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Potential uses for bracken (*Pteridium aquilinum* (L.) Kuhn) in organic agriculture

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Summary

Bracken is a weed species due to its toxic nature and adverse effects on agriculture and ecology. This poster reviews research into historical uses for fronds and litter harvested as part of organically approved control methods. The use of bracken as an over winter mulch reduced losses of nitrogen and potassium from bare soil and maintained soil temperatures. Bracken litter was found to be a viable biofuel, with a calorific value comparable to wood and low ash and alkali metal contents. The contents of frond ash were investigated, with high concentrations of potassium found giving them a value as organic fertiliser. The addition of frond ash to soil significantly increased clover growth and number of nodules. The addition of frond ash to soil significantly increased the yield of saleable main crop potatoes. These findings have shown that bracken has a value especially within organic agriculture.

Keywords: Bracken, mulch, ash fertiliser, potassium, clover, potatoes

Introduction

Large yields of fronds and litter from the organically approved control methods of cutting bracken produces large yields of biomass. Some uses for this biomass have been investigated during Ph.D. study at University of Aberdeen, from 2000–2002. This paper summarises the findings from this research.

Uses for Bracken Material

Protective mulch

The use of bracken fronds and litter was investigated on a bare soil over winter. Frond Mulch reduced losses of available K by 41 kg ha⁻¹. Litter mulch reduced losses of available N by 11.6 kg ha⁻¹. Litter mulch maintained soil temperatures a mean 0.4°C above normal and frond mulch a mean 0.75°C above normal. These findings show that bracken is valuable as organic mulch.

Biofuel

Bracken fronds have been used for centuries as biofuel. This is probably due to the high yields obtained of 5-16 tDM ha⁻¹ in Scotland (Donnelly, 2002) and high calorific value of 21 GJ t⁻¹ (Callaghan

et al., 1981). Bracken does not require planting, the use of herbicides and pesticides, fertilisation or weeding. It does not require subsidies, and inhabits land of low value. These findings show that bracken litter also has a potential as a biofuel.

The potential of bracken litter was investigated, as one off yields of litter can be as heavy as 101 tDM ha⁻¹ (Marrs, 1999). The calorific value of litter was found to be lower than that of fronds at 19.5 GJ t⁻¹. The concentrations of moisture and alkali metals were lower than that of the fronds.

Contents in ash from fronds and litter

Ash produced from the incineration of fronds collected between May and November contained between 23.5–41.8% K. The yield of frond ash at Muir of Dinnet peaked in July/August at 469 kg ha⁻¹. The estimated value of frond ash as an organic K based soil amendment based on K concentrations only was £350–£1200 per tonne.

Use of frond ash as K fertiliser

The effect of the addition of frond ash to soil on white clover (*Trifolium repens*) was investigated. Yields of clover herbage increased in comparison to the control (no ash added) by 169%, and the number of root nodules by 141%. These increases were linked to the K concentrations in the ash and to concentrations of calcium and other nutrients.

The effects of addition of frond and litter ash on organic main crop potatoes (*Solanum tuberosum*) were investigated. Ash was added in accordance with K concentrations and recommendations for addition of K for main crop potatoes. Frond ash increased yield of 45–65 mm tubers by 76% compared to the control (no ash). The addition of litter ash increased the yield of 45–65 mm tubers by 30%. The value of the addition of one tonne of frond ash on potato yields was estimated at £437 t⁻¹. The value of the addition of one tonne of litter ash on potato yields was estimated at £236 t⁻¹. Both of these experiments show that both bracken frond and litter ash are of value.

Conclusions

This research has shown that bracken is valuable as mulch. It is also valuable as biofuel, at a time when efforts to reduce the effects of global warming are increasing. The by-product ash should also be considered more valuable than the biofuel, as it contains high concentrations of K and other valuable nutrients. Further large scale trials are required.

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References

- Callaghan T V, Scott R, Whitaker H A. 1981.** The yield development and chemical composition of some fast growing indigenous and naturalised British plant species in relation to management as energy crops. *Natural Environmental Research Council Contract Report to the Department of the Environment.*
- Donnelly E. 2002.** *Potential Uses for Bracken (Pteridium aquilinum (L.) Kuhn) in Organic Agriculture in Scotland.* Ph.D. Thesis, University of Aberdeen.
- Marrs R. 1999.** Above ground mass and species diversity: assessing the effects of compartmentation and the setting of conservation targets. *Oikos* **87**:541–548.