WEED SEED EXCRETION BY SHEEP - TEMPORAL PATTERNS AND GERMINABILITY

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Summary. Duration and rate of weed seed excretion by sheep was measured. Excretion of cutleaf mignonette, *Reseda lutea*, seeds began within 24 h of ingestion, peaked between 3 and 4 days and then declined until the last seed was detected on day 12. Recovery of ingested seeds was 23%. Excretion of silverleaf nightshade, *Solanum elaeagnifolium*, seeds also began within 24 h, with most seeds excreted in the first 7 to 9 days. Single seeds were detected 23 and 31 days after ingestion. Excreted seeds of both species were germinable. Sheep were clearly shown to be potential vectors for seeds of both species. Current common on-farm quarantine periods of several days are inadequate. Stock should, where practical, be quarantined for at least 14 days to reduce the risk of spreading undesirable weed seeds. Further research on feed rations and purgative treatments may be useful in reducing excretion duration.

INTRODUCTION

Cutleaf mignonette and silverleaf nightshade are major perennial weeds of arable areas of South Australia which can survive grazing, cultivation, drought and most herbicide applications. There are no easy control measures for large infestations so emphasis must be placed on reducing their rate of spread. Strong circumstantial and anecdotal evidence of spread via seed excreted by sheep during pasture phases of ley rotations has been recognised by the authors. Four experiments were conducted in South Australia to determine the potential of grazing sheep as vectors for seed of both species.

METHODS

Experiment 1. This experiment was conducted to measure the rate, duration and germinability of cutleaf mignonette seed excreted by sheep. Seven penned sheep were each fed 7000 seeds and then a diet of oaten hay (800 g/day) and dry pellets (800 g/day). Dung was collected daily for 25 days from a collection bag attached to each sheep. Total seed excretion was measured daily for each sheep and germination (10/20°C for 12/12 h; dark) was measured every second day.

Experiment 2. Fresh sheep dung was collected fortnightly from a volunteer mallee pasture infested with silverleaf nightshade. Seeds/500 dung and berries/m^2 (mature and green) were counted at each sampling date. Silverleaf nightshade density declined from 3.5 shoots/m^2 in mid-January to zero in early May. The stocking rate was 1 sheep/ha for the first sampling date, then an average of 2.5/ha for the remainder of the experiment. Silverleaf nightshade was the only significant source of green forage present from November to May. Excreted and field-collected seeds were incubated in fluctuating light and temperature conditions (dark/light at 10/30°C for 12/12 h) to measure germinability.

Experiments 3 and 4. In Experiment 3 ten sheep were removed from a silverleaf nightshade-infested volunteer pasture in late February and placed in a pen with a concrete floor. Excreted seeds were counted in fresh 500 g dung samples which were collected every second day from the concrete floor for 17 days. The sheep were each fed approximately 1 kg of medic hay daily, and dung was swept from the floor after each sampling time. Experiment 4 was conducted with similar methodology to Experiment 3, except that 1 kg dung samples were collected for 31 days, commencing in early April.

RESULTS AND DISCUSSION

Experiment 1. Excretion rate and duration are shown for cutleaf mignonette in Fig. 1. Germination of excreted seeds two days after ingestion was only 0.8%, compared to 3.0% for uningested seed, reflecting the high dormancy level of the freshly-harvested seed. "Soft" seed may have been digested prior to excretion, thus reducing the germinability of excreted seed. Germination rose to 3.2% for excreted seed after outdoor weathering for three months. An average of 23% of ingested seed was recovered after excretion.

Experiment 2. Silverleaf nightshade seed excretion, germinability and field berry density for Experiment 2 are shown in Figs 2, 3 and 4.

Experiments 4 and 5. Silverleaf nightshade excretion for Experiments 4 and 5 are shown in Figs 5 and 6.

These experiments have demonstrated that sheep eat silverleaf nightshade berries under field conditions, and that weed seeds can be excreted for at least 31 days after ingestion. Viable and germinable seeds of both species were excreted.

In Experiment 1 cutleaf mignonette seed excretion began within 24 h after ingestion and peaked between 3 to 4 days after ingestion. After day 4 there was a steady decline and the last seed was detected on day 12 (Fig. 1). The low, but significant germination of excreted seeds confirmed a report from Ozer and Hasimoglu (2) in Turkey that excreted cutleaf mignonette seed retained some viability.

In Experiment 2 seeds were found in the dung of sheep grazing under field conditions from mid-January until late April (Fig. 2). The highest numbers were found between late January and mid-March. The highest concentration was equivalent to 672 seeds/kg of fresh dung, during the period when green berries were abundant (Fig. 4) and pasture reserves were lowest. Fig. 4 shows a decline in berry density during late summer and autumn, presumably caused by sheep grazing. The occurrence of seeds in dung ceased about two weeks after berry density had declined to zero (Figs 2 and 4). It appears that grazing pressure on berries increases as alternative feed reserves decline, leading to ingestion of almost all berries present. This pattern, observed in 1991 near Cleve, might be different in other seasons or areas where alternative feed reserves vary.

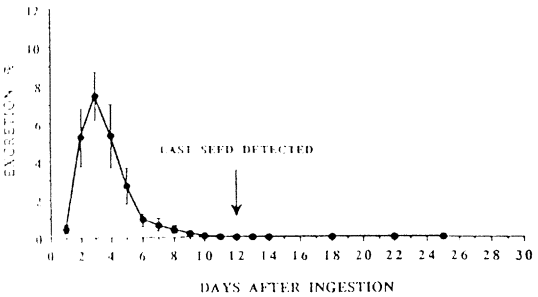

Figure 1. Cutleaf mignonette seed excretion (% of ingested) in Experiment one.

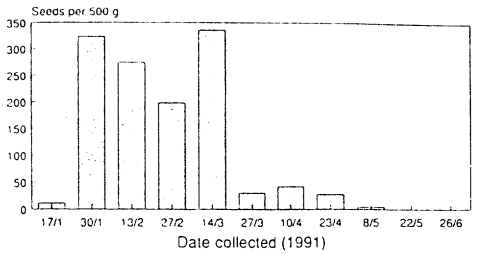

Figure 2. Silverleaf nightshade seeds (per 500 g dung) in Experiment 2.

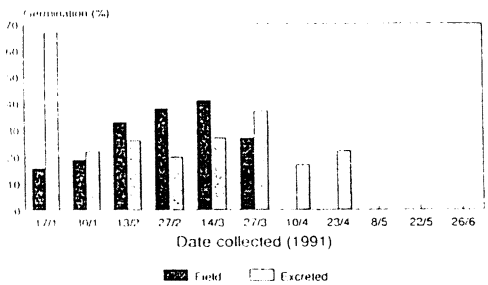

Figure 3. Germination (%) of field-collected and excreted silverleaf nightshade seed in Experiment 2 (Note: Field seed not available after 27/3/91).

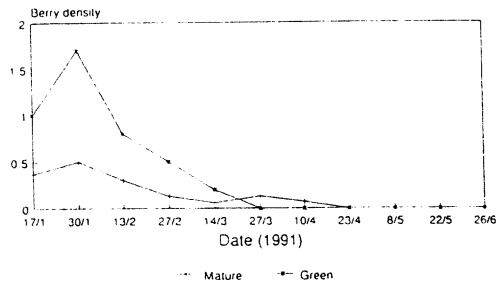

Figure 4. Density (per m^2) of silverleaf nightshade mature and green berries in Experiment 2.

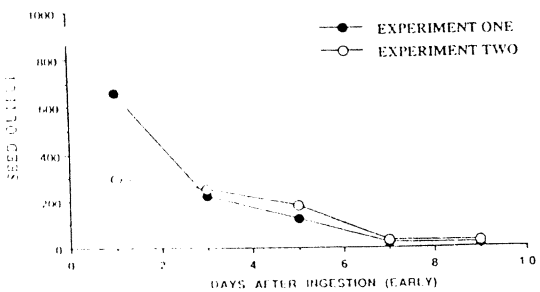

Figure 5. Number of silverleaf nightshade seeds excreted from day 1 to day 9 in Experiments 3 (per 500 g dung) and 4 (per kg dung).

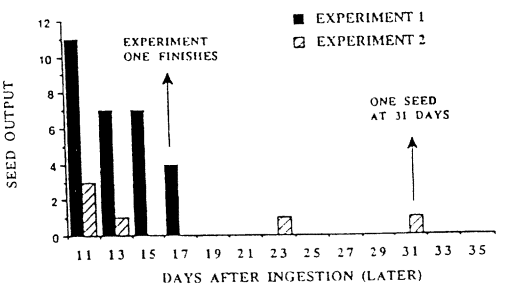

Figure 6. Number of silverleaf nightshade seeds excreted from day 11 to day 31 in Experiments 3 (per 500 g dung) and 4 (per kg dung).

Seeds collected from dung in Experiment 2 had a germination percentage of between 18-67%. Germination occurred at all of the sampling times at which sufficient seed was recovered to perform the test (Fig. 3). Germination percentage was initially high, but declined to about 20-30%. Uningested field-collected seeds had a higher germination percentage than excreted seed (Fig. 3). It is likely that "soft seed" (low dormancy) would be digested, unless excreted quickly. As a result it would be expected that excreted intact seeds would have a higher level dormancy than fresh seed samples which still contained the "soft seed" component, leading to a lower germination percentage. McKenzie (1), in a similar study, found that germination of excreted seed was higher than normal seed. The reason for this discrepancy is not known, but may be a function of the dormancy status of the normal seed. Subsamples of dung from the late January collection were incorporated into the top 5 cm of pots of sand and placed outside (Adelaide) to weather without supplementary watering. In July 1992, healthy silverleaf nightshade seedlings in the four-leaf stage were observed. This demonstrates that silverleaf nightshade seedlings can establish from within intact dung pellets. The authors have also recorded seedlings of cutleaf mignonette growing from within sheep dung under field conditions.

Experiments 3 and 4 show that seed excretion declines over a period of at least 31 days after silverleaf nightshade is ingested (Figs 5 and 6). The majority of seed was excreted within the first 7 to 9 days, but significant numbers were excreted 15 to 17 days after ingestion. The single seed detections at day 23 and day 31 (Fig. 6) may be of little practical significance in most situations. In a similar study McKenzie (1) found that sheep excreted silverleaf nightshade seeds for at least six days after ingestion, but measurements were not taken after 7 days. Their study found that almost all seed was excreted within 4 days. A difference in diet may account for this variation. St-John Sweeting (3) reported similar temporal patterns of weed seed excretion from horses to those found for cutleaf mignonette and silverleaf nightshade.

This research highlights the potential role of sheep as vectors for cutleaf mignonette and silverleaf nightshade spread. It appears that sheep will eat silverleaf nightshade berries for as long as they are available if alternative pasture reserves are low. Cutleaf mignonette seed (1320 seeds/kg dry dung) has also been detected in field-collected sheep dung by the authors (Heap, unpublished data). If sheep have been grazing in a field which contains viable seeds of either species then it would be prudent to assume that they may be excreting viable seed. If they are to be moved to an area with little or none of the weeds, then they should be quarantined for at least one week and preferably two weeks. Even after two weeks there is a small chance of spreading viable seeds. The inconvenience of quarantining sheep should be regarded as an insurance premium. The greater the time of quarantine, the less is the risk of spreading viable seeds.

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