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Farming without fallow

H M. Fisher

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UNDER the more intensive cropping rotations common in the early development of the cereal areas of Western Australia bare fallowing was a basic technique in cereal production. By ploughing the land in July or August and keeping it bare of vegetation for nine or ten months, either by grazing or cultivation, a substantial beneficial effect on the subsequent crop could be expected.

As a result of fallowing, wheat yields increased by 30 to 40 per cent. The effect of fallowing on the availability of moisture and plant nutrients was generally considered responsible.

Apart from this fallowing had other important advantages. It helped to control many insect pests and diseases, and eliminated certain noxious weeds.

Also, time spent on fallowing meant time saved in finally preparing the land in autumn before the crop was sown—an important consideration in the "pre-mechanisation era".

Over the past 20 to 30 years, farming in the cereal belt has undergone marked changes, largely associated with the establishment of subterranean clover leys over vast areas. This development has taken place particularly in areas receiving from 14 to 20 inches of rainfall a year.

Leguminous pastures for stock play an increasingly prominent role and stock numbers have increased. At the same time, such pastures have restored soil fertility to a high level.

Greater application of power and mechanisation to farming provides more scope and efficiency in the preparation of land for crops. Many diseases, insect pests and weeds can now be controlled by chemical seed dressings and crop sprays. In the case of some cereal diseases, resistant varieties also play a part.

Of considerable significance also has been the development since World War II of extensive tracts of light land. Here the hazards of soil erosion are high, particularly following any deterioration of soil structure precipitated by intensive cultivation and cropping.
Conclusions from trials over many years provide little support for the use of bare fallow in cropping clover ley in the medium rainfall areas. The trials indicate that with appropriate techniques for land preparation and sowing, high cereal yields can be maintained without fallow.

Under these conditions the necessity and advisability of retaining bare fallow in clover ley rotations was open to doubt.

It was suggested by Shier and Dunne in 1934 that in the medium rainfall areas, fallowing was unlikely to be essential for the first crops grown after a long period of clover pasture. This view was based on the grounds that both soil fertility and moisture supply should be adequate under these conditions. Some support for this suggestion was provided by the results of a trial at Chapman Research Station, Nabawa, in 1933. Wheat crops were grown with and without fallow on land which had carried volunteer pasture for six years, and the best yields were obtained without fallow.

After the last war there began a marked expansion in the area of sown pasture and numbers of stock in the medium rainfall areas. This, together with steady rise in the price of wool, led to widespread consideration of eliminating fallow on clover ley land.

As there remained little factual evidence to support the change, trials were commenced to establish a basis for assessment.

**TRIALS ON CLOVER LEY**

Establishment of subterranean clover on the Chapman (Nabawa) and Wongan Hills research stations began after World War II and enabled trials on clover ley to be commenced in 1948 at these two centres. Information was accumulated for a number of years under a range of seasonal conditions.

Subsequently, further trials were conducted on subterranean clover ley in the Moora district and at Newdegate. At Salmon Gums two trials were carried out on barrel medic ley.

**CHAPMAN (NABAWA) RESEARCH STATION**

Trials at this station were on fertile, medium textured sandy loam, and followed four to five years under mixed subterranean clover—Wimmera ryegrass—barley grass pasture.

The station is closely representative of the soils and conditions for grazing and cropping in the Chapman Valley and is broadly typical of conditions for clover ley farming in the wetter districts of the

On new light land where soil nitrogen is limited fallowing (left) produces spectacular results
In Western Australia cereal production on clover ley is chiefly in the areas with 14 to 20 inches of annual rainfall. In these areas improved pastures support a large sheep population and have had marked effect on soil fertility. Trials were conducted at a number of centres throughout the region to establish whether fallowing was necessary for cereal crops on clover ley land.
northern wheatbelt. Average annual rainfall is 17.9 inches with 15 inches falling during the May-October period.

Nine trials were carried out from 1948 to 1958, fresh sites being selected each year. Simple comparisons were made of the yield of wheat crops grown with or without fallow, the two treatments being repeated six times in a randomised layout.

Generally, attempts were made to prepare both treatments as adequately as possible under existing conditions.

Fallowed plots were initially broken up in July-August. In some years, depending largely on weed infestation, additional spring and late summer working was given.

The unfallowed plots were broken up after opening rains in autumn and all plots (fallowed and unfallowed) were reworked with a tyned implement before sowing.

With the exception of one year (1951) the initial working in each case was done with a mouldboard plough. In 1951 a scarifier was used to prepare the unfallowed plots. The trials were grazed to some extent during spring and summer.

The crops were grown in plots five to six chains long and the width of the seeding machine, mostly without intervening buffers. Seeding rate was 60 lb. an acre, and sowing was carried out with a combine in almost every trial. Appropriate rates of superphosphate were applied.

Depending on seasonal conditions sowing was delayed for from one to four weeks after the initial cultivation of the unfallowed plots in autumn. In most years the delay amounted to one to two weeks. All plots were sown at the same time.

Seasonal conditions varied considerably. Dry years were experienced in 1948 and 1954 while in 1955 and 1958 rainfall was well above average.

Seasonal variations were reflected in conditions for weed control. In good pasture seasons such as in 1953 fallowing operations met with difficulty because of the amount of pasture material present. In the absence of fallow pasture grasses set prolific amounts of seed which ensured a dense population the following year. This, together with the considerable bulk of dry residues left even after grazing, tended to affect preparation and weed control when the unfallowed plots were broken up after opening rains.

In 1957 and 1958 root rot fungi infested the crops on unfallowed land and yields were markedly reduced.

Wheat grown without fallow (left) and with fallow (right) at the Chapman Research Station (Nabawa) in 1954. Sown after four years of clover ley the plots yielded 25.2 and 23.9 bushels an acre respectively.
THE GREAT THIRST

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TABLE I.
COMPARISON OF WHEAT YIELDS WITH AND WITHOUT FALLOW ON CLOVER LEY LAND—CHAPMAN RESEARCH STATION

Yields in bushels per acre.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fallowed</th>
<th>Not Fallowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948</td>
<td>18.4</td>
<td>22.0</td>
</tr>
<tr>
<td>1949</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td>28.3</td>
<td>26.0</td>
</tr>
<tr>
<td>1951</td>
<td>22.9</td>
<td>17.0 (1)</td>
</tr>
<tr>
<td>1952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1953</td>
<td>22.9</td>
<td>26.6</td>
</tr>
<tr>
<td>1954</td>
<td>30.5</td>
<td>30.1*</td>
</tr>
<tr>
<td>1955</td>
<td>27.9</td>
<td>28.8*</td>
</tr>
<tr>
<td>1956</td>
<td>24.1</td>
<td>18.0 (2)</td>
</tr>
<tr>
<td>1957</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1958</td>
<td>32.0</td>
<td>19.1 (3)</td>
</tr>
</tbody>
</table>

Mean yields all years .... | 25.7 (100) | 23.6 (92) |
Mean yields omitting 1951, 1957 and 1958 | 25.3 (100) | 26.4 (104) |

* Yields not significantly different—(P = .05)

(1) Unfallowed plots were broken up with a scarifier—fallowed plots were ploughed.
(2) and (3)—"Takeall" affected crops grown without fallow.

WONGAN HILLS RESEARCH STATION

Trials were on sandy soils overlying clay at shallow depth (6 to 12 inches). The sites carried mixed subterranean clover—Wimmera ryegrass—brome grass pasture for four to five years before cropping.

This station, which is in the north central cereal belt, has a lower rainfall than Chapman, averaging 14.0 inches annually with 10.8 inches falling during the May-October period.

Seven trials were conducted from 1948 to 1954, the procedure and layout being similar to that at Nabawa. The most important variation was the use of a rigid tyne scarifier rather than a mouldboard plough for initial cultivation of both fallowed and unfallowed plots. Also a lower seeding rate of 45 pounds an acre was used, in accordance with the standard practice in this area.

Growing period rainfall was well below average in all years except 1953, when above average rains were received.

As at Nabawa, a good pasture season in 1953 resulted in some difficulty with fallowing operations and preparation of unfallowed plots for the trial sown in 1954. Minor infestation with webworm (Talis spp) was recorded in some years, but damage was never significant. No disease of any consequence occurred.

TABLE 2.
COMPARISON OF WHEAT YIELDS WITH AND WITHOUT FALLOW ON CLOVER LEY LAND—WONGAN HILLS RESEARCH STATION.

Yields in bushels per acre.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fallowed</th>
<th>Not Fallowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948</td>
<td></td>
<td>20.7</td>
</tr>
<tr>
<td>1949</td>
<td></td>
<td>14.7</td>
</tr>
<tr>
<td>1950</td>
<td></td>
<td>25.2</td>
</tr>
<tr>
<td>1951</td>
<td></td>
<td>29.9</td>
</tr>
<tr>
<td>1952</td>
<td></td>
<td>26.6</td>
</tr>
<tr>
<td>1953</td>
<td></td>
<td>31.3</td>
</tr>
<tr>
<td>1954</td>
<td></td>
<td>21.4</td>
</tr>
</tbody>
</table>

Mean yields all years .... | 24.2 (100) | 19.4 (80) |

* Yields not significantly different—(P = .05)

In subsequent years the scope of the trials at this station was extended to include various aspects of land preparation in association with the fallow treatments.

In 1955, 1956 and 1958 the mouldboard plough and the rigid tyne scarifier were compared broadly as types of implements for initial cultivation of fallowed and unfallowed land.

In the former two trials three times of sowing following autumn cultivation were also included.

Apart from these additional aspects for investigation the trials were carried out in a manner similar to the first series of trials conducted before 1955.

In the years 1955 and 1958 rainfall was above average. As in 1953, prolific pasture growth presented some difficulties in preparation, particularly where the land was scarified.

Generally, diseases were absent except for minor incidence of "takeall" in the 1958 trial.
The comprehensive trial at Wongan Hills in 1956. Cultivating machines were compared in association with times of planting on fallowed and unfallowed land. (Cereal buffers between the large fallowed and unfallowed blocks have been cut for hay)

### TABLE 3.

CULTURAL EXPERIMENTS WITH WHEAT GROWN ON CLOVER LEY LAND
WONGAN HILLS RESEARCH STATION

Grain Yields in bushels per acre.

<table>
<thead>
<tr>
<th></th>
<th>1955</th>
<th></th>
<th></th>
<th>1956</th>
<th></th>
<th></th>
<th>1958</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nil</td>
<td>7</td>
<td>14</td>
<td>Nil</td>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Fallowed—ploughed (winter)</td>
<td>18-9</td>
<td>26-3</td>
<td>28-2</td>
<td>1955</td>
<td>128-3</td>
<td>1958</td>
<td>16-9</td>
</tr>
<tr>
<td>Fallowed—scarified (winter)</td>
<td>13-7</td>
<td>21-1</td>
<td>21-9</td>
<td>1955</td>
<td>180</td>
<td>1958</td>
<td>18-0</td>
</tr>
<tr>
<td>Not fallowed—ploughed (autumn)</td>
<td>15-6</td>
<td>24-7</td>
<td>27-2</td>
<td>1955</td>
<td>210</td>
<td>1958</td>
<td>19-6</td>
</tr>
<tr>
<td>Not fallowed—scarified (autumn)</td>
<td>14-2</td>
<td>24-0</td>
<td>24-6</td>
<td>1955</td>
<td>14</td>
<td>1958</td>
<td>13-3</td>
</tr>
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</tr>
</tbody>
</table>

Statistical Data:

1955—SE as % of GM. Fallow 17% Cultivation 6% Times 1-9%.

Significance Levels—(a) Fallow (N.S.); (b) Cultivation -0-05; (c) Times -0-01.

Least Significant Difference—P< -0-05 P< -0-01 P< -0-01

<p>| | | | | | | | |</p>
<table>
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</tbody>
</table>

1956—SE as % of GM. Fallow 16-8%; Cultivation 5-1%; Times 1-8%.

Significance Levels—(a) Fallow -0-01; (b) Cultivation -0-001; (c) Times -0-001, (a x c) -0-001

Least Significant Difference—P< -0-05 P< -0-01 P< -0-001

<p>| | | | | | | | |</p>
<table>
<thead>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

1958—SE as % of GM. = 3-7%.

Significance Levels—TREATMENTS N.S.; Fallow 0-05.
This station is in the extreme south-east of the cereal belt and the trials were conducted on clay soils typical of the surrounding mallee. Average annual rainfall is 13.2 inches, with only 7.9 inches received during the six months from May to October. Expectancy for useful rains during early autumn is somewhat higher than in other parts of the cereal belt.

The sites carried a good stand of barrel medic—Wimmera ryegrass—barley grass pasture for four to five years before the trials began.

Trials were carried out in 1959 and 1960, in which the disc plough and the rigid tyne scarifier were compared for initially cultivating fallowed or unfallowed land.

In 1959 three times of sowing were also incorporated. After the initial breaking up of the unfallowed plots after opening rains sowings took place immediately, after three weeks and after six weeks.

Growing period rainfall was above average in 1959 and average in 1960. Few difficulties were encountered except during fallowing operations for the 1959 trial. Here seasonal conditions delayed cultivation and prolific pasture growth was difficult to handle satisfactorily. No diseases occurred.

NEWDEGATE DEMONSTRATION FARM

Newdegate is in the central south region of the cereal areas. Average annual rainfall for the demonstration farm is 14.4 inches with 9.3 inches from May to October.

One trial was carried out in 1960 on sandy soil overlying clay. The site had been under subterranean clover—Wimmera ryegrass pasture for five years.

The trial compared yields of barley on fallowed and unfallowed land.

The effect of ploughing after summer rain in January was also investigated. This was a midsummer reploughing in the case of land that had been fallowed and a short fallow where the land had not been ploughed in the previous spring. In

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TABLE 4.
CULTURAL EXPERIMENTS WITH WHEAT ON BARREL MEDIC LEY
SALMON GUMS RESEARCH STATION.

Grain Yields in bushels per acre.

<table>
<thead>
<tr>
<th></th>
<th>1959</th>
<th>1960</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date sown*</td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6/5</td>
<td>28/5</td>
<td>18/6</td>
</tr>
<tr>
<td>Fallowed—ploughed (winter)</td>
<td>21.6</td>
<td>11.0</td>
<td>7.5</td>
</tr>
<tr>
<td>scarified (winter)</td>
<td>13.9</td>
<td>9.9</td>
<td>7.5</td>
</tr>
<tr>
<td>Not fallowed—ploughed (autumn)</td>
<td>22.3</td>
<td>11.4</td>
<td>11.6</td>
</tr>
<tr>
<td>scarified (autumn)</td>
<td>17.6</td>
<td>10.5</td>
<td>9.7</td>
</tr>
<tr>
<td>Means</td>
<td>10.7</td>
<td>9.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

* All plots cultivated on 3/5/60 after rain and weed germination.

Statistical Data:

1959—SE : = 3.5% G.M.:

Significance Levels :
(a) Fallow - .001;
(b) Cultivation - .001;
(a x b) - .05.

Least Significant Difference:

<table>
<thead>
<tr>
<th>Treatments</th>
<th>P &lt; .05</th>
<th>P &lt; .01</th>
<th>P &lt; .001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>2.0</td>
<td>2.9</td>
<td>4.0</td>
</tr>
</tbody>
</table>

1960—SE : = 6% G.M.:

Significance Levels :
(a) Fallow - .001;
(b) Cultivation - .01;
(c) Times - .001;
(a x c) - .01.

Least Significant Difference:

<table>
<thead>
<tr>
<th>Treatments</th>
<th>P &lt; .05</th>
<th>P &lt; .01</th>
<th>P &lt; .001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>1.3</td>
<td>1.7</td>
<td>2.3</td>
</tr>
<tr>
<td>Times</td>
<td>0.6</td>
<td>0.9</td>
<td>1.2</td>
</tr>
</tbody>
</table>
TABLE 5.
CULTIVATION EXPERIMENT WITH BARLEY ON CLOVER LEY LAND
NEWDEGATE DEMONSTRATION FARM, 1960

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Grain Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallowed (ploughed 14/9/59)—not ploughed back</td>
<td>7.4</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot; ploughed back in May</td>
<td>17.4</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot; ploughed back January and May</td>
<td>14.7</td>
</tr>
<tr>
<td>Not Fallowed—ploughed once in May</td>
<td>17.2</td>
</tr>
<tr>
<td>&quot; &quot; &quot; ploughed twice—January and May</td>
<td>15.8</td>
</tr>
</tbody>
</table>

Statistical Data:
S.E. = 7.9% G.M
Significance Levels: Treatment -0.01; Treatment 1 v.s. rest -0.01; Treatments excluding Treatment 1 N.S., Fallow N.S., Cultivation N.S.

this trial a disc plough was used for all major operations. All plots were lightly cultivated before sowing.

Seed was sown at 45 pounds an acre with a combine.

Heavy rain fell in January and March, while the May-October rainfall was above average. No difficulties were experienced either in general preparation or through diseases and pests and the crops generally grew well.

MOORA DISTRICT

In 1953 two trials were conducted by Mr. H. G. Neil, Agricultural Adviser, Moora, on the properties of Messrs. P. A. Sandland and R. Lukin in that district.

Wheat yields on fallowed and unfallowed clover ley land were compared.

The area receives an annual rainfall of about 18 inches, of which almost three quarters falls during May to October. The rainfall in 1953 was above average.

P. A. Sandland

The trial was on the loamy clay soil which had carried subterranean clover pasture for five years. All plots were initially ploughed with a mouldboard plough and were spring tyne cultivated immediately before sowing.

Wheat was sown at 45 pounds an acre with a combine, one week after the initial ploughing of unfallowed plots.

At the time of fallowing a dense sward of pasture was present.

The yields obtained were:
- Fallowed 24.1 bushels per acre.
- Not fallowed 36.8 bushels per acre.

R. Lukin

The plots were on a loamy clay soil in a low lying area which suffered from waterlogging to some extent. The site had carried clover pasture for four years.

All cultural operations, including the initial cultivation and reworking before sowing, were done with a rigid tyne scarifier. Sowing was delayed for two weeks. Wheat was sown at 45 pounds an acre with a combine.

The yields were:
- Fallowed 12.3 bushels per acre.
- Not fallowed 22.7 bushels per acre.

GENERAL DISCUSSION OF RESULTS

Fallow

The trials at Nabawa present the broad outcome of cropping clover ley land without fallow. They provide also an illustration of some of the main problems of cropping in the absence of fallow and the effects produced.

In 1951, when the scarifier rather than the plough was used to break up the unfallowed areas, low yields resulted.

In 1957 and 1958 crops grown without fallow suffered from "takeall" and yields were again reduced.

These effects had no appreciable long term influence however and the average result over all trials was in favour of fallow to the extent of only 8 per cent.
Consideration of yields over the six years in which there were no such apparent reasons for yield differences shows that in only one year, 1950, did the yield after fallow significantly exceed that on unfallowed land. In 1950 an exceptionally dry summer and heavy opening rains during May, favoured the retention of available soil nitrogen on fallow and made land preparation more difficult under the moist conditions in autumn.

At Wongan Hills the results were extremely variable. In the earlier series of trials up to 1954 there was a tendency for crops grown without fallow to fail badly in some years. In four years out of the seven in which trials were conducted however, wheat yields without fallow were quite satisfactory and approximately equal to those obtained after fallow.

**Land Preparation**

In the first series of trials at Wongan Hills it became clear that soil preparation was not satisfactory. The result was that all plots suffered to some extent from weed infestation. In the case of fallowed plots this was related to conditions both at the time of the initial working in July-August and also following the opening rains of the season in which the crop was grown. Generally, the opportunity for weed control was greater on fallowed than on unfallowed land.

During the three seasons 1955, 1956 and 1958 yields were compared on fallowed and unfallowed land prepared initially with either a mouldboard plough or a scarifier. In 1955 and 1956 sowing at various times after autumn cultivation was also incorporated.

Use of the scarifier resulted in lower yields under all circumstances.

The yields obtained were to some extent a reflection of conditions at the time the main cultivation was carried out. In 1955, for instance, the season favoured prolific growth of pastures. Cultivation with a mouldboard plough handled this growth best on the fallowed land and was also most effective in the next year on unfallowed land. In 1958 good weed control was obtained on all plots and the yields of individual treatments were not significantly different.

In the Moora district both trials indicated that excellent yields could be obtained without fallow on clover ley land, particularly where a mouldboard plough was used for preparation. In these trials fallowed plots received identical total cultivation to unfallowed plots, the only difference being the time at which the initial working was performed. The comparatively poor yields on fallowed land emphasise the importance of an adequate working after autumn rains particularly where initial cultivation was with a scarifier, or where conditions were not ideal for carrying out the initial fallowing operations.

**Time of Sowing**

At Wongan Hills there was a general tendency in 1955 for yield to increase with a delay in sowing, the effect being slightly more pronounced on unfallowed land. In 1956 a delay of two weeks in sowing was again of benefit on unfallowed land but proved detrimental on fallow.

A similar trial at Salmon Gums in 1960 produced the same result. Here a delay of three weeks had little effect on unfallowed land but reduced yield on fallowed land. Likewise a delay of nearly six weeks reduced yield less on unfallowed than fallowed land.

These results suggest that while it is usually not detrimental to delay sowing for up to two weeks after breaking up unfallowed land, early sowing is advisable on fallow.

**A possible basis for these requirements involves soil nitrogen supply.**

On fallowed land, nitrogen is in readily available form and therefore prone to leaching by any rains falling before the crop is sown. A clear example of this is often seen on fallowed new light land where crops suffer from nitrogen shortage if not sown soon after opening rains. Where the land is not broken up until after the opening rains of the season, nitrogen is unlikely to be immediately very mobile, being contained in growing plants and plant residues. Availability could be further restricted by soil organisms which require nitrogen to begin the process of breaking down the dry pasture residues turned in at that time. The likelihood of nitrogen loss is therefore not as great on unfallowed land.

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At Wongan Hills Research Station wheat was sown at various times following autumn cultivation. It was found that a fortnight’s delay in sowing increased yield on unfallowed clover land, but could reduce yield on fallow as compared with early sowing.

Delay in sowing also favours more efficient weed control since the weed growth turned under in the first cultivation is not immediately returned to the surface by the planting machine. It is possible also that it has important effects in controlling some diseases and pests by eliminating host plants for a short period. Such effects would be expected to be more important for crops on unfallowed land.

It must be acknowledged that the effect of time of sowing has some impact on conclusions from early trials, tending to favour unfallowed land. It has been pointed out that in these trials sowing was invariably delayed. Yields of crops on fallow may not therefore have been the best obtainable under the prevailing conditions.

In relating this to practice however, the allowance required is not of great significance. Invariably, sowing immediately after reworking the fallow following opening rains is not practicable over large areas, so that crops sown on fallow are not normally likely to benefit greatly in this regard.

On the other hand, it is likely that when the season breaks early and sowing must be delayed for some weeks, or in seasons with heavy summer rains, fallowed land might suffer a good deal of deterioration before the crop is sown. This likelihood is increased on the lighter soil types and in wetter regions where removal of nutrients from the vicinity of the germinating seeds is favoured.

Other Aspects

The trial at Newdegate generally supported experience at the other centres. As in the trials at Moora the importance of adequate working following opening rains was illustrated by the very poor yields obtained where the land was fallowed but was not worked back before sowing.

An additional feature of interest was the effect of ploughing after January rains. This produced a short fallow in the case of previously uncultivated land and was a midsummer reploughing in the case of fallowed land. In both cases the January ploughing reduced yields and was at most of no benefit. These results of summer ploughing should not be applied to any set of conditions other than those at this one station in 1960. Further work is being carried out to follow up this isolated result.

PASTURE REGENERATION

Observations made on pasture growth on many of the experiments in the years following the crop clearly showed a slower regain on land that had been fallowed.

Barley and brome grasses were much reduced, their place being taken by species such as capeweed and Erodium, which thrive in the absence of competition.

At Wongan Hills clovers were almost eliminated whether the crop was on fallowed or unfallowed land and reseeding was generally necessary to restore the legume quickly. At Nabawa sowing of...
clover was not usually necessary on unfallowed land but fallowed plots carried only a very sparse stand for at least the first year.

MORE GRAZING WITHOUT FALLOW

On clover ley farms working on a four to five year rotation, bare fallowing for cereal crops restricts the pasture area, and therefore the stock carrying capacity, by some 20 to 25 per cent.

Loss in stock production is further accentuated in many areas by the comparatively slow regain of pastures after a crop with fallow.

On properties with rising stock numbers and increasing demand for pastures to support them any benefit from fallowing would thus need to be very large to support such losses. In many cases the decision to eliminate fallow has been made on the assumption that increased grazing would compensate for any decrease in crop yields.

Some farmers, reluctant to accept the possibility of decreased crop yields, have felt a middle course to be desirable. They have tried a technique which amounts to a "semi fallow"—ripping the land in July or August with widely spaced, narrow gauge cultivator points so that the pasture is only partially destroyed. With this method some grazing is provided while the land receives a partial working in preparation for sowing the crop.

In the light of present experience it appears that semi-fallow methods are unlikely to boost crop yields above the level likely to be obtained with no fallow cultivations at all. Nor will this practice eliminate the necessity for thorough autumn preparation. The overall outcome therefore is a loss of grazing and negligible compensatory gain in crop yield.

CONCLUSION

The disabilities of bare fallowing for crops on clover ley include:—

• Time and expense involved in its preparation.
• Losses in stock production.
• Undesirable effects on soil properties.

These factors, and the fact that no yield increases are likely to result from fallow in the medium rainfall areas, provide strong reasons for the elimination of fallow on clover ley farms.

Recent trials on clover ley land have shown that:

• The yield of cereal crops grown without fallow is generally equal to that of crops on fallowed land.
• Strict attention to soil preparation is necessary on unfallowed land. Best results have been obtained by initially breaking up the land with a mouldboard or disc plough rather than a scarifier.
• On unfallowed land a delay of one or two weeks between initial ploughing and sowing is not detrimental and often results in increased yields. Early planting is necessary on fallowed land.
• In seasons which favour pests and diseases such as webworm and root rots, wheat crops sown without fallow on clover ley are prone to damage. However, webworm can be controlled by chemical means and the incidence of root rot is variable. The trials indicate that in most areas loss in yield from these effects is not great enough to warrant the use of fallow for control.
• Better pasture regeneration occurs after a crop sown without fallow. In such places as the Chapman Research Station it is unnecessary to resow subterranean clover after a crop on unfallowed clover ley, whereas regeneration on fallowed land is poor.

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