, large areas of semi-arable land await considerable scope for improvement. A big development in sheep management has come through oat crops which have been fed off as a supplement to dry natural pasture. The mature oat crop grazed in late summer-autumn supplies high quality feed at the right time.

However, simply sowing oats and reserving the crops for autumn feed is not enough. The big need is for improved soil fertility by growing better annual legume pastures; and they have to be stimulated with liberal applications of superphosphate.

Clovers best suited are Dwalganup, Geraldton, Yarloop and Clare in the 17-19in. rainfall areas.

(*b*) THE HIGHER RAINFALL HILLS lie in the Clare-Watervale, and the Lyndoch-Angaston-Eden Valley areas and have a rainfall of 20-26in.

The soils are mainly podzolic, with some rocky hills and alluvial valleys; some of the hills are red-brown earths.

The bulk of the area carries only partially developed pastures—large acreages of the subterranean clovers Mt. Barker and Eden Valley occur naturally.

Biggest scope for improvement lies in the more arable, gentler slopes and

Preparing rough hill country for an oat crop. The crop will be grazed in the autumn when other feed is scarce.

better drained flats. Here, highly productive phalaris-subterranean clover pastures can be established and the better drained flats grow lucerne well.

In fact, sowings of perennial grasses on arable portions and aerial topdressing of steeper hills would lift production considerably in these hills.

The Black Soil Zone

The black soils occur in patches in County Light and County Stanley. They are dark, heavy textured earths that crack in the summer.

Lighter areas of these soils occur around Freeling and Salter's Springs and a heavier phase is found in the Giles Corner, Tanunda, Saddleworth and Merilden areas.

Inherently more fertile than the other soil types, the black soils are generally considered the best for cropping in the lower north; over the years wheat yields would average more than 10 bags through much of this zone. Furthermore, due to their ability to store moisture, they respond more to fallow than the red-brown earths.

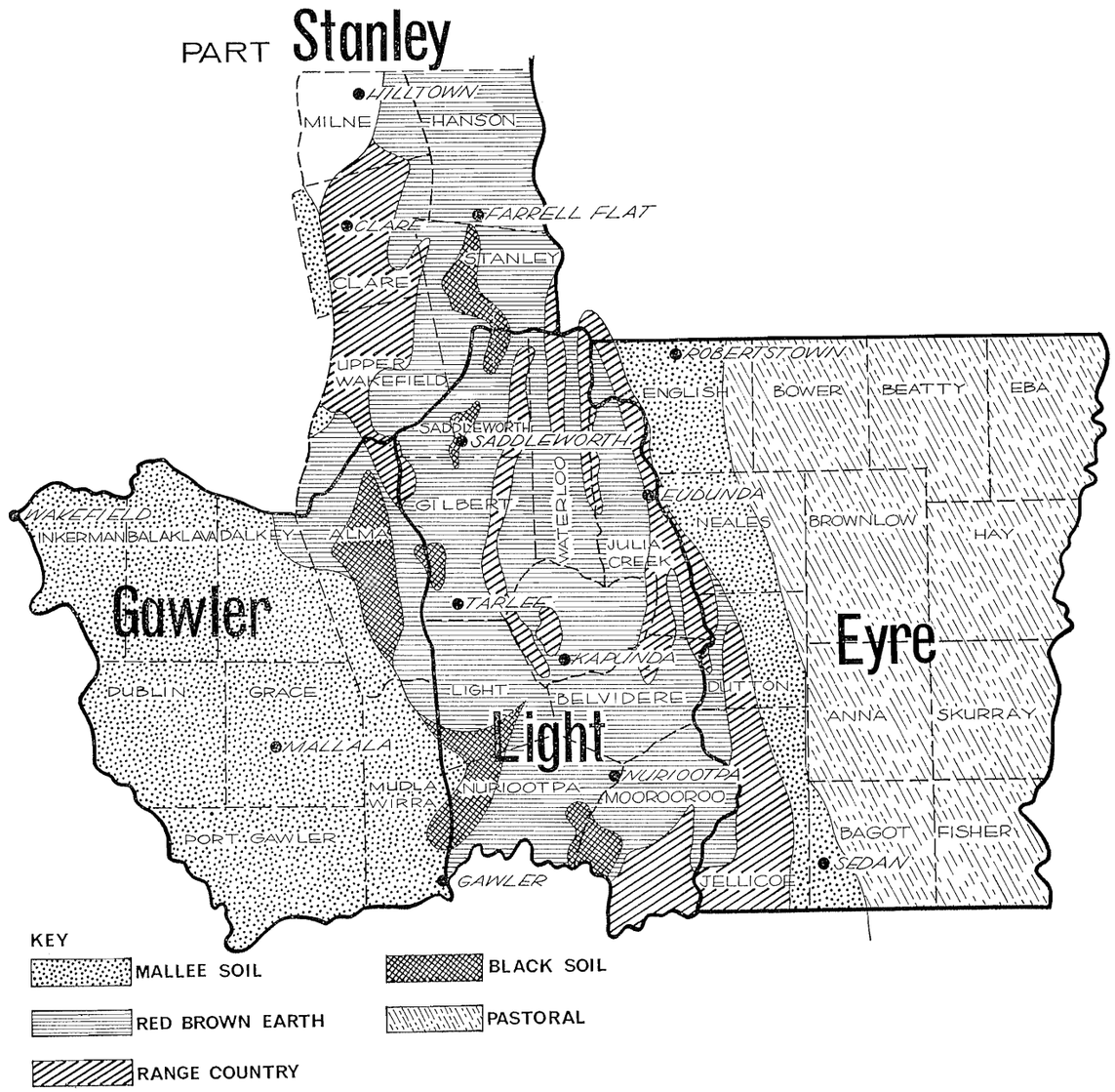
Field peas also give the best yields in this zone.

Pastures have been mainly natural burr clover, because although they are alkaline soils, the heavier soils in particular have not grown barrel medic as well as the mallee soils. Snail medic also grows well on the black soils. Clare subterranean clover has proved to be the most successful of the subterranean clovers on these soils, and good stands have been established in some areas.

Quite significant responses to pasture growth have been obtained due to the addition of zinc and manganese in some of the black soils.

Map 1

Land use—Lower North



Map 2

Rainfall map—Lower North

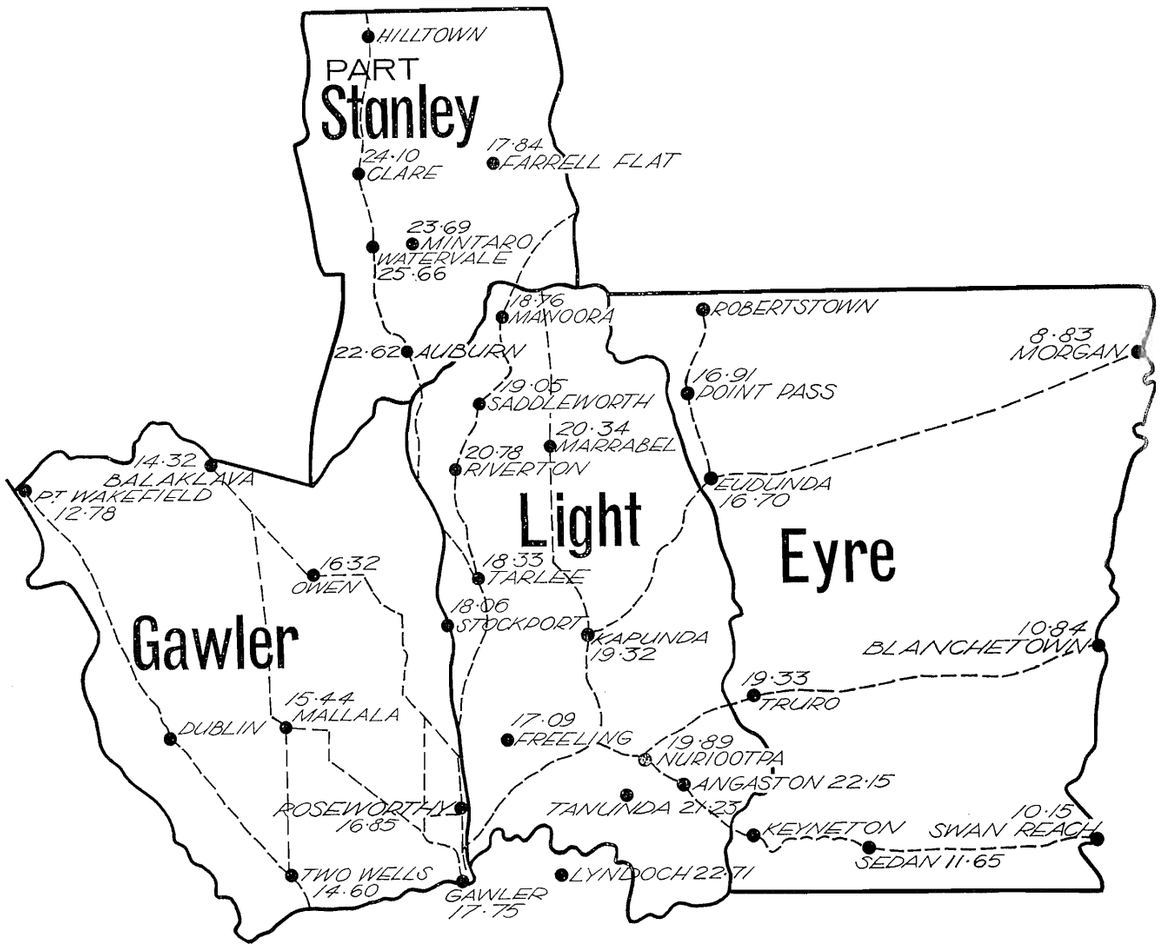


Table A—GENERAL

Zone	Rainfall	Soils	Water Supplies	Size of Farms	Value of Farms
1 Red-Brown Earth Zone	From 16in. to 17in. on the western and eastern fringes to 20in. to 22in. in Mintaro, Marrabel, Hill River areas	The R.B.E.* soils vary considerably through the area. R.B. Clay loam soils occur mainly in undulating country. Deeper soils on lower slopes and flats. Some limy R.B.E. is on higher slopes and rises particularly in the Riverton-Auburn areas. On the eastern side of Co.** Light, the hard setting shallower sandy clay soils occur ; these are highly erodible and difficult to manage	Mainly reticulated water supplies. Dams in undulating country. Some bores of varying quality (80 to 800 grains/gallon) Odd areas provide sufficient quantities for small irrigation schemes, especially in Hill River-Barossa area	There is considerable variation and diversification. Cereal farms from 400 to 1,500 acres ; average about 500 to 600 acres. In the Barossa district are smaller, more intensive areas in conjunction with horticultural and dairy production. Generally considered 700 to 800 acres most economical unit in ahe area for a cereal-sheep farm	Land values vary considerably. In the 18in cereal zone £45 to £60 per acre is general. in southern part of Co. Light because of proximity to facilities and markets, to £80 per acre. Harder setting fringe country, £40-£45 per acre
2 Mallee Soil Zone Adelaide Plains	From 12in. on coastal areas joining St. Vincent Gulf to 17.5in. in the Wasleys-Gawler areas	Mainly flat or gently undulating with loamy mallee and sandy mallee soils on rises, and odd flats of heavier red clay-loam soils (small areas only) adjoining the eastern ranges	Mainly reticulated water. Some bores, mainly small supplies for stock water only, ranging from 160 to 250 grains/gallon	Cereal farms 600 to 800 acres in better R.F.*** areas aroundWasleys. Nearer Gawler, farms are smaller and more intensive. Larger in lower R.F. areas	£30 per acre lower R.F. lighter coastal areas ; to £80 in the eastern side depending on proximity to towns and markets
Murray Plains	On Murray Plains 15in. against the hills, to 11in. in the marginal cereal areas, down to 8in. in the pastoral country	Rubbly limestone and loamy mallee soils ; some undulating country east of the Truro-Eudunda range, some stony hills	Mainly from dams and bores	Average cereal farms 1,000-2,000 acres. Many cereal farms run in conjunction with eastern pastoral blocks	£15 to £35 depending on locality in the cereal country. Down to £2 for low R.F. pastoral (blue bush) country
3 Black Earth Zone	17.5in. to 18in. in the Roseworthy-Freeling, Salter Springs areas. 18in. to 19in. Giles Corner, Saddleworth and North Manoora areas. 19in. to 20in. Tanunda, Gomersal areas	Odd patches of heavy black soils occur in many areas. There are concentrated areas which range from the very heavy, deep black crackling soil at Giles Corner to the lighter more friable black earths around Freeling. These deep soils are inherently fertile and store moisture efficiently	Mainly reticulated water supplies. The soils unsuitable for dams because they undermine readily	As for R.B.E. Zone generally. But these are select cereal growing areas and are generally 700 to 1,000 acres	There is only a limited area of these soils and the farms seldom change hands. Prices would be equal to top for R.B.E. country
4 Hill Country Zone	Higher R.F. range 19in. to 25in.	Podsolic soils in higher R.F. areas around Angaston-Keyneton Watervale-Clare Stony on top of steeper hills. Sandy R.B.E. soils with rocky upper slopes run through the cereal areas	Mainly from dams ; suitable sites occur in gullies	Difficult to define, because in the agricultural areas 400 to 1,000 acres of arable land often held in conjunction with similar areas in the hills. In better R.F. areas, e.g. Clare, from 100 to 250 acres on mixed dairy-horticulture sheep holdings to larger sheep properties	Similar to other areas. Land values vary £80 to £100 for higher producing small farms : to £40 to £60 on fringes
	Lower R.F. range 14in. to 18in.	Shallow R.B.E. soils with rocky hills	Reticulation to limited areas	Eudunda range—mainly larger grazing properties in lower R.F. areas. Some smaller intensive farms	£15 to £40 per acre depending on R.F. and topography with sone hills in lower R.F. areas possibly less

* R.B.E. = red-brown earth/s.
** Co. = County
*** R.F. = rainfall.

Table B—TYPE OF PRODUCTION

Zone	Crops	Rotation	Fertilizers	Pastures	Special Crops	Livestock
1 Red-Brown Earth Zone	Wheat, barley, oats, field peas. The heavier red soils seem more suited to soft wheats—Heron, Insignia and in later areas, Pinnacle. Of the semi-hard wheats, Dirk, Gabo mainly grown. 'mportant field pea area. Barley is not as important as on the mallee soils	Rotations changing from the old F.W. & F.W.P. with introduction of sub. clover pastures. With sown pastures it is normal to grow 3 to 5 years pasture followed by 2 to 3 crops, eg. P.P.P.P.F.W. Peas B. or P.P.P.W.B. or W. In areas over 18in. R.F., there has been a trend towards less fallow on the sub. clover country	Normal phosphate application 90 lb. to 120 lb. with crops; a little more with field peas. With increased sowings of sub. clovers more top-dressing is being carried out. Nitrogen fertilizers sometimes used with wheat on the lower fertility soils (particularly the hard setting, poorly structured red soils)	Volunteer pastures of poor quality. Does not grow barrel medic naturally except on some limy R.B.E. Big increases in production achieved with sub. clover pastures. Varieties: ·riable R.B.E.—Clare; Lower R. F. areas—Geraldton ; red soils—Yarloop, Geraldton, Dwalganup. Later areas—Woogenellup. In all cases, barrel medic added on limy soils generally. If variable within one paddock normal to sow mixture of strains	Lucerne seed production with more efficient methods has more than tripled in recent years. The Marrabel-Saddleworth area on the river flats is now most important area ; a so around Clare, Hilltown. Increasing interest in harvesting sub-clover seed, particularly Clare, in last year or so	Mixed farming area. Sheep mainly Merinos. Pigs, poultry, dairying are important side-line production particularly on smaller farms
2 Mallee Soil Zone	Wheat, barley, oats, small area field peas. Suitable for both semihard and soft wheat. Varieties mainly grown Gabo, insignia 49, Heron, Dirk 48. Raven and Gamenya becoming popular because of rust resistance	Being a medic area the normal rotation has been F.W.P.B.P. or in some areas F.W.P. Fallowing is practised widely. In some more favoured areas wheat is sown on grassland e.g. W.P.B.P. Co. Gawler in many years grows equal quantities of barley and wheat. Stubble sowing of oats for feed and reaping is also practised	Normal superphosphate applications 90 lb. to 120 lb. with crops. Pastures top-dressed sometimes in the more favoured areas. In the lower R.F. areas this is less frequent. Nitrogen fertilizer used to a small extent on the lighter soils with varying results	Pastures are mainly barrel medic, Wimmera ryegrass and barley grass. Woolly burr medic occurs in lower R.F. areas. Barrel 173 has a big potential on lighter soils ; Harbinger on the low R.F. sandy ridges on the western side. Some lucerne is sown but competition from barley grass often a problem	Some field peas, mainly White Brunswicks grown around the Roseworthy-Wasleys-Alma areas	A mixed farming area, mainly sheep. Merinos ; prime lamb production important. Pigs and poultry increasing. Some dairying, beef fattening on Adelaide Plains
3 Black Earth Zone	Wheat, barley, oats field peas. Some of the best wheat growing areas in the wheat belt. Suited to semi-hard wheats particularly Dirk types and Gabo in earlier districts. Some Insignia 49, Heron are grown. Field peas are also important	These soils give big response to fallowing. Normal rotations—F.W.P., F.W.P.B. Because of the thistle problem F.W. Peas, B.O.P.P. is now more common in the higher R.F. areas	Superphosphate 100 lb. to 150 lb. with crops. Because of cropping frequency pastures not generally top-dressed	In the past, mainly naturally occurring burr medic. Some of ighter black soils grow barrel medic. Heavier soils suited snail medic. With the trace elements, zinc and manganese, Clare sub. clover grows well in some of the better R.F. areas. New species Medicago Rugosa, is very promising. Phalaris minor occurs naturally and grows prolifically in the wetter soils	Mainly cereals and field peas. Odd areas of Phalaris canariensis have been harvested	As for Zone 1, with more specialized cereal and sheep production and less emphasis on side-line enterprises
4 Hill Country Zone Higher R.F.	Very little cash cropping. Some arable flats and moderate slopes sown to cereals	Mostly pasture country. Arable portions cropped mainly for renovation and sowing of pastures where required. High erosion risk	Some top-dressing. In steeper areas increasing interest in aerial top-dressing	Clare—Watervale area, mainly Mt. Barker sub. clover; fringe areas. Yarloop and Clare sown to increase winter production. Keyneton-Angaston area mainly Mt. Barker and Eden Valley strains, some Yarloop and Woogenellup is sown. Excellent phalaris country. Lucerne does well on the well drained flats. Pastures generally not well balanced—need renovation.	Very little. On the well drained river flats some lucerne seed production. Odd phalaris and sub. clover paddocks harvested	Mixed farming area; important dairying district. Sheep main line of production. Some beef cattle in conjunction with sheep

Table B—TYPE OF PRODUCTION—*continued*

Zone	Crops	Rotation	Fertilizers	Pastures	Special Crops	Livestock
Lower R.F.	Oats for stock feeding becoming increasingly important	Mainly volunteer pasture. Arable portions cropped for pasture renovation	Superphosphate is for most part only applied with oats and clover sowings	Mostly undeveloped pasture of low carrying capacity. Increased oat and clover sowings on arable portions. Clovers—mainly—suited—Geraldton, Dwalganup, Yarloop ; Clare in favoured spots	Not important	Mainly Merinos for wool production. Some beef cattle

Table C—PROBLEMS

Zone	Weeds	Cereal Diseases	Erosion	Trace Elements	Other
1 Red-Brown Earth Zone	Widespread weeds are:—Hoary Cress—possibly most serious weed problem ; wild artichoke, salvation jane, saffron, variegated and soldier thistles. Limy R.B.E.—Horehound Tomato Weed, Cape Tulip, St. John's wort, and dock in particular areas. Odd patches skeleton weed have appeared	Take-all, rhizoctonia, eelworm and rust. In the later areas, rust is becoming a problem ; with occurrence of new races in 1963 and 1964 significant losses have occurred	Very high erosion risk on the harder setting red clay-loam soils, much of which are contour banked. Extensive areas still require banking	Not generally required. Zinc deficiency has been located on limy R.B.E. Gypsum is sometimes used on hard clay pans	Some indications of clover disease in sheep associated with sub. clovers. Practice has been to sow Yarloop and Dwalganup as clover mixtures. Heavier soils difficult to work when wet some years e.g., 1956 and 1963. Large areas now sown and soil structure damaged through frequent working when wet. Heavier rain following seeding on poorly structured soils causes surface sealing and can affect germination
2 Mallee Soil Zone	Soursob is a particular problem on loamy mallee soils. Saffron thistle and three corner jack are widespread. Horehound, onion weed, wild artichoke. wild mignonette, Ward's weed, tomato weed, also occur. Fumitory, mustard and sheep weed are the main crop weeds. Murray flats-skeleton weed has spread in recent years	Mainly take-all and rhizoctonia. Eel worm on lower fertility sandy soils. Other diseases are seasonal, e.g., rust, powdery mildew	Some drift on sandy ridges. This is mainly flat country but some water erosion has occurred adjacent to the hills	No real problems. Main need is for more superphosphate and greater use of legumes particularly on the lighter soils	Talis on Murray Plains has caused damage in crops sown immediately after initial working. High drought frequency is the limiting factor in the marginal country
3 Black Soil Zone	Wild Artichoke and the thistles, particularly variegated thistle, grow most prolifically. In some areas hoary cress is a problem. Normal cropping weeds occur, particularly short fruited wild turnip and dead nettle	Odd areas have been affected by eelworm	Where these soils occur on the mid slopes, erosion risks are high. Tend to undermine even when banked	Manganese and zinc deficiencies found, but do not appear to affect cereal crops very significantly. Odd cases of marsh spot (manganese deficiency) have occurred in peas. Responses to manganese and zinc have been obtained in pasture legumes particularly on Clare sub. clover	Difficult to work when wet. Becomes extremely boggy and slippery
4 Hill Country Zone	Saffron thistle becoming a problem. Cape weed and salvation jane are problems in all the better pasture areas. Cape tulip is a serious weed in the Clare area and is limiting development	In the arable areas where cereals are grown, diseases are similar to 1	Erosion hazard is very high. Care is needed in grazing not to bare out northern slopes. These scalded areas take a long time to recover. Podzolic soils are extremely erodible and contour banking is sometimes necessary before cultivation	Not required as a general rule	Steep hills and rocky slopes restrict development. Waterlogging of poorly drained lower areas causes problems of management

Table D—POTENTIAL FOR INCREASED PRODUCTION

Zone	Increasing Soil Fertility	Alternate Land Use
1 Red-Brown Earth Zone	There is a vast potential in this favoured rainfall area for increased production by sowing down worn out red soils to good sub. clover pastures. In recent years these pastures have increased soil fertility and lifted sheep and cereal production. The big need is for the use of higher seeding rates of clovers and in some cases more superphosphate. Control of pasture pests, red mite and lucerne flea by well-timed spraying is essential.	Due to nearness to markets there is a potential for more specialized side-line production—pigs, dairy cattle ; also for increased clover and lucerne seed production.
2 Mallee Soils Zone	There is still a big potential for better pastures, particularly on the lighter soils around Balaklava, with use of newer medics Barrel 173 and Harbinger. Odd patches of heavier soil flats in between limy rises adjoining County Light are suited to early sub. clover varieties. Increased superphosphate applications on pastures could give good reponses. Sour sob control by planned late cultivation and cropping could assist on loamy mallee soils. Control of mite and flea is important.	Due to nearness to markets, on Adelaide Plains there is a swing towards dairy cattle, pigs and poultry. This is the main prime lamb producing area in the district, but could be increased. Fattening of beef cattle could be increased. Main increase could come with greater efficiency on the smaller farms, by having larger single units.
3 Black Earth Zone	These self-mulching soils are inherently the most fertile in the district, but the need is for better pastures—Clare has been best of the sub. clovers but by and large medics appear to grow better. Recent work has indicated that better pastures result from mixtures e.g. barrel 173, snail medic, Medicago rugosa, Clare sub. clover with addition of zinc and manganese.	Any major change in land use is unlikely. Increased yields and sheep numbers could result from higher soil fertility brought about by better pastures. Some change in cropping programmes may be necessary to achieve this because of weed problems.
4 Hill Country Zone Higher R.F.	The scope for increased production in the hills country is great. On the more arable slopes and better drained flats more clover, lucerne and perennial grasses could be sown. Also on wet flats strawberry clover could extend the pasture season and make better use of late rains. The scope on the rocky hill, is limited to top dressing and maintaining cover.	Higher R.F. areas could be used more intensively for dairy farming and prime lamb production. The big need is for better pastures containing more perennial grasses, particularly phalaris which does well. Currie cocksfoot could also be useful.
Low R.F.	There are thousands of acres of these hills, where little pasture improvement has taken place.	On the lesser slopes and flats, liberal use of superphosphate, sowing clovers, and oats would lift carrying capacity.

Table E—COUNTY LIGHT

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62
WHEAT										
Acres	41,819	43,819	45,360	37,596	26,635	25,436	30,996	39,196	53,575	62,536
Yield, Bushels	836,652	1,005,001	1,140,970	589,061	431,713	362,491	772,599	435,927	1,406,919	1,390,023
Yield, Bushels/Acre	20.01	23.32	25.15	15.67	16.21	14.25	24.93	11.12	26.26	22.23
BARLEY										
Acres	23,650	26,005	18,444	21,131	23,161	25,616	28,304	28,589	35,024	26,699
Yield, Bushels	651,228	652,846	367,236	501,241	517,257	329,771	773,129	259,045	981,313	547,574
Yield, Bushels/Acre	27.54	25.06	19.91	23.72	22.33	12.87	27.32	9.06	28.02	20.51
OATS										
Acres	10,005	6,967	9,220	8,526	9,237	12,639	14,814	14,928	15,317	10,745
Yield, Bushels	195,368	155,703	189,638	150,324	237,162	150,036	482,583	106,596	368,134	239,334
Yield, Bushels/Acre	19.53	22.35	20.57	17.63	25.68	11.87	32.58	7.14	24.03	20.27
PEAS										
Acres	5,403	6,737	8,832	8,839	7,111	9,686	8,112	7,551	6,433	7,630
Yield, Bushels	112,170	116,750	107,127	156,212	143,249	31,970	124,399	9,102	90,291	74,882
Yield, Bushels/Acre	20.76	17.32	12.13	17.68	20.13	3.30	15.32	1.21	14.04	9.82
Total Cereal Prod.	1,728,668	1,930,300	1,804,971	1,396,838	1,329,381	874,268	2,036,423	810,670	2,846,957	2,251,813
MISCELLANEOUS CROPS										
Lucerne Seed (Acres)	80	149	428	807	809	826	1,211	1,413	1,428	1,791
Lucerne Seed (cwt)	127	169	401	775	994	630	1,383	2,016	2,200	3,507
HOLDINGS										
Number	1,600	1,619	1,524	1,687	1,611	1,600	1,584	1,585	1,579	1,593
Acres	533,258	514,492	541,087	546,711	542,107	545,174	551,466	557,066	559,398	560,752
Average, Acres	333	318	359	324	337	341	348	351	354	352
RAINFALL										
April-November	22.83	16.34	12.67	20.46	22.65	10.36	17.61	7.27	20.77	16.22
Year	25.23	18.77	15.87	25.85	24.51	11.22	19.73	11.44	24.67	17.90

Table E—COUNTY LIGHT—*continued*

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62
TOPDRESSED PASTURES										
Acres	42,632	62,276	67,188	78,440	87,197	94,827	75,701	60,993	33,900	48,937
Tons	1,925	3,108	3,354	4,251	4,603	4,910	3,701	3,077	1,685	2,395
Lb./Acre	101	112	112	153	131	116	110	113	111	109
SHEEP AND WOOL										
Sheep, Number	334,781	341,607	362,534	395,185	428,636	405,522	428,003	342,649	407,213	472,649
Sheep Shorn	363,419	361,303	364,853	408,494	449,670	491,433	442,448	460,235	388,184	489,393
Wool (lb.)	4,016,727	3,605,738	3,859,268	4,770,889	5,113,116	4,771,171	4,841,035	4,706,724	4,348,285	5,548,427
Wool/Head (lb.)	11.05	9.98	10.58	11.68	11.37	9.71	10.94	10.23	11.20	11.341
CATTLE										
Beef	1,157	1,558	1,899	2,227	2,399	2,187	2,482	1,409	2,341	4,115
Dairy	11,408	11,455	11,187	11,510	11,695	10,890	10,261	9,331	9,547	10,530
Total	12,565	13,013	13,086	13,737	13,094	13,077	12,743	10,740	11,888	14,645
PIGS										
Number	5,634	5,700	6,988	6,294	7,035	7,575	7,105	7,312	9,514	10,669

Table F—COUNTY GAWLER

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62
WHEAT										
Acres	78,958	80,568	79,750	77,093	66,854	59,025	65,601	72,095	93,253	97,767
Yield, Bushels	2,349,285	2,059,060	2,162,251	1,622,610	2,021,336	939,333	1,699,989	773,883	2,618,454	2,201,874
Yield, Bushels/Acre	29.75	25.56	27.11	21.05	30.24	15.91	25.91	10.73	28.08	22.52
BARLEY										
Acres	58,061	63,509	58,450	60,011	70,644	65,935	76,794	69,114	83,949	65,210
Yield, Bushels	1,865,786	1,664,034	1,162,270	1,494,227	2,436,919	753,811	2,282,972	473,052	2,828,438	1,259,389
Yield, Bushels/Acre	32.16	25.89	19.88	24.90	34.50	11.43	29.73	6.84	33.69	19.31
OATS										
Acres	10,290	5,976	9,441	11,470	15,219	9,682	16,856	16,902	18,741	9,481
Yield, Bushels	247,390	110,103	173,689	239,114	424,158	77,410	447,020	37,539	507,265	167,452
Yield, Bushels/Acre	24.04	18.42	18.40	20.85	27.87	8.00	26.52	2.22	27.07	17.66
PEAS										
Acres	1,061	1,597	2,439	3,616	4,103	5,702	5,598	3,479	4,046	4,138
Yield, Bushels	18,576	31,880	34,756	68,643	91,280	28,680	97,184	8,312	57,145	35,351
Yield, Bushels/Acre	17.50	19.96	14.24	18.99	22.25	5.29	17.36	2.39	14.12	8.54
Total Cereal Prod.	4,481,031	3,865,077	3,532,966	3,464,595	4,973,693	1,799,234	4,435,579	1,292,786	6,011,302	3,664,066
HOLDINGS										
Number	863	877	825	926	914	909	902	963	973	990
Acres	567,957	568,727	572,493	581,117	579,043	571,737	573,908	575,443	572,937	574,016
Average, Acres	658	648	694	628	634	629	636	598	589	580
RAINFALL										
April-November	19.87	13.51	11.65	16.02	17.74	8.77	14.11	6.07	16.56	13.02
Year	22.72	16.49	14.36	20.60	19.71	9.48	15.54	9.91	20.18	14.47
TOPDRESSED PASTURES										
Acres	23,120	37,799	39,223	47,239	63,344	65,500	46,677	39,132	21,082	26,613
Tons	937	1,713	1,887	2,178	3,423	2,926	2,114	1,763	908	1,164
Lb./Acre	91	102	108	103	121	100	101	101	96	100
SHEEP AND WOOL										
Sheep, Number	320,778	299,202	312,333	333,821	389,179	307,264	363,645	248,081	354,800	400,818
Sheep Shorn	310,808	295,018	299,256	336,267	372,788	380,699	328,747	331,071	303,449	412,600
Wool (lb.)	3,642,012	2,990,642	3,228,791	3,966,409	4,203,100	3,797,659	3,570,573	3,650,615	3,243,602	4,568,684
Wool/Head (lb.)	11.72	10.14	10.79	11.80	11.27	9.98	10.86	11.03	10.69	11.08

Table F—COUNTY GAWLER—*continued*

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62
CATTLE										
Beef	1,224	1,639	1,596	1,801	3,416	3,580	3,731	2,011	3,564	5,497
Dairy	7,715	7,863	7,229	7,323	7,411	6,397	6,071	5,689	5,694	6,352
Total	8,939	9,502	8,825	9,124	10,827	9,977	9,802	7,700	9,258	11,849
PIGS										
Number	3,759	4,218	5,931	5,730	7,120	8,321	7,785	8,817	10,632	12,275

Table G—COUNTY EYRE

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62
WHEAT										
Acres	33,144	26,954	30,486	35,210	30,994	26,065	29,725	17,771	41,804	40,844
Yield, Bushels	590,745	389,551	357,431	496,728	606,255	165,169	549,051	120,834	807,924	526,770
Yield, Bushels/Acre	17.82	14.45	11.72	4.11	19.56	6.34	18.47	6.80	19.33	12.90
BARLEY										
Acres	4,877	5,241	4,619	5,277	6,299	5,634	7,422	5,148	8,665	5,781
Yield, Bushels	110,194	105,662	57,497	102,022	163,496	44,221	209,898	34,538	222,479	80,654
Yield, Bushels/Acre	22.59	20.16	12.45	19.33	25.96	7.85	28.28	6.71	25.68	13.95
OATS										
Acres	4,252	3,322	4,369	5,335	4,844	5,906	7,856	3,778	8,733	4,458
Yield, Bushels	89,930	47,747	61,369	93,054	117,221	35,141	240,716	20,444	221,341	79,652
Yield, Bushels/Acre	21.15	14.37	14.05	17.44	24.20	5.95	30.64	5.41	25.35	17.87
PEAS										
Acres	3	—	18	18	32	57	—	12	50	25
Yield, Bushels	60	—	144	123	414	—	—	F	F	450
Yield, Bushels/Acre	20.00	—	8.00	68.32	12.94	—	—	—	—	17.80
Total Cereal Prod.	790,929	542,960	476,441	691,927	887,386	244,531	999,665	175,816	1,251,744	687,526
MISCELLANEOUS CROPS										
Lucerne Seed (Acres)	15	16	27	6	108	7	45	—	95	48
HOLDINGS*										
Number	628	673	539	594	554	531	516	508	500	495
Acres	812,943	808,436	857,204	885,779	869,765	864,467	842,490	863,300	857,045	850,660
Average, Acres	1,294	1,201	1,591	1,490	1,570	1,628	1,632	1,699	1,714	1,718
RAINFALL										
April-November	14.49	9.20	8.91	15.23	13.96	6.52	12.40	5.55	13.65	12.41
Year	16.09	10.99	11.18	19.31	16.43	7.21	14.04	8.16	17.18	13.81
TOPDRESSED PASTURES*										
Acres	4,653	7,608	9,915	12,008	15,884	13,977	11,451	8,621	7,869	8,644
Tons	220	338	460	593	713	739	590	385	426	473
Lb./Acre	106	100	104	111	101	118	115	100	121	123
SHEEP AND WOOL*										
Sheep, Number	194,798	163,626	189,989	213,557	237,199	212,362	211,141	184,421	214,723	235,837
Sheep Shorn	216,145	199,090	202,744	226,579	255,642	269,799	224,676	244,698	213,257	254,363
Wool (lb.)	2,509,760	2,229,403	2,096,764	2,595,982	2,995,048	2,734,359	2,424,878	2,625,235	2,340,336	2,837,393
Wool/Head (lb.)	11.61	11.20	10.34	11.46	11.72	10.13	10.79	10.73	10.97	11.15
CATTLE										
Beef	542	438	554	1,051	1,193	736	1,730	716	1,696	2,483
Dairy	4,133	3,848	3,752	3,847	4,123	3,497	3,395	3,027	3,062	3,289
Total	4,675	4,286	4,306	4,898	5,316	4,233	5,125	3,743	4,758	5,772
PIGS										
Number	1,834	1,847	2,257	2,184	2,737	2,982	2,706	3,018	3,758	4,071

* Estimated Figure

Table H—PART COUNTY STANLEY

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62
WHEAT										
Acres	25,165	27,521	28,307	22,138	11,861	17,212	17,511	24,009	28,389	37,018
Yield, Bushels	627,103	739,940	767,285	434,571	198,433	327,633	506,678	303,741	844,611	839,118
Yield, Bushels/Acre	24.92	26.89	27.11	19.63	16.73	19.04	18.93	12.61	29.75	22.24
BARLEY										
Acres	5,313	7,671	5,195	5,677	7,427	8,262	10,005	9,402	12,517	8,284
Yield, Bushels	138,479	187,003	110,228	139,904	146,243	141,363	317,912	109,271	328,455	174,830
Yield, Bushels/Acre	26.06	24.38	21.22	23.75	19.70	7.11	25.50	11.62	23.84	21.10
OATS										
Acres	6,149	6,812	7,552	7,834	6,679	9,633	11,056	10,876	10,436	7,816
Yield, Bushels	143,308	162,867	166,793	168,177	130,894	154,157	362,537	119,797	287,013	203,956
Yield, Bushels/Acre	23.31	19.93	22.09	21.47	19.60	16.00	32.80	11.01	27.50	26.09
PEAS										
Acres	205	524	913	586	565	906	1,085	1,483	1,004	897
Yield, Bushels	4,478	6,191	9,050	6,774	9,616	4,539	14,250	3,189	10,582	9,164
Yield, Bushels/Acre	21.84	10.80	9.91	11.56	17.02	5.01	12.61	2.15	10.54	10.22
Total Cereal Prod.	851,368	1,096,482	1,053,536	749,871	535,349	556,420	1,088,553	535,998	1,440,659	1,236,232
MISCELLANEOUS CROPS*										
Lucerne Seed (cwt.)	1,958	1,557	2,515	1,992	1,900	1,995	1,866	1,988	1,902	1,298
HOLDINGS										
Number	419	418	414	393	381	377	373	368	366	362
*Acres	291,058	285,990	292,020	310,807	341,583	347,905	344,302	343,543	344,740	349,063
*Average, Acres	700	690	780	790	900	920	920	930	940	960
RAINFALL										
April-November	21.84	15.83	13.10	17.58	23.12	11.24	16.13	7.48	19.62	16.08
Year	24.21	18.35	16.33	22.03	25.11	12.77	18.32	11.27	23.20	17.98
TOPDRESSED PASTURES*										
Acres	17,327	29,268	26,327	33,522	34,034	38,150	31,997	23,708	19,375	24,265
Tons	823	1,077	1,249	1,645	1,662	1,850	1,439	1,079	946	1,044
Lb./Acre	106	82	106	110	76	109	101	102	109	96
SHEEP AND WOOL										
Sheep, Number	261,831	247,121	254,903	270,592	276,049	278,119	277,812	237,540	251,497	287,380
Sheep Shorn	305,658	280,816	293,623	310,782	315,476	329,453	314,576	320,605	292,934	337,111
Wool (lb.)	3,222,643	2,693,308	2,932,654	3,573,437	3,443,497	2,984,300	3,194,221	3,208,765	2,922,778	3,666,485
Wool/Head (lb.)	10.54	9.59	9.98	11.40	10.91	9.05	10.14	10.01	9.12	9.80
CATTLE										
Dairy/Beef	5,555	6,214	6,373	6,606	6,603	6,569	6,507	5,617	6,285	8,397
PIGS										
Number	1,207	1,277	1,783	1,270	1,813	2,062	1,693	1,922	2,763	3,059

* Estimated Figure