GRAVEL AND CONVENTIONAL MOLE DRAINAGE FOR DRYLAND CROPPING IN SE AUSTRALIA

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Abstract

In a wet year when waterlogging was widespread, gravel mole drainage reduced the duration of waterlogging and significantly increased dry matter production of canola. Gravel moles increased final harvest yields by 19% and performed consistently better than conventional moles due to greater longevity in unstable sodic subsoils.

Keywords: cropping, drainage, gravel, mole, subsoil, waterlogging

In the high rainfall (>500 mm / annum) ?dryland? cropping regions of south-eastern Australia, perched watertables often appear close to the soil surface (<0.5 m). Dense clay subsoils with low hydraulic conductivities restrict the downward movement of water and roots. Periodic waterlogging early in the life of a winter grain crop can seriously reduce production in 50% of years. In north-eastern Victoria alone, average annual crop and pasture losses are estimated to be $10 million (1).

This paper reports the effects of gravel and conventional mole drainage on the production of canola in north-eastern Victoria.

Materials and methods

The experiment was located on a site west of Rutherglen. Gravel moles (5.0 m spacings) and conventional moles (2.5 m spacings) were installed in April 1994 on a Sodic Brown Dermosol (2). The drainage treatments were replicated four times and arranged in a randomised block design. Plot size was 50 x 50 m. A surface drain was installed around the perimeter of the plot area to prevent run-on. Mole drains ran into two lateral pipe drains spaced at 50 m apart. The plots were sown to canola (*cv.* Siren) on May 10 1996.

Conventional mole drains are unlined channels formed in the clay subsoil with a mole plough (Figure 1). The floating beam mole plough is the preferred plough design as it minimises irregularities in the slope of the drain caused by local surface undulations (4).

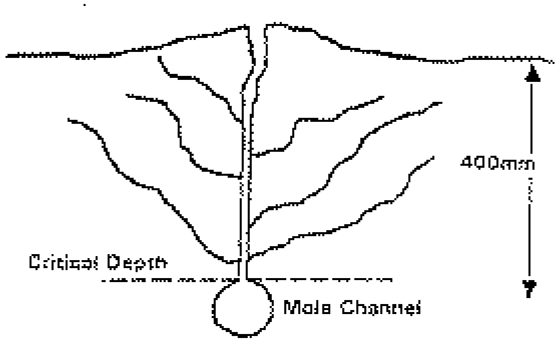

Figure 1: Conventional mole drain

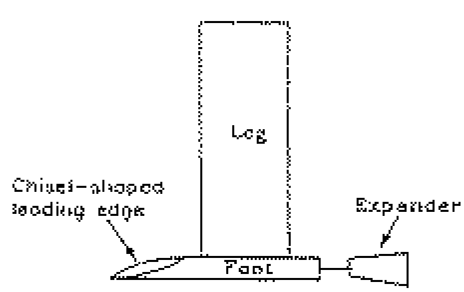

Figure 2: Conventional mole plough components

The time of installation of conventional moles is critical such that subsoil moisture content must be at approximately 30% to ensure good channel formation. Conventional moles were reinstalled in March

1996 following observations of mole channel collapse due to the low subsoil moisture content (<20%) at time of moling.

Gravel moles are similar to conventional moles but are filled with gravel for greater longevity in unstable sodic soils. They can be used in some soils where conventional mole drains fail due to the rapid collapse of the channels. The gravel mole plough was built at Rutherglen, based on an Irish design (3). This was the first time gravel mole drainage has been tested in Australian cropping soils prone to waterlogging.

Pipe drains are still required in most circumstances to remove the water collected by the moles from the paddock. However, as the spacing of pipes can be greatly increased due to the installation of moles perpendicularly across the collector pipes, the cost of subsoil drainage can be reduced.

Results and discussion

In 1996, heavy rainfall in June and July caused periodic waterlogging in the undrained plots during the vegetative stages of canola growth. The subsurface drainage treatments reduced the duration of waterlogging in the upper 150 mm of the soil profile from 18 days (no moles) to only 1 day (gravel moles). This significantly increased dry matter production during the season (Table 1) and reduced crop variability. Compared with the undrained plots, gravel moles increased harvest yields by 19% due to the alleviation of waterlogging early in the season.

Table 1. Dry matter and harvest yields of canola (*cv.* Siren) in 1996.

Treatment		Dry matter production (t/ha)		Harvest yields (t/ha)
?	8 Aug	12 Sept	24 Oct	?
Gravel moles	1.43	2.43	6.22	2.08
Conventional moles	1.12	1.98	5.20	1.85
No moles	1.06	1.70	4.62	1.75
l.s.d. (P=0.05)	0.27	0.42	0.81	0.22

The costs of mole drainage systems are highly dependent on the paddock situation and soil type. Subsoils of very low infiltration will require more intense drainage systems than better draining soils. Intensive systems require closely spaced pipes (<50m apart) which greatly increases costs.

On average, conventional mole systems will cost around $600-$900 /ha. Conventional moles may need to be reinstalled every 2-4 years at a cost of approximately $50 /ha. The addition of gravel moles increases costs by $200-$600 /ha, although it is anticipated that this one-off cost will last for twenty or more years.

Conclusion

The adaptation of overseas technology to alleviate waterlogging offers the potential of mole drainage systems to significantly increase grain production in the high rainfall areas of Australia. Gravel mole drains provide an effective long-term strategy to minimise the effects of waterlogging on a wide range of Australian cropping soils.

Acknowledgments

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