

Strategic tillage for soil amelioration — how does it change the weed management strategy?

Catherine Borger¹, Sultan Mia¹, George Mwenda¹, Sarah Collins², Stephen Davies³, Gausul Azam¹

¹Department Of Primary Industries And Regional Development, Northam, Australia

²Department Of Primary Industries And Regional Development, South Perth, Australia

³Department Of Primary Industries And Regional Development, Geraldton, Australia

catherine.borger@dpiird.wa.gov.au

Summary Soil amelioration via strategic tillage is occasionally necessary for no-tillage systems to alleviate soil constraints. Amelioration may include deep ripping in compact soil, soil mixing to incorporate surface soil amendments like lime or a full soil inversion to bury the surface soil due to water repellence, herbicide-resistant weed seeds etc. Deep ripping, mixing and full inversion were applied at two field sites at Yerecoin and Darkan WA in 2019. The sites were used to investigate the impact of tillage practices on weed seed burial, emergence, and growth in the following three years (2019 to 2021). Full inversion buried 88% to 89% of annual ryegrass and great brome seed to a depth of 10-20 cm. Ripping and spading left 31% to 91% of seed in the top 0-10 cm of soil, with broad variation between sites (i.e., soil type). Of the seeds that were buried, most were at 10-20 cm. Even though tillage depth was 30-40 cm, very few weed seeds were buried below 20 cm.

Soil inversion reduced weed density and annual ryegrass remained at a density of <1 plant m⁻² for the three years after amelioration. Great brome density was reduced compared to the no-tillage control but recovered more successfully than annual ryegrass in the three years after amelioration, reaching 11 plants m⁻² at Yerecoin and 147 plants at Darkan. This was possibly because great brome seed can have high emergence from a depth of 5-15 cm whereas annual ryegrass seeds have low emergence at 5 cm. Deep ripping and spading had no consistent impact on weed density. A comprehensive weed management plan is required following soil amelioration, to control existing weeds or maintain the benefit of soil inversion for large-seeded species like great brome that may reinfest the system.

Keywords soil renovation, mouldboard, integrated weed management, seed bank, *Lolium rigidum*, *Bromus diandrus*