Mulched Rip Lines Stop Soil Erosion under Annual Cropping on Steep Slopes

Bill Cotching

Department of Primary Industries, Water and Environment, Tasmania, Australia
(E-mail: bill.cotching@dpiwe.tas.gov.au)

Abstract: A new soil erosion control technique has been developed for use on steep slopes used for annual cropping. A purpose-built implement has been designed for installing the mulched rip lines. Immediately after sowing of the crop a 2-tined implement is used with a wheeled tractor to install rip lines on the level across the slope. Cereal straw is laid at the same time by the implement on top of the rip lines at the rate approximately 5 tonnes/hectare. The rip lines are spaced from 25 to 80 metres apart depending on the slope of the paddock. This methods of erosion control is designed to keep runoff water on the paddock by slowing water movement down slope with the straw and getting the water to infiltrate into the soil via the rip lines. As an added bonus, any soil moving down slope is trapped by the straw and so prevented from leaving the paddock.
Keywords: soil erosion control, rip, mulch

1 Introduction

Soil erosion is one of the major management challenges on red ferrosols (Isbell,1996) (Humic Eutrodox, Soil Survey Staff,1998) in Australia (Cotching,1995). Spring rains in late August and September can cause a lot of erosion in northwest Tasmania (Cotching,1995) with consequent effects on crop yield (Cotching *et al.*,2002 in press) and stream water quality (Sims and Cotching,2000). Erosion rates in northwest Tasmania have been measured using both direct and indirect methods. Indirect measurements on red ferrosols using ^{137}Caesium on slopes of 9%—20% have found long term (40+ years) loss rates averaging 2.5 Mg • ha^{-1} • a^{-1}—5.3 Mg • ha^{-1} • a^{-1} under intensive cropping rotations (Richley *et al.*1997). Direct measurement of soil loss in rill erosion under bare fallow has found loss rates of 10 Mg • ha^{-1} • a^{-1}—142 Mg • ha^{-1} in single storm events (Sims and Cotching,2000). Under pasture, mean annual soil losses of 0.3 Mg • ha^{-1} • a^{-1} were measured on slopes of 8%—32% (Richley *et al.*,1997). Soil formation rates are poorly defined but are likely to be less than 0.5 Mg • ha^{-1} • a^{-1} from consolidated bedrock material (Edwards and Zierholz,2000) such as basalt, the parent material of these red ferrosols. Soil formation rates on red ferrosols under eucalyptus forest in Victoria, Australia, were calculated at 0.39 Mg • ha^{-1} • a^{-1} and 0.68 Mg • ha^{-1} • a^{-1} (Feller,1981). Red ferrosols in northwest Tasmania occur on flat to steep terrain. Land capability surveys have found that the greatest proportion of this land has slopes of 13%—28% (Moreton and Grose,1997). The rates of soil erosion under intensive cropping rotations on red ferrosols in Tasmania exceed soil formation rates many fold and so intensive annual cropping on these steeper slopes requires the use of soil conservation measures to minimise erosion and ensure sustainable use.

2 The technique

A new soil erosion control technique has been developed for use on steep slopes used for annual cropping in northwest Tasmania. This involves the installation of mulched rip lines in paddocks sown to annual crops using a purpose-built implement (Fig. 1). The technique has been found to be most useful in crops of onions (*Allium cepa*), pyrethrum (*Tanacetum cinerariifolium*), poppies (*Papaver somniferum*) and peas (*Pisum sativum*).

Immediately after sowing of the crop, contour lines are marked out on the level (using a hand held inclinometer) across the slope with small brightly coloured flags. A wheeled tractor is then used

with a 2 tined ripper implement to install rip lines on the level across the slope (Fig. 2). Soil is ripped to a depth of approximately 250mm. Cereal straw is laid at the same time by the implement on top of the rip lines at the rate of a small square bale to 25—30 metres of rip line (approximately 5 tonnes/hectare).

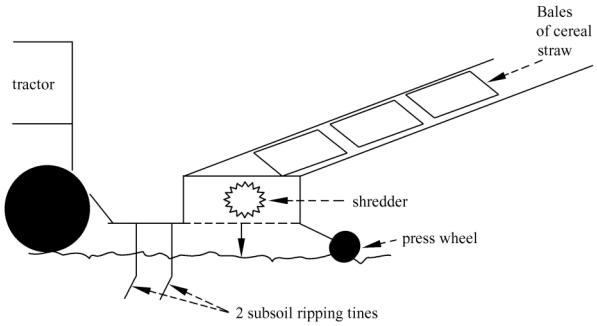

Fig.1 Diagramatic representation of ripper-mulcher implement

On slopes of 12%—14% the mulched rip lines are spaced at approximately 40 metres apart. On steeper slopes the lines are spaced as close as 25 metres apart while on flatter slopes they can be up to 80 metres apart.

Fig.2 Laying straw mulch on rip lines in a recently sown onion crop

The new technique works differently to past methods of erosion control because the straw and rip lines are designed to keep runoff water on the paddock by slowing water movement down slope with the straw and getting the water to infiltrate into the soil via the rip lines. The rip lines create a zone of loose soil which acts like a ‘sponge’. As an added bonus, any soil moving down slope is trapped by the straw and so prevented from leaving the paddock (Fig. 3).

Fig.3 Eroded soil prevented from leaving the paddock by being caught in the straw mulch

Previous erosion control techniques relied on catching runoff water in sloping contour drains and directing it into grassed drains to take the water off the paddock. There has been a lot of resistance from farmers and contractors to the drains because they give a rough ride when spraying by tractor, crops have to be pulled either side of the drain prior to harvest, drains have to be filled in before harvest, and spray and harvesting equipment suffer breakages. This new technique overcomes all of these problems. Also, less ground is used for the rip line than a drain. Measurements of runoff have shown significant reductions in the volume of runoff from mulched rip lines compared to drains (Fig. 4). Measurements of runoff were conducted using 1.63 m lengths of plastic pipe buried at ground level which collected surface runoff via slits cut in the pipe. Collectors were placed at the end of a drain or at 20 m intervals on a paddock of 11% average slope which was sown to onions.

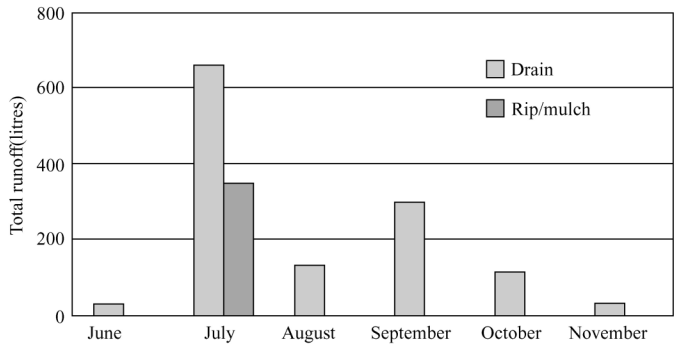

Fig.4 Monthly runoff from runoff collectors

Paddocks of onions and pyrethrum have been the main beneficiaries of the erosion control but paddocks of poppies and peas have also been protected. In the 2001 growing season 400 ha of cropped paddocks were protected from erosion using this technique. Funding for the implement and a field officer to design the layout and operate the implement have been provided jointly by the State Government of Tasmania and the Federal Government of Australia through the Natural Heritage Trust. Farmers are recommended to adopt this soil erosion control technique as part of normal practice on all cropping farms in the area. This simple new erosion control technique is a very low cost insurance against likely soil erosion.

References

Cotching W.E. 1995. A review of the challenges for long term management of krasnozems in Australia. Australian Journal of Soil and Water Conservation **8**(1): p.18-27.

Cotching W.E., Hawkins K., Sparrow L.A., McCorkell B.E., Rowley W. 2002 (in press). Crop yields and

soil properties on eroded slopes of red ferrosols in northwest Tasmania. Australian Journal of Soil Research **40**(4).

Edwards K., Zierholz C. 2000. Soil formation and erosion rates. In "Soils: Their Properties and Management" Second Edition. (Eds PEV Charman, BW Murphy). p.39-57. (Oxford University Press: Melbourne.)

Feller M.C. 1981. Catchment nutrient budgets and geological weathering in *Eucalyptus regnans* ecosystems in Victoria. Australian Journal of Ecology **6**: p. 65-77.

Isbell R.F. 1996. "The Australian Soil Classification". Australian Soil and Land Survey Series, Volume 4. (CSIRO: Collingwood, Vic.)

Moreton R.M., Grose C.J. 1997. Land Capability Survey of Tasmania. Forth Report (Department of Primary Industry and Fisheries: Tasmania, Australia).

Richley L., Loughran R.J., Elliott G.L., Saynor M.J. 1997. A National Reconnaissance Survey of Soil Erosion Tasmania. A report prepared for the Australian National Landcare Program (University of Newcastle: Callaghan, NSW.)

Sims C.C., Cotching W.E. 2000. Erosion and Water Quality - Turbidity and Sediment Loads from Selected

Catchments in Tasmania's North West. Natural Resource Management Journal **3**(1): p.8-14.

Soil Survey Staff 1998. "Keys to Soil Taxonomy" 8th ed (Natural Resources Conservation Service, United States Department of Agriculture.) Available at http://www.statlab.iastate.edu/soils/keytax/.