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Effects of adsorbents and probiotics in mitigating simplexin poisoning effects in cattle fed Pimelea

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Pimelea poisoning of cattle occurs only in arid inland Australia and is caused by the toxin, simplexin found in some native Pimelea plant species. Pimelea-affected cattle show distinctive physical symptoms including subcutaneous oedema under the jaw and brisket, diarrhoea and anaemia. Simplexin was thought to be circulated in the bloodstream to exert its toxic effect, but due to its hydrophobic nature the extent of its blood carriage is unknown. Fletcher *et al*. (2014) postulated a possible role of rumen microorganisms adapting to detoxify simplexin in cattle fed Pimelea over a prolonged period of time. Anecdotal reports have suggested cattle supplemented with biochar and bentonite showed resistance towards Pimelea poisoning. In this project, a pen trial (QAFFI/QASP/337/20/DAF) was conducted to determine the efficacy of adsorbents (biochar and bentonite) and a bacterial inoculum for reducing the effects of Pimelea poisoning in steers.

Thirty steers (8 months old) with no previous exposure to Pimelea were assigned to six treatment groups containing five animals per group stratified by weight. Each steer was allocated to individual pens in a randomised block design. The six treatment groups were: (1) Positive control: hay + Pimelea, (2) Negative control: hay only, (3) Non-activated biochar: hay + Pimelea + non-activated biochar, (4) Activated biochar: hay + Pimelea + activated biochar, (5) Bentonite: hay + Pimelea + bentonite, and (6) Inoculum: hay + Pimelea + rumen-derived inoculum. Hay was fed to all steers daily on an *ad lib* basis. Steers in all groups (other than Negative control) were fed Pimelea daily to provide a dose of 5 µg simplexin/kg bw/day, with the dose increased to 7.5 µg simplexin/kg bw/day at Week 9 of feeding. The biochar and bentonite were fed daily at a dose of 0.3 g adsorbent/kg bw/day. The bacterial inoculum was administered orally (200 mL) to steers fortnightly. Pimelea feeding and treatments were stopped at the end of Week 11, with hay fed to all steers until Week 14. The health of steers was monitored and scored daily. Steers were taken to the crush weekly to be weighed and for jugular blood collection. Jugular blood was sampled for haematology and biochemical analyses and for simplexin detection using LC-MS analysis.

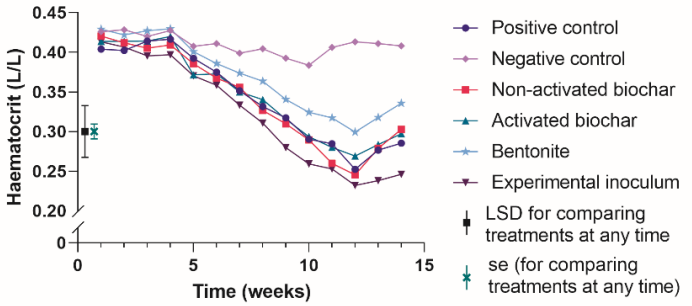

Fig. 1. Blood haematocrit levels measured weekly for all six treatment groups during the feeding trial. Data was presented as adjusted means standardised for the blocks, covariate, group and missing values. LSD, Fisher's protected least significance difference; se, standard error of mean.

All steers fed Pimelea showed signs of Pimelea poisoning with diarrhoea, oedema and increased heart rates observed. Four steers were euthanised with two steers showing adverse effects of Pimelea poisoning while two steers had coincidental physical causes of decline. After Pimelea feeding was ceased, remaining affected steers gradually recovered and were free of any symptoms. For Pimelea dosed animals there was a general trend in decreasing haematocrit (Fig. 1), haemoglobin, packed cell volume, red blood cells and mean corpuscular haemoglobin concentration, with the magnitude of decrease varying between treatments. In all five parameters, the bentonite treatment group showed an increased resistance to the Pimelea impacts compared to other treatment groups. The activated biochar, non-activated biochar and experimental inoculum did not reduce Pimelea poisoning effects in steers and the five parameters from the three treatment groups were similar to the Positive control group. An LC-MS/MS method was developed for simplexin detection in freeze-dried blood with a simplexin limit of detection (LOD) of 3 ng/g in dried blood. However, simplexin in freeze-dried blood from steers fed Pimelea was below the detection limit, despite steers exhibiting characteristic signs of Pimelea poisoning. Overall, the animal trial showed evidence of bentonite-fed steers to be resistant against Pimelea poisoning compared to biochar and inoculum treated steers while simplexin was below the detection limit in freeze-dried blood.

Reference

Fletcher MT *et al*. (2014) *Journal of Agricultural and Food Chemistry* **62**, 7402–7406.

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