

Effects of Age of Weed and Method of Weed Management on Phosphorus Losses in Runoff



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Introduction

- The contribution of crops and cover crop residues to eutrophication is a growing concern among water quality experts.
- Weeds are plants, and their potential contribution to phosphorus (P) losses in runoff is relatively unknown.
- Weeds are managed at different times of the year using a variety of methods.
- Quality recommendations on effective weed management strategies during the non-growing season is needed.

Objective

To assess the growth stage of weeds and the method of weed control that is most critical for P release during the non-growing season.

Methodology

Study Area

- The study was done in the greenhouse of the Department of Plant Science, at the University of Manitoba.

Weeds Seeds and Sample Collection

- Weed seeds and the soils for their cultivation was collected from a study site at Elm Creek, Manitoba.
- Six weed species (including volunteer wheat and canola) were grown for 60 days.
- One-third of the weeds were terminated every three weeks (at 3 weeks, 6 weeks, and 9 weeks), and samples were collected.
- Three weed control methods (desiccation, herbicide and no management) were used at the times of weed termination.

Methodology contd..



Rebecca harvesting fresh weed samples for the unmanaged and desiccation treatments



Rebecca loading some weeds into the herbicide spray chamber for the herbicide treatment.



Leachates or extracts collected from the weed plants

Extraction Method Used

Each plant sample collected was divided into two parts. One half of the samples collected were subjected to freezing at -18°C for 24-48 hours and thawing at +18°C for 12-18 hours. This was used for the determination of total phosphorus in the leachate. While the other half of each samples were dried at 65°C for 48 hours, grinded, digested and used for the determination of total P in the biomass.

Results

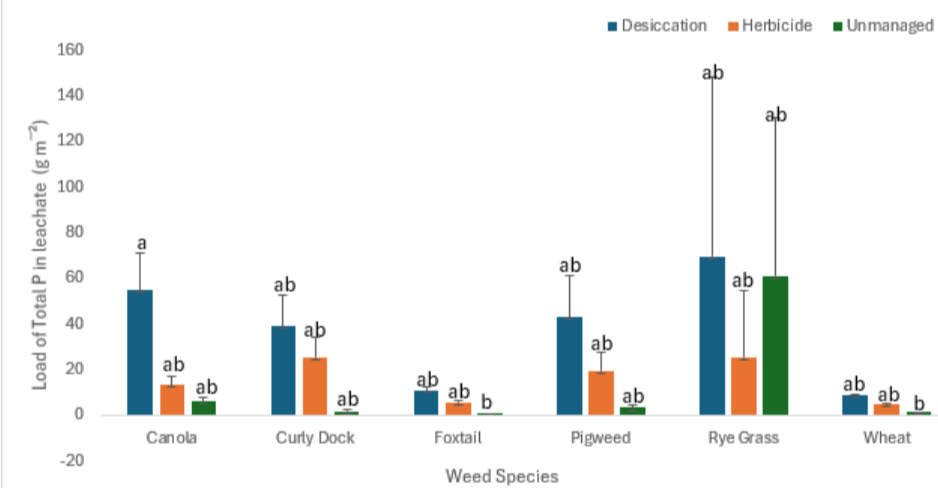


Fig. 1. Effect of weed management practice on TDP load in runoff (significant at $p < 0.05$)

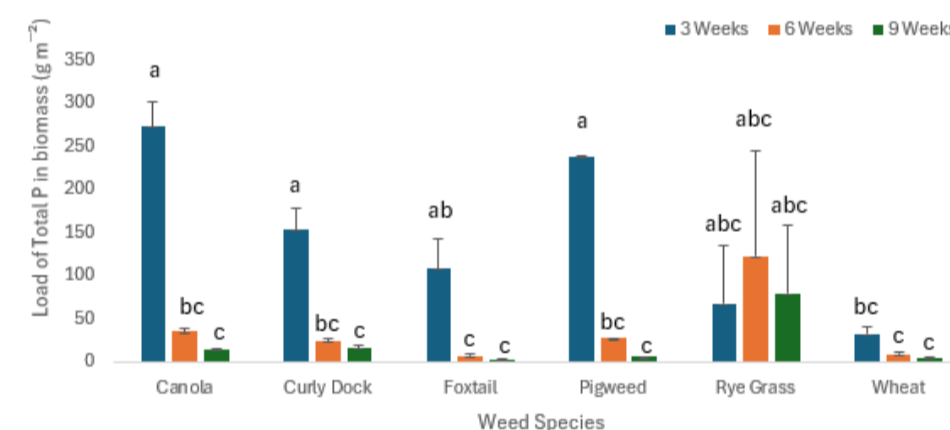


Fig. 2. Effect of age of weeds on total P load in weed biomass (significant at $p < 0.05$)

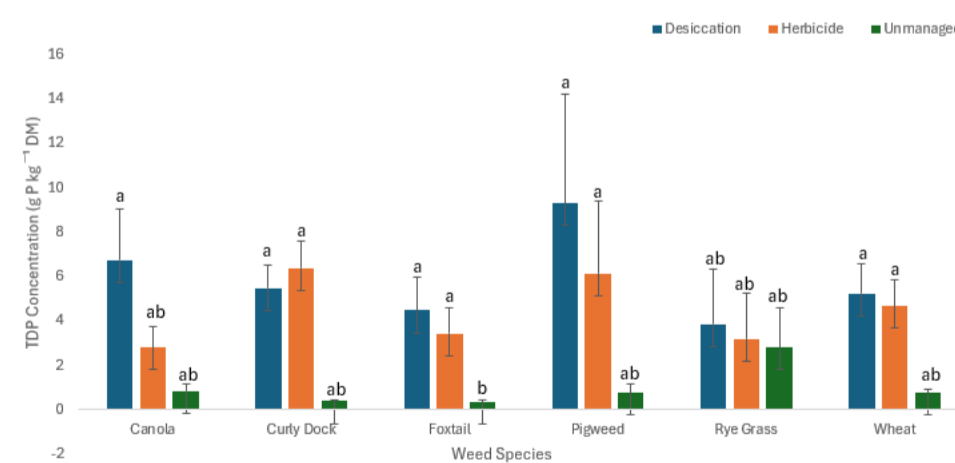


Fig. 3. Mean TDP concentration in weeds under different weed management practice

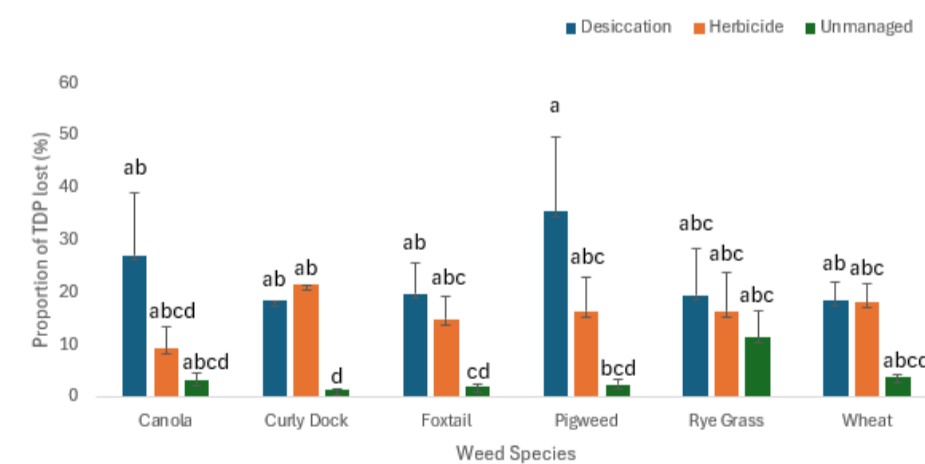


Fig. 4. Percentage of TDP released from weeds under different weed management practice during the non-growing season (significant at $p < 0.05$)

- Load of total P in leachate: The quantity of runoff P lost per area was lower in unmanaged wheat and foxtail plants than in desiccated canola plants.
- Load of total P in biomass: The quantity of biomass P lost per area was higher in younger canola and pigweed plants. Generally, older plants released lower quantity of P from their biomass.
- The proportion of TDP lost was similar across all weed species and management.

Results contd..

- TDP Concentration: There was no significant difference in TDP concentration among all weed species and weed management methods used.

Discussion

- High load and concentration in the desiccated plants can be attributed to the shrinking and damage of plant cells, due to drying effects.
- Younger plants released more P than older plants possibly because of their low lignin content, weak cell walls, and soluble P stored in their tissues.

Conclusion

- The method of weed management (desiccation) was the major determinant of the higher TDP loads in the leachate.
- The age of the weeds (younger plants) was the major determinant of the higher TP loads found in the biomass.
- The proportion of TDP lost in the leachate was low (less than 50%). However, weed management could result in higher TDP losses in runoff, while no management could result in higher P retention in the biomass.

References

- Robertson, T., Bundy, L. G. and Andraski, T. W. 2007. Freezing and drying effects on potential plant contributions to phosphorus in runoff. J. Environ. Qual. 36: 532-539.

Acknowledgement

This research is supported by NSERC Alliance.