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D J. Carder

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LAND USE IN THE KULIN-KONDININ-HYDEN DISTRICT

Notes on a recent survey

By D. J. CARDER, Soil Conservation Adviser

A RECENT survey by the Department of Agriculture's Soil Conservation Service has highlighted the nature of the problems facing farmers with flooded or salt-affected land near salt lake country in the wheatbelt.

The 43 farms chosen for the survey bordered the line of salt lakes and low channels which stretch from east of Hyden to Kondinin Lake. Most of the farms worst affected by salinity and flooding in the catchment area were included in the survey.

The survey was undertaken to guide future advisory work and to indicate the best line of approach for similar studies in other areas. It was carried out in October and November of 1967 by the author and other Soil Conservation Officers of the Department of Agriculture, Narrogin.

The survey

The statistics of the productive use of land on the survey farms gave a background against which the size and urgency of the problems of salt and flooded land could be judged.

Most of the farms had about a third of their cleared land under cereals, wheat being 85 per cent of the crop. One farm had 56 per cent of its cleared land under wheat. On average a fifth of the cropped acreage was clover land.

While the amount of land in fallow was declining, only half the farms had 20 per cent. or less of their cleared land ever sown to legumes. Some of the biggest areas sown to legumes were on farms where the policy has been to sow a few pounds of clover with every crop. This is not recommended for these areas where competition for moisture between crop and clover is often intense. However, in 1967, on 22 of the farms, a total of 7,300 acres of clover was sown alone or under grazed cover.

Half the farms carried less than the equivalent of 1½ dry sheep per pasture acre. The highest stocking rates in 1967 were on two farms carrying 2.7 and 3.5 dry sheep equivalents per acre of pasture (not including stubbles).

On the survey farms the amount of cleared normal land (with the area of salt or flooded land deducted) varied from 1,120 to 14,300 acres. The six smallest areas of normal land were: 1,120, 1,400, 1,800, 1,850, 2,260 and 2,355 acres. None of these six farmers had any further land to clear.

Relevant statistics for the 43 farms surveyed were:—

<table>
<thead>
<tr>
<th>Description</th>
<th>Acres</th>
<th>Per Cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleared land</td>
<td>165,800</td>
<td>100</td>
</tr>
<tr>
<td>Salt affected</td>
<td>6,960</td>
<td>4</td>
</tr>
<tr>
<td>Subject to occasional shallow flooding</td>
<td>10,000</td>
<td>6</td>
</tr>
<tr>
<td>Total problem area</td>
<td>16,960</td>
<td>10</td>
</tr>
</tbody>
</table>

Although an average 10 per cent. of the cleared area surveyed presented some problems of management, and reduced productivity to some degree, on some individual farms problem-land represented as much as half the cleared area.
The salt problem

Soluble salts, mainly common salt, have concentrated at the soil surface in four types of situation:

- In the lakes and channels of the main drainage system.
- On some of the rises bordering the lakes and channels.
- In seepage areas on higher slopes.
- In the flat valleys tributary to the main drainage line.

The salts probably started accumulating in the lakes and channels long before the area was settled.

The salt affected rises usually have grey "fluffy" soils which originally carried Morrel timber. These soils have a natural salt content many times higher than other soil types.

The seepage areas are usually small and occur below lateritic ironstone.

The waterlogging type of salt in the tributary valleys is the most serious as it can affect large areas of farm land.

Flooding

Two types of flooding were found in the survey area:

- The sideways spread of excess water from lakes and channels. This type of flooding was found not to be very important as the lakes and channels are mostly well-defined and some farms closest to the lakes were the least affected by it.

- The accumulation of runoff water in the shallow valleys before it reached the main drainage line. Those valleys with a low gradient to the drainage line were worst affected and farmers said that on this land crops could be lost in particularly wet seasons. Farmers also feared that flooding might increase the area affected by salt.

Research has shown that surface flood water can not enter the ground water through the floors of the valleys. Here the ground water is trapped under a "mantle" of clays in the valleys and is under pressure from water infiltrating in the higher parts of the catchment. The pressure of the ground water is upward and in places salty water can rise through the mantle by capillary action.

A good plant cover can suppress the accumulation of salt at the surface for a time or perhaps indefinitely. But any failure or removal of plant cover can allow capillary movement of salty water right to the surface especially in spring and give rise to a salt problem. Surface flooding aggravates the situation by weakening or destroying plant cover.

Some results

Salt-affected land

Of the 43 farms surveyed, 23 had substantial areas (more than 40 acres) of salt-affected land. In all cases, affected land was grazed, and only seven of the properties had fencing to control the grazing.

The salt-affected land was regularly cropped on one farm, and partly cropped on one other. On 12 farms the salt-affected land was regularly or partly cultivated and sown to salt-tolerant plants.

Land subject to flooding

Fourteen of the farms in the survey had considerable areas of land subject to flooding (more than 70 acres) and nine of these cropped their flooded land or had done so recently. Of these nine, six reported crop failures, two reported partial

<table>
<thead>
<tr>
<th>Salt problems on 43 farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem area per farm (acres)</td>
</tr>
<tr>
<td>No. of farms</td>
</tr>
<tr>
<td>Cleared land affected by salt (%)</td>
</tr>
<tr>
<td>No. of farms</td>
</tr>
</tbody>
</table>

444
crop failures, and one said his crops "seldom-failed."

All 14 farmers grazed the land subject to flooding. Nine reported no failures, one a part failure, and four claimed complete pasture failures.

Two of the failures were of Cyprus barrel medic which is not suited to wet conditions. One area of Wimmera ryegrass faded out when it was no longer cultivated, and in the other case clover was sown under a crop and germination was very poor.

**Contouring**

Thirteen of the 43 farms had contoured areas ranging from 50 to 2,800 acres. Most of the contouring was in the form of grade banks, although some areas had contour working guidelines without banks.

The farmers were asked to assess their future needs for contouring. Twenty-two thought they needed more contouring, and the areas involved ranged from 100 acres to 2,500 acres.

**Conclusions**

The urgency of alleviating the salting and flooding problem for an individual farmer depended upon whether that farmer had enough unaffected cleared land to make his farm economic.

Of the farms in the survey, 37 had problems from salting or flooding, or both. On about five of these farms problems were acute because there was relatively little unaffected cleared land. It was on these farms that the results of reduced production was most felt. Farmers on such properties relied on an assured income from cropping, and could least afford crop failures.

Land affected by salting and flooding posed the following three sorts of problems:

<table>
<thead>
<tr>
<th>Problem area per farm (acres)</th>
<th>Nil</th>
<th>0-100</th>
<th>101-500</th>
<th>501-1,000</th>
<th>1,001-2,000</th>
<th>Over 2,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of farms</td>
<td>20</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cleared land affected by flooding (%)</td>
<td>0</td>
<td>0-1</td>
<td>1-10</td>
<td>11-20</td>
<td>21-30</td>
<td>Over 30</td>
</tr>
<tr>
<td>No. of farms</td>
<td>20</td>
<td>7</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Problems of attitudes**

Many land surveyors and many farmers (in W.A. generally, not just in this area) have ignored the natural drainage lines. Location lines have been surveyed with little or no reference to the natural drainage pattern and natural flow lines have been cleared and cropped. The result has been gullying, the accumulation of salt, and the drowning of crops.

Many farmers have found it difficult to change their management on an affected area which has grown good crops. As a result some farmers tend to take undue risks or to undertake extravagant or technically dubious measures to keep "good" land under crop.

**Problems of the land**

The worst affected land is in the main lake and channel country and in the tributary flats and valleys leading down to the main channel. Initially, much of the main channel country carried distinctive native vegetation but because it was inter-mingled with, or closely bordered by first class arable land, much of it has been cleared and cropped. Such channel country comprised some of the most unproductive land in the wheatbelt. The easiest way of preventing problems resulting from salt accumulation would have been by either not including the land in farm blocks, or by not clearing it. In fact this latter solution had been adopted on some farms.

The risks involved in farming the tributary flats and valleys would have been virtually impossible for the early settlers to predict. The valleys carried no signs of salinity. Their natural drainage lines carried fresh water, or were so small that they were not obvious until after clearing, perhaps many years later.
This survey showed that the main flooding problem occurs in these side valleys. There was also the risk of salt problems caused by valley waterlogging.

Problems of farm economics

Farmers with an adequate area of normal cleared land have an opportunity to build up working and development capital. Their farms would be a success in spite of problem land, as they can more easily adjust their management and reduce the risks of failure. They also have the opportunity to experiment and, possibly, to acquire additional normal land. For such farmers the problem of salt and flooded land is not so urgent.

For the farmer with a small farm or small area of normal land, the problems of salted and flooded land are a vicious circle. He is least likely to have the capital needed for improvements or to acquire more land. He is more dependent on assured crop yields but is forced to take greater risks of crop failure.

Possible changes and remedies

No real improvement can be made on salted land unless it is fenced to allow controlled grazing. Suitable salt-tolerant edible plant species also need to be established. (Suitable plants are listed and methods of establishment are given in a number of free Department of Agriculture publications.)

Bluebush is well suited to the powdery Morrel soils on the high banks, and samphire could be established naturally along the main drainage channels once grazing pressure is removed.

Puccinellia is a most valuable plant to establish in drainage channels and seepage areas. On flat areas with patchy salt, attempts should be made to restore normal pasture by growing Geraldton sub-clover, Wimmera rye grass and oats after cultivation.

Land liable to flooding which is not salt, or not yet salt, has been the subject of much controversy in many areas of W.A. Some very far reaching and extravagant remedies have been canvassed. In the heat of controversy possible benefits of changes in land management, employing standard and well-known methods, have not had the consideration they deserve.

The main suggestions which arise out of this survey also apply to many other parts of the sheep and cereal areas with flooding problems.

- The greatest potential for increased productivity and return on outlay undoubtedly lies in non-salty land.
- There is scope for greater economic productivity on the normal land of most properties, even those which are most intensively farmed at present.

In the survey area and similar areas there is much land still to be sown to legume pastures for which suitable species are now available. Only five of the survey farms had ever been completely sown to legume pastures. Thirty-three farms had less than half of their cleared land sown to legumes. Stocking rates varied from less than half a sheep up to 3.5 dry sheep equivalents per acre of pasture.

- Wheat is most likely to fail on flood-prone land.

No wheat, or as small a proportion as possible of each year's crop, should be sown on such land. On small farms this may involve selecting suitable normal soil-types for more frequent or multiple cropping. Oats, if grown at all, could be sown mainly on flood-prone land either for grain or as a pasture component.

- Pasture is less likely to fail on flood-prone land as long as the species used are Geraldton sub-clover and Wimmera ryegrass. These are the most suitable species at present available but more may be developed.

- Pasture is more likely to prevent flood-prone land from developing a salt problem than cropping to wheat which is liable to fail.

- Physical flood-regulating systems such as levee banks are technically and legally feasible in only a limited number of situations. They are also costly and these costs should be charged against the increase in crop yields expected from their use. The possible benefits from changes in land management as suggested above are well worth consideration first.
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