# Silage for managing weed seeds

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**Summary** Reducing the number of viable weed seeds entering a field is critical to successful weed management. Viable seeds can result from weed survivors that reach maturity, or can be imported into the field *via* livestock, grain, fodder, or machinery. Few reports exist on the survival of seeds in silage, or the consequence of feeding the silage to livestock. Seeds from five grass weeds, six broadleaf weeds and three pasture species were ensiled, underwent 48 hour in sacco digestion or both. Seed germination was determined after incubation at 25/15°C on a 12 hour temperature cycle.

Tetrazolium staining was used to determine the viability of ungerminated seed. Seed germination and viability were compared with untreated seeds. Seed from all grass weeds except annual ryegrass were rendered unviable after being ensiled, whereas some broadleaf weed seeds remained viable. Digestion had a similar effect as ensilage on reducing seed viability, except for silverleaf nightshade and prairie ground cherry where no reduction in viability was observed. The viability of marshmallow seed and the three pasture species was not significantly reduced by either ensilage or digestion. Ensile or digestion can provide non-chemical options for effective weed management for certain weed species.

**Keywords** Weed seed, silage, viability.

## INTRODUCTION

A key for successful weed management is prevention of replenishment of the weed seedbank. Most weed management tactics focus on preventing weeds surviving, reproducing and naturally replenishing the seed bank. Movement of weed seed into a field in fodder or ingested by livestock is often given little consideration.

Previous studies by Blackshaw and Rode (1991) and Mayer *et al.* (2000) indicate that, while the majority of weed seeds are destroyed by ensilage, a small percentage remain viable. More recently, Westerman *et al.* (2012) reported that seeds from a range of weeds were capable of surviving ensilage, with up to 32% of seeds from velvetleaf (*Abutilon theophrasti* Medik.) remaining viable.

Numerous studies have reported the viability of weed seeds after passage through livestock. The percentage of viable seeds excreted tends to be lower for sheep compared to cattle (Stanton 2006). Seed survival rates varies between weed species, with up to 79% of giant rat's tail grass (*Sporobolus pyramidalis* Beauv.) seed remaining viable after passage through cattle (Bray *et al.* 1998).

There is limited data available on the combined effect of both ensiling and digestion on the viability of weed seeds.

The aim of this study was to determine the effect of ensiling and digestion on the viability of seeds of 11 Australian weed species and compare this to the viability of three pasture species.

## MATERIALS AND METHODS

Weed seeds of 14 species (Table 1) were collected from the field in late spring and placed in Dacron bags (50 seeds per bag) of the type used for degradability studies and ensiled for 3 months in chopped cereal forage. Two bags of each seed species were placed in each of 4 plastic bag mini-silos (replicates).

Upon opening each silo, all bags of weed seed s were removed. bag of each weed species plus a bag containing 50 untreated seeds of each species, were placed in the rumen of 1 of 4 mature Red Poll steers

**Table 1.** Weed and pasture species examined.

| Common name | Scientific name |
|---|---|
| Annual ryegrass | *Lolium rigidum* Gaud |
| Barley grass | *Hordeum* spp. |
| Brome grass | *Bromus* spp. |
| Silvergrass | *Vulpia* spp. |
| Wild oats | *Avena fatua* L. |
| Horehound | *Marrubium vulgare* L. |
| Marshmallow | *Malva parviflora* L. |
| Prairie ground cherry | *Physalis hederifolia* A.Gray |
| Silverleaf nightshade | *Solanum elaeagnifolium* Cav. |
| Wild radish | *Raphanus raphanistrum* L. |
| Wireweed | *Polygonum aviculare* L. |
| Biserrula | *Biserrula pelecinus* |
| Bladder clover | *Trifolium spumosum* |
| French serradella | *Ornithopus sativus* |

for 48 hours. Bags from each mini-silo were placed in the rumen of the same animal. The remaining bags removed from the silage were stored in the laboratory prior to testing. Seed germination and viability was tested against control seeds that had been stored in the laboratory under ambient conditions.

After silage and digestion treatments had been imposed, recovered seeds were placed on Whatman No. 2 filter paper moistened with 4 ml of distilled water in a 9 cm Petri dish. Petri dishes were sealed with Parafilm and incubated for 21 days at 25/15°C day/night temperatures with a 12 hour photoperiod. Remaining ungerminated seeds were tested for viability using the tetrazolium test.

Transformation did not improve the level of variance within the data, therefore ANOVA was conducted on raw percentages.

## RESULTS AND DISCUSSION

The viability of untreated seeds varied with species (Figure 1). Viability of the wireweed and wild radish seed used in this experiment was very low, suggesting issues with the maturity of the seed at collection.

Ensiling reduced the viability of all weed seeds, except for marshmallow (Figure 1). This high level of viability for marshmallow corresponds to reports by Westerman *et al.* (2012) of nearly 70% survival after ensiling. The three pasture species evaluated also had high levels of viability after ensiling.

Digestion also reduced the viability of most weed seeds, though the effect was more variable than ensiling. The viability of seed from marshmallow and the three pasture species was similar to that observed after ensiling. In addition, seed from annual ryegrass, silverleaf nightshade and prairie ground cherry also had high levels of viability after digestion. For silverleaf nightshade and prairie ground cherry, seed viability was not reduced by/ digestion.

The combination of ensiling plus digestion rendered all weed seeds non-viable except for those of marshmallow. The viability of seed from the three pasture species remained high after exposure to both ensiling and digestion. It was concluded that ensiling prior to feeding to ruminants is an effective strategy an Integrated Weed Management package.

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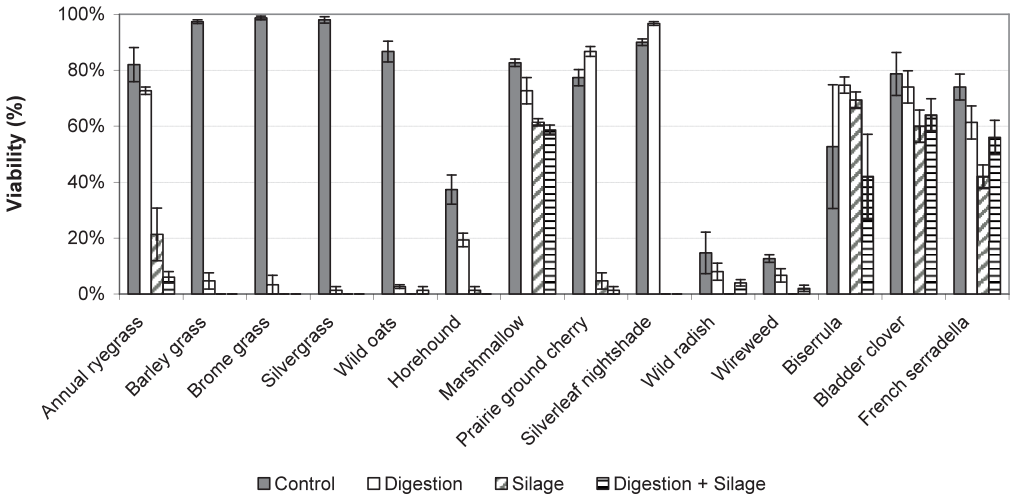


**Figure 1.** Effect of ensiling and digestion on the viability of weed and pasture species. Each column is the mean of four replicates (standard error bars shown).

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