Environmental and Hydrological Implications of Innovative Sprayable Biodegradable Polymer Membrane: First Results

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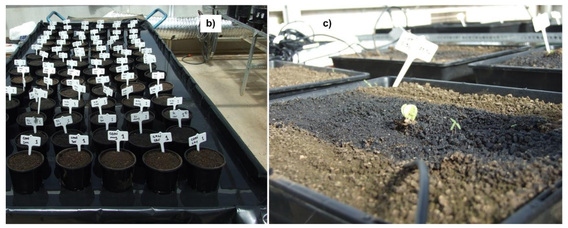
INTRODUCTION

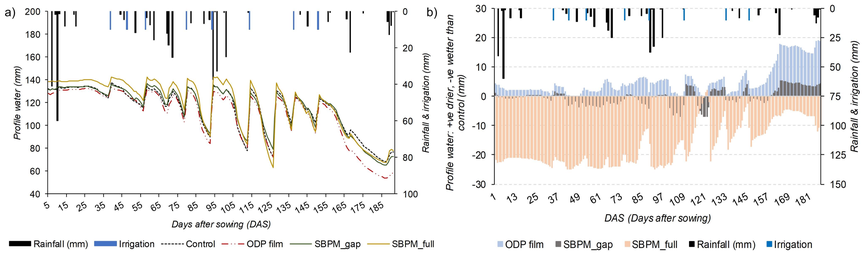
- Agricultural management techniques like plastic mulch films are widely used to enhance crop production by conserving soil water and increasing temperature with the ability to suppress weeds.
- However, the use of plastic represents large environmental concern since the recovery of plastics from soils and its persistence in the environment is causing global problems.
- *To solve the problem, researchers have turned their attention to biodegradable products while lately sprayable biodegradable polymer membrane (SBPM) technology was introduced.*

OBJECTIVE

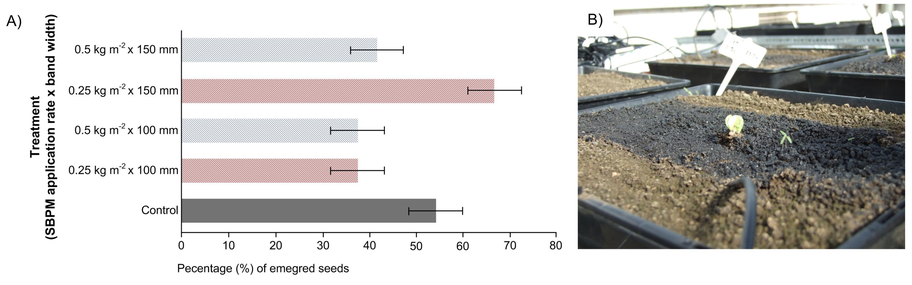
To produce **Sprayable Biodegradable Polymer Membrane (SBPM)** capable of replacing preformed plastic mulch films currently used in crop production.



b) Pot experiments with various seedlings and c) tray experimentc with different SBPM band width and application rate.

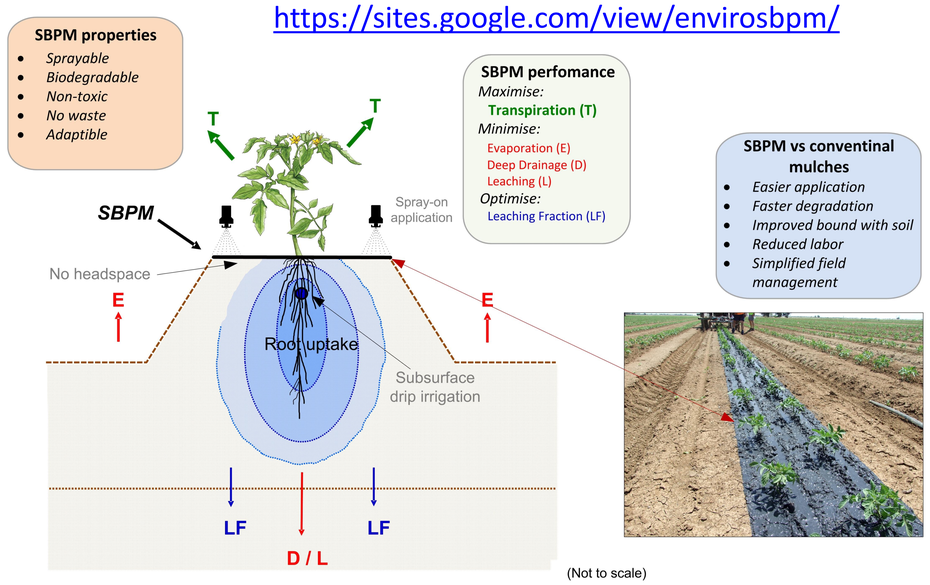


a)The effect of oxo-degradable plastic (ODP) mulch film and SBPM (SBPM_gap and SBPM_full) treatments on soil profile water content during the cotton growing season; (b) the comparison of soil profile water under the ODP, SBPM_gap and SBPM_full treatments, shown in relation to the control: positive is drier and negative is wetter than the control.

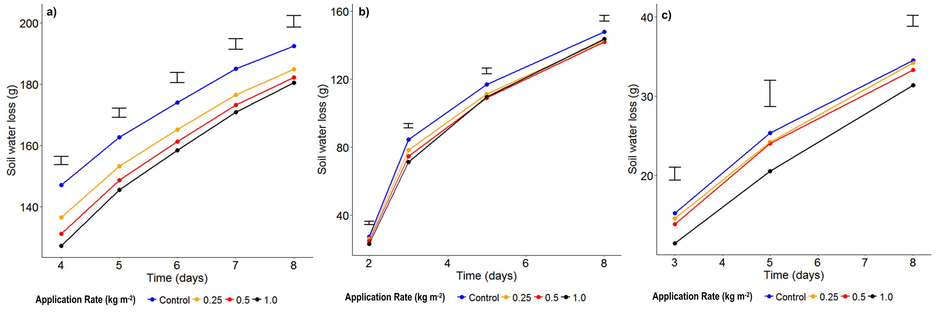


A) Average seedling emergence for both cotton and sorghum species (n=30), and B) example tray with emerged seedling and weeds.

https://sites.google.com/view/envirosbpm/

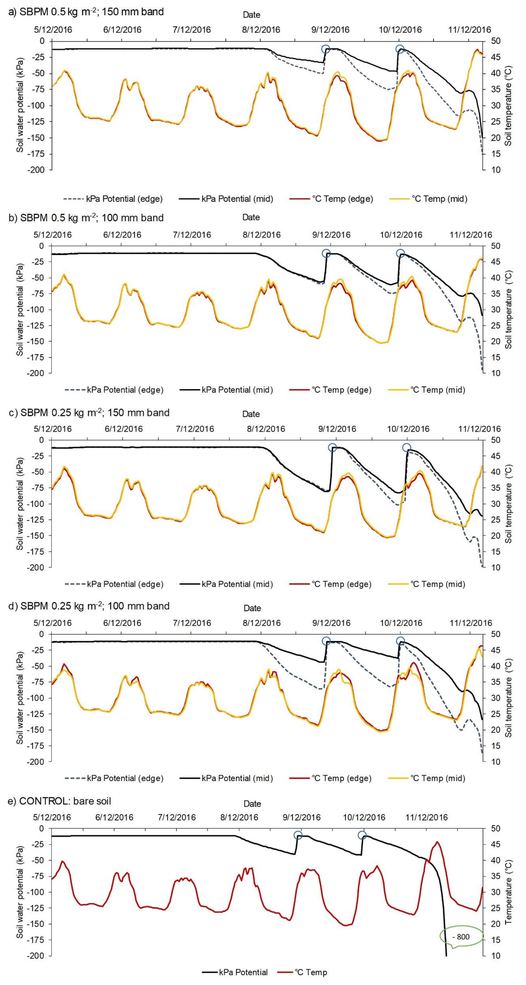


A schematic of sprayable biodegradable polymer membrane (SBPM) technology indicating its properties, performance, and comparison with conventional plastic mulch films. The lower right-hand photo shows an application of SBPM in a tomato field experiment near Echuca, Victoria, Australia.



Soil water loss (g) in pots with different application rates of SBPM (0.25 kg m^{-2}, 0.5 kg m^{-2}, 1 kg m^{-2}) and control (bare soil) for (a) experiment 1 (with seedlings) and (b) experiment 2 (without seedlings) (c) with additional graph showing water loss calculated from water content sensors (without seedlings, experiment 2).

Soil water potential (kPa; middle and edge position) and temperature (°C) in tray plots (n=3) under SBPM band widths of 100 and 150mm and application rate rates of 0.25 kg m^{-2} and 0.5 kg m^{-2} in comparison with bare soil control.



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CONCLUSIONS

- *First results indicate that SBPM technology could limit soil evaporation, reduce irrigation needs and prevent weed emergence while at the same time providing environmentally sustainable agricultural practice through its biodegradability, nontoxicity and sprayability nature.*
- *This innovative technology shows large potential even at this early development stage with the need for further improvement of SBPM formulation, management and properties.*
- *In summary, the future of the SBPM technology depends on its ability to perform as well as prefabricated plastic and biodegradable mulch films which are currently in use, while also reducing the production cost.*