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Surfactant Modification of Water Repellent Soils and Consequences to Rootzone Water and Apple Productivity

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Abstract:

Soil water repellency (SWR) is a well known phenomenon impacting Australian soils, yet studies evaluating the consequences of SWR on yield and quality are conspicuously absent. With the recent impacts of drought on water quantity in the Murray-Darling basin, the projected impacts of climate change, and the expansion of production of high value orchard crops, the sustainability of production requires development of novel strategies to optimize the efficient delivery and use of water. Recently discovered synergistic co-formulations of alkyl polyglycoside and ethylene oxide-propylene oxide (EO/PO) block copolymer surfactants have accelerated research on the effects of surfactants on wetting of water repellent soils. The objective of this study was to determine 1) the effect of surfactant treatment on soil water content and wetting front depth in mini-sprinkler irrigated, water repellent, Goulburn Valley clay loam soils and 2) the consequence of SWR remediation on yield of Malus domestica Borkh. Variety Pink Lady in 2006/07 and variety Gala in 2007/08. Soil surfactant was applied at the initial rates of 0, 5 and 10 L haP-1P in November of each year, then at 0, 2.5 and 5 L haP-1P respectively at monthly intervals through March, 2007 or January, 2008. Surfactant treatment significantly increased wetting front depth and soil volumetric water content at 10cm or 20 cm. Surfactant treatments increased total yield by 20% and 49% ($p = 0.05$) in 2000/07 and 2007/08, respectively, as a result of increased mean fruit size of 17g versus 41g ($p = 0.05$). Mitigation of SWR in 2006/07 resulted in a net return of $6,364 haP-1 Pfor the variety Pink Lady and in 2007/08 resulted in a net return of $3,600 haP-1 Pfor the cultivar Gala. This is the first study to assess the impact of SWR on productivity in apples.

Impact Statement:

This study demonstrates that SWR can result in significant depression of apple productivity. Under precision irrigation, simple SWR mitigation strategies (low level surfactant applications) can have profound effects on soil hydrological status to improve sustainable apple production.

Category: Agricultural BMPs
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