Can cattle spread giant rats tail grass seed (*Sporobolus pyramidalis*) in their faeces?

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Abstract

Giant rats tail grass (GRT) (*Sporobolus pyramidalis* and *S. natalensis*) is an unpalatable and aggressive weed of pastures that has the potential to infest large areas of northern Australia. One possible means of spread is in the manure of cattle. In a pen trial where cattle were fed one dose of a known quantity of GRT seed, three questions were posed: (i) does GRT seed pass through the gut of cattle? (ii) if so, is the seed viable?, and (iii) how long does it take for seed to pass through? Forty one percent of the seed fed to the cattle was excreted. Seventy nine percent of that seed remained viable giving a total of 28% of seed fed to cattle passing through unharmed. Greater than 94% of excreted seed was excreted on days 2 and 3 with none being detected in sub-samples of manure after day 4. The practical implications are that, once eaten, GRT seed can be spread in the manure of cattle. As a precautionary measure, cattle being moved from GRT infested areas to clean areas should be detained on a diet free of GRT seed for at least 4 days before release.

Key words: Sporobolus pyramidalis, giant rats tail grass, seed transport, cattle manure, weed spread.

Giant rats tail grass (GRT) (*Sporobolus pyramidalis* and *S. natalensis*) is a tufted, perennial grass which can grow to 1.7 m tall. It is an unpalatable and aggressive weed that can reduce animal production from pastures by up to 50% (7), outcompete other pasture grasses and threaten biodiversity.

Introduced from Africa in the 1960's in contaminated pasture seed (3), GRT is estimated to currently infest 90 000 ha of coastal and sub-coastal Queensland and north-ern New South Wales (J.Wright, *pers. com.*). Vogler *et al.* (11), estimated the potential distribution of GRT in Australia, using a climate adaptation model, to be throughout eastern and northern Australia, with small areas in South Australia and southern Western Australia.? This area was generally above the 500 mm rainfall isohyet and covers an estimated area of 223 million ha (W.Vogler, *per. com.*). GRT is currently declared in Queensland with a P2 or P3 category depending on shire.? P2 means plants are to be destroyed and P3 means plants must be reduced in numbers and distribution.

Successful weeds usually have an effective dispersal mechanism for invading new areas, or maintaining dominance in infested areas. Some examples of modes of dispersal are wind, water, contaminant of seed, vehicles, farm machinery, movement of stock and animals and in manure. Understanding the mechanisms of spread used by a weed is necessary to design precautionary measures which can be used to reduce the chances of the weed invading its full potential range. This is especially important when dealing with relatively new imported species.

GRT seed does not appear to be spread large distances by wind. Less than 1% of GRT seed was dispersed past 2 m from the edge of an infestation when using seed traps to collect seed (W.Vogler *pers. com.*). *Nassella tri-chotoma* (serrated tussock), a perennial tussock grass weed in southern Australia, has seedheads which break off when mature and are rolled around by the wind which then spreads seed. Seeds have been found up to 15.5 km from the nearest infestation (6). Dispersal by wind makes it difficult to prevent seed entering clean areas.

The history of many infested paddocks suggests that GRT was introduced by planting contaminated pasture seed (7). The pericarp of GRT seed becomes mucilagin-ous when wet (8). This enables the seed to stick to stock, animals and machinery. As the seed dries it becomes less sticky and falls off. This mechanism would allow GRT seed to be transported considerable distances and is possibly the major mechanism for spreading seed around a paddock and within a property.

Another suspected method of transport is in cattle faeces. Seeds of many species are able to survive the digestive tract of animals and remain viable after excretion (*eg.* 5 and 10). Gardener *et al.* (5), found that few seeds of tropical tussock grasses including *S. indicus,* survived passage through the bovine digestive tract. Most of the grass seeds that did survive were relatively short stoloniferous species adapted to heavy grazing such as *Axonopus affinis* and *Pennisetum clandestinum*.

A lag time exists from when seed is eaten, until all seed is excreted, which can be up to 10 days (4). This lag time would allow seed to travel large distances.? Andrews (2) investigated the excretion of giant parra-matta grass (GPG, *S. indicus* var. *major*) and GRT.? Viable GPG seed was excreted by cattle, with all seed excreted in 7 days in one experiment and 4 days in another experiment. GRT seed was excreted, but these seeds were not tested for viability.

The aim of this experiment was to answer three important questions:

• does GRT seed pass through the gut of cattle?

• if so, is the seed viable?

• how long does it take for seed to pass through the digestive tract of cattle?

Three steers in feeding pens were force fed one dose of GRT seed. The numbers of seed in manure and the viability of the excreted seed was measured in the days following ingestion.

Materials and methods

This experiment follows closely the method used by Andrews (2) when investigating the excretion of GPG in cattle manure.

Seed collection, pre-treatment and germination procedures

Giant rats grass seed was harvested by drawing fingers along mature seed heads. The seed was stored for 1 month. The seeds were manually separated from the glumes and ancillary structures to ensure they did not affect the activity of the seed passing through the digestive tract of a beast. Four replications of 100 seeds were tested for initial viability. Alternating day/night temperatures were used in the incubator. After 2 days the seeds were pricked using the technique of Andrews (1), to overcome any dormancy and induce the seeds to germinate. Three thousand seeds were counted into each of 3 gelatine capsules.

Animals and feeding

Three brahman steers, with an average weight of 445 kg were placed into separate feeding pens. The cattle were fed forage sorghum chaff *ad libitum* for 14 days prior to feeding the GRT seed, to allow them to acclimatise and clean out most seeds from the digestive tract. The cattle were force fed the gelatine capsule which contained the GRT seeds. The capsule ensured all seeds were ingested. The cattle continued on the diet of sorghum chaff *ad libitum* until the completion of the experiment.

Faeces collection and recovery of GRT seeds

Manure was collected twice daily, bulked for a 24 hr period and stored in a cold room at 4^{o}C until processed.? Day 1, was the 24 hr period from feeding the seed.? Manure was collected for 10 days. Each daily collection of manure per beast was mixed thoroughly using an electric mixing apparatus, before 10 subsamples of 100 g fresh manure were taken.

The seeds were recovered using water to wash the manure subsample through sieves (9). The residue was placed in alfoil containers and dried in a fan forced dehydrator at 40^{o}C for approximately 15 hours. The dried residue was sorted under an illuminated magnifying glass to find any GRT seeds.

Germination tests

The recovered seed was counted and tested for viability using the method described for testing the initial seed viability. Each viability test had a different number of seed depending on how many seeds were excreted.

Results

Giant rats tail grass seed was excreted by cattle. An estimated 41% of the seed fed to the 3 steers in this experiment was excreted. The initial viability of the GRT seed used in the experiment was high at 95.5% ?3.3, with the viability of excreted seed being 79%.? Therefore, of the total seed fed to cattle, 28% was excreted as viable seed.

Ninety four percent of the recovered seed was excreted on day 2 and day 3 (Fig. 1), with 66% excreted on day 2 and 28% on day 3. Greater than 50% of seed recovered was excreted by day 2. One beast excreted a small amount on day 1 and a small amount (4%) was excreted by all cattle on day 4. No seed was detected in subsamples after day 4.

Due to the low numbers of seed collected on day 1 and day 4, it is difficult to make statements about changes in seed viability with increased retention time in the digestive tract (Table 1). GRT seed excreted on day 2 and day 3 had an average viability of 75% and 62% respectively. No seeds from day 4 germinated, but only 7 seeds were tested.

Discussion

An estimated 41% of the GRT seed fed to cattle was excreted in this experiment. If cattle ingest GRT seed a proportion will be excreted in the manure. This has been found for many species, for example, Simao Neto *et al.* (10) recovered 22% of *Bracharia decumbens* and 38% of *Axonopus affinis* as sound seed after the seed was fed to cattle.

Many people believe cattle do not ingest GRT seed.? Since this experiment was conducted, field manure samples have been collected from 3 GRT infested pad-docks and analysed for GRT seed. Nineteen to 160 GRT seeds/kg of fresh manure were found in manure collect-ed in winter when little standing seed was present in the paddock (S.Bray, unpublished data). This investigation will continue over a few seasons. Andrews (2) found large numbers of GPG seeds in field manure samples and estimated daily seed intake by cattle of up to 8300 seeds which he suggests is surprisingly large as the seedheads are unpalatable.

The average viability of GRT seed excreted by the 3 steers was 79%. The high viability of the excreted seed is not substantially lower than the initial seed viability of 95.5%. An estimated 28% of the total seed fed to cattle remained viable. Andrews (2) estimated that 19% of GPG seed fed to cattle remained viable. The large amount of viable seed excreted suggests that GRT has potential to germinate and establish after transport in manure. To counter this statement many farmers suggest they have never seen a GRT seedling growing out of a manure pat. Andrews (2), found that after leaving manure containing GPG seed intact outdoors for 7 months, no GPG plants were present even though a number of other species were growing. Alternatively, paddock manure containing GRT seed was spread out in a thin layer on a bed of sand in a plant house. Some GRT seedlings did establish although not as many as expected (S. Bray, unpublished data). These new data confirm that GRT is ingested and excreted as viable seed by cattle and under the right conditions will germinate and produce healthy seedlings. Andrews (2) suggests that spread of GPG seed after ingestion is not likely to be significant unless the manure is dispersed soon after excretion. Dispersion does occur with trampling, defecating while walking, with rain, splatters off trucks and the effect of dung beetles is unknown.

Ninety four percent of the GRT seed was excreted on day 2 and day 3, with 4% excreted on day 4. No seed was found after day 4. This implies that cattle require a least 4 days quarantine on a diet free of GRT seed to clean out the digestive tract. This time requirement will depend on the quality of the diet and possibly type of cattle. Andrews (2), found that it took 4 days until no more GPG seed was excreted in one experiment with Friesian heifers, but took 7 days in another experiment.

Conclusions

A high proportion (41%) of giant rats tail grass seed was excreted in cattle manure with 28% of total ingested seed remaining viable after passage through the digestive tract of cattle. No GRT seeds were found after 4 days which suggests a quarantine/cleanout period of at least 4 days is required to remove seed from the digest- ive tract of cattle.

Stock and GRT seed movements can be controlled within a partially infested property by placing cattle in a regularly checked clean holding paddock before mov-ing to a clean paddock. This quarantine period is especially important when moving stock from an infested to a clean district. The holding period would also allow seed to dry and fall off cattle coats.

Graziers should take care when purchasing cattle, especially from GRT infested regions that they do not introduce GRT onto their properties.

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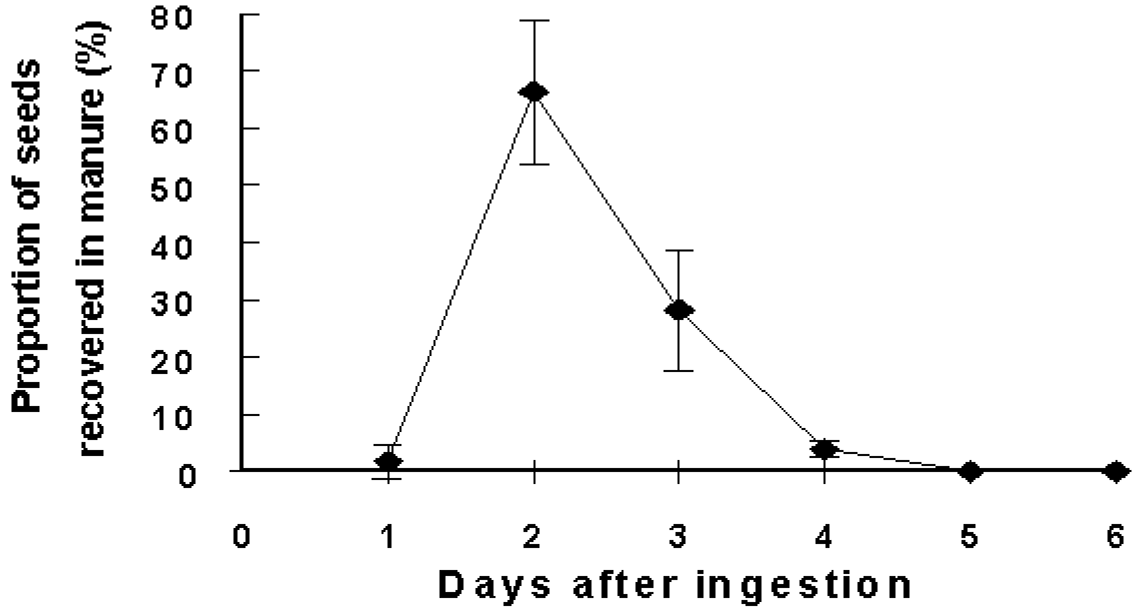

Figure 1