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W J. Burdass

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MULTIPLE CROPPING WILL INCREASE THE EROSION HAZARD

By W. J. BURDASS, B.Sc., Soil Conservation Adviser, Katanning

WITH the low price of wool and the price of wheat high in comparison, farmers need little encouragement to increase their acreage of crops. Unfortunately with increased cropping comes the risk of increased erosion—unless there is a simultaneous increase in the use of conservation practices.

Multiple cropping is taken as being a system in which two or more crops are grown in succession in a rotation with one or more years of legume based pasture. Continuous cropping eliminates the pasture completely.

Continuous cropping has always had its attractions. It is the ultimate in specialisation and offers an ultra simple system of farming. In the past it has had its problems, the main ones being those of maintaining fertility, maintaining production at a profitable level, and the one which has often been overlooked until it was too late—that of soil erosion.

Now, it seems that research has come up with the answers for maintaining production at profitable levels in a continuous or multiple cropping system using stubble burning as an essential tool. This solves the first of the problems and to some extent the second, but the third, in the light of present day economic pressures, is again in danger of being overlooked.

The widespread adoption of multiple cropping without a corresponding increase in the adoption of soil conservation practices must inevitably lead to widespread and serious erosion.

Multiple cropping is being practised quite extensively already, and signs that all is not well were seen in the Katanning district last year. Paddocks in crop for the second year in succession suffered severe

Fig. 1.—Gulllying in second year crop in 1967. Attributable to a wet July, no conservation practices and multiple cropping.

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erosion in a number of instances; adjacent paddocks in crop for the first time after pasture, whilst not immune from erosion did not suffer to the same extent.

It is not suggested that other factors were not involved; nevertheless, the fact that the worst erosion occurred on paddocks in crop for the second successive year, appeared significant.

Whilst no experimental evidence is available in W.A. to prove that erosion increases with cropping, there is plenty of evidence from elsewhere that it does.

The effects of cultivation and cropping

Cultivation and cropping go hand in hand and together are associated with most of the serious erosion that occurs in the South-West of the State. This is because the erosion hazard is worst when a paddock is denuded of vegetative cover, and the surface soil is loose and easily detached by the forces of wind and water.

The more often a paddock is cropped the more frequently this situation occurs.

A paddock that has vigorous pasture established on it is safe from widespread erosion provided it is not overgrazed.

Cultivation, besides removing the cover from the surface of the soil, also breaks down the soil structure mechanically, reducing cloddiness and increasing the proportion of small loose particles. Coupled with this, chemical and biological forces are at work breaking down the soil "crumb structure," liberating more small soil particles that can be moved by the forces of erosion. Included in these small particles is a high proportion of the soil's organic matter.

Cultivation, by aerating the soil and by exposing more of it to the elements, also increases the rate of oxidation and hence the depletion of organic matter.

The loss of this organic matter is particularly important, as the soil nitrogen status is closely linked to the proportion of organic matter in the soil.

Quantitative measurements of soil "crumb structure," organic matter, and available nutrients can and have been made. It has been found that whilst the build-up of "crumb structure," organic matter, and nitrogen goes on steadily under legume pasture, the reverse processes occur much more rapidly during periods of cultivation and cropping.

Thus, successive years of cultivation and cropping not only increase the frequency of the most serious erosion hazard but because of this deleterious effect on soil structure and fertility tend to increase the severity of soil loss as well.

The effects of stubble burning

As was mentioned earlier, stubble burning is an essential part of the method suggested by recent research enabling
continuous cropping to be carried out profitably. Several reasons are put forward why the stubble burn is necessary. These include

- The need to destroy the large bulk of organic matter which if ploughed in, would "lock-up" nitrogen in the soil and induce nitrogen starvation in the early stages of crop growth.
- The need to reduce the carry over of pests and diseases that might be present in the stubble.
- The beneficial effects of a hot burn in the control of weed competition.

These reasons are valid, and in the light of present knowledge, stubble burning is essential if profitable crops are to be taken in successive years.

Unfortunately stubble burning does have serious disadvantages. The main one is the removal of vegetative cover from a paddock exposing it to the wind erosion and the effects of possible summer thunder storms.

The destruction of organic matter contributes over a period of time to the reduction of soil organic matter, and the loss of structure, which predispose a soil to erosion.

**Ways of reducing the erosion hazard**

It is doubtful if continuous cereal growing can be practised in Western Australia, on any but the flattest and most stable soils, without serious erosion developing.

Continuous cropping is practised in some parts of the world, as for example in Britain. There, the climate is very different and because of this they do not have such rapid oxidation and loss of organic matter. Soil fertility is much higher and can be maintained by the addition of large amounts of fertiliser, particularly nitrogen.

Multiple cropping in rotation with legume pasture is practised in W.A. Provided it is not taken to excess and provided sound soil conservation practices are followed, it should not only be profitable in the short time but should not lead to excessive erosion in the long term.

In order to reduce the erosion hazard inherent in multiple cropping of erosion prone soils, the following suggestions are put forward.

- Bear in mind that in general the longer the period a paddock is in crop the more severe is the erosion hazard likely to be. Restrict cropping to a maximum of two successive years of crop and then return the paddock to legume based pasture. The pasture must be maintained in a vigorous state by regular top dressing and suitable grazing management.

Legume based pasture is the key to the maintenance of fertility.
and stability in most of our soils. In general the longer a paddock remains in pasture the greater is this beneficial effect on fertility and stability.

Where up to half a farm is cropped annually, it is probably better to crop each paddock every second year—rather than take two successive crops alternated with two years pasture; provided the pasture regenerates well after the crop.

- Soils vary in stability. The erosion hazard increases with increase in slope. Select the flatter slopes and the more stable soils for multiple cropping.
- Maintain fertility by adequate applications of superphosphate and nitrogen. Nitrogen becomes important in the second and succeeding crops on old land that has carried good legume pasture. On new land, particularly on the lighter soils it is important even with the first crop when the ground has not been fallowed.
- Burn late and plant early, selecting the right variety to reduce the vulnerable period when the soil lacks cover.
- Do not overwork soil—a fine seed bed is more vulnerable than a rough one.
- Follow recommended conservation practices
  - do not cultivate natural depressions
  - cultivate on the contour
  - construct contour grade banks where necessary
  - REMEMBER that conservation practices will be even more necessary in a multiple cropping system than when single crops only are taken

—contour cultivation must become the norm on all sloping land.

Will a stable system of continuous cropping develop?

At present the legume based pasture is the key to both soil fertility and stability and it appears unlikely that this will alter for some time to come.

For a system devoid of pasture to be stable, the crop will have to afford similar protection to the soil that a moderate to good pasture gives.

The crop must be dense and vigorous. Fertility will need to be greatly increased, and for this to happen a cheap, readily available source of nitrogen will have to be found.

The soil structure will need to be maintained or improved. This suggests that crop residues which are now being burnt will need to be incorporated into the soil to be converted into soil organic matter. Again a cheap source of nitrogen will be required to overcome the “locking-up” of nitrogen during the period that the stubble is being broken down.

Weed control will need to be achieved with limited cultivation. The vulnerable period between the ground being broken and being afforded protection by the crop must be reduced or eliminated. This suggests—“chemical ploughing” or the possible use of stubble mulch techniques combined with weedicides.

The final requirement is that mechanical conservation measures—contour cultivation, contour banks and similar structures will need to be accepted as an integral part of the farming operation where soil and slope dictate their use.

For any system to develop it will require research. Research not only into short time aspects of profitability, but into the long term aspects of soil stability as well.
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