

Investigating the spread and impact of Indian couch in Queensland and identifying management options for beef producers

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Abstract

Indian couch (*Bothriochloa pertusa*) is a stoloniferous and fast spreading perennial grass of the Old World tropics. Since its early introductions into Australia, it has spread and become a naturalised pasture species. In some situations, overgrazing, often coupled with drought, has led to the loss of native perennial grasses and eventual invasion and dominance by Indian couch. Feedback from producers indicates both virtues and shortcomings associated with Indian couch grass. For example, “it holds soil together”; being able to provide high ground cover and arrest soil erosion, versus “it doesn’t last”; having reduced drought tolerance when compared to native grasses and being a less reliable source of feed. The following paper presents the findings of a Meat & Livestock Australia and DAF funded project. This project has investigated the scope and rate of spread of Indian couch, along with identifying drivers of spread, quantifying landscape function and production impacts, and testing treatment options. The research findings, in conjunction with producer knowledge, will be used to develop best-bet management guidelines for managing Indian couch.

Keywords: Indian couch, grazing management, beef production, tropical pastures

Introduction

Indian couch is a naturalised grass found throughout the eucalypt woodlands of eastern Queensland. It is an invasive, stoloniferous grass that can hold soil together, but threatens to replace desirable 3P (Productive, Palatable, Perennial) grasses. Different aspects of Indian couch invasion in pastures are being investigated by a project (B.ERM.1105) jointly funded by Meat & Livestock Australia and Department of Agriculture and Fisheries (DAF). This paper addresses the scope of Indian couch invasion, drivers, and rate of spread. Which is then followed by an examination of landscape function and production impacts of Indian couch. Each section initially explores the literature and expert opinion, and then presents project findings. The final section outlines how the project is developing Indian couch management options for beef producers. This includes the synthesis of information that incorporates producer feedback collected by the project, which will be used to identify Indian couch best-bet management options across three Queensland Reef Catchments: Burdekin, Fitzroy, and Burnett-Mary.

The scope of Indian couch spread

Indian couch can be found across northern Australia, including grazing lands, road reserves and National Parks. Early reports of Indian couch expansion in Queensland were in the order of 0.8 million hectares (Walker and Weston 1990) and were occurring in parts of coastal and sub-coastal north Queensland where native Black speargrass (*Heteropogon contortus*) was being replaced by Indian couch under heavy grazing.

The current project assessed the potential invasion area of Indian couch in Queensland. Rapid road survey and assessment of Indian couch occurrence in nearby paddocks for the Burdekin, Fitzroy, and Burnett-Mary catchments were undertaken. From a total of 571 survey points Indian couch was present on 263 occasions. Historical data sets (DAF land condition and pasture monitoring and 'Living Atlas of Australia') were used to extract Indian couch presence data. This data was spatially mapped using ArcMap, and grazing land management land type data associated with these sites was extracted from the GIS layers. Extrapolated Indian couch invasion areas, based on land types, were mapped using the most current land type mapping and validated with current project data to identify land types with known Indian couch occurrence. The land types included brigalow, scrubs on shallow and deep clays, box country and box on clay, all basalt, goldfields, ironbark and bloodwood on non-cracking clay, and silver-leaved ironbark on cracking clay. The project assessed the potential invasion area of Indian couch in Queensland to be in the order of 14 million hectares.

Drivers and rate of spread

Early reports of the rapid colonisation of Indian couch in north-east Queensland were aided by drought and overstocking (McKeon *et al.* 2004). Indian couch monocultures now exist throughout this area. The spread of Indian couch is facilitated by grazing (Lebbink 2020) and exacerbated under heavy stocking rates (Peter O'Reagain, *pers. comm.*). Further reports of its spread include pastures in central Queensland, with invasions being typically symptomatic of declining fertility and high pasture utilisation (Stuart Buck, *pers. comm.*). Additionally, Indian couch is known to establish between inter-tussock gaps of pastures during wetter years (post drought) before native species have time to recover, hence established Indian couch plants are then able to outcompete later establishing native plants (Ash *et al.* 2011).

Historical QGRAZE sites were resurveyed, as per QGRAZE methodology (Back 2005), to compare current records with past records to further explore the drivers and rate of spread of Indian couch. QGRAZE is a long-term monitoring system that was implemented by DAF in 1991 to monitor pasture condition and measure pasture species change of grazing lands in Queensland. Sites were selected across the Burdekin and Fitzroy catchments to give a range of historical Indian couch frequencies from 0 to 75%. This was possible for the Burdekin catchment, with more sites to choose from and levels of Indian couch frequency across different land types. In the Fitzroy catchment, sites on the same land types were selected that had Indian couch present (frequencies <5%) and absent.

Twenty-two sites were resurveyed in the Burdekin and Fitzroy catchments: eleven sites per catchment. The change in Indian couch frequency (%) across all sites was assessed according to different change categories for Indian couch frequency: Absent, Decrease, Low-Medium (L-M) increase, and High (H) increase. An increase up to 25% was classed as a L-M change and an increase in Indian couch frequency >25% was classed as a H change. Given the low number of sites in each of the change categories, some categories were combined for analysis. The Absent or Decrease were categories combined into one category. The sites in the change category L-M or H were also combined into another category. For each of the Burdekin and the Fitzroy catchments, a two-sample binomial test

showed the proportion of sites in the change categories L-M and H combined (8 of 11), was significantly different from that of the combined Absent/Decrease category (3 of 11) (P -value=0.033).

The project is yet to discuss with landholders these findings and understand how they relate to management and climate histories.

Landscape function impacts

Indian couch plants can quickly spread over bare soil by stolons that root at the nodes to grow a network of plants. The issue with Indian couch is a double-edged sword. On one hand Indian couch can provide high ground cover and arrest soil erosion, being ideal for soil conservation purposes. On the other hand, Indian couch is a perennial drought-evading plant, having reduced capacity to withstand long periods of drought relative to other perennial grasses (Whyte 1968) and therefore its cover is unreliable. Nonetheless, pastures dominated by Indian couch have been reported to produce less run-off and soil loss than those dominated by native tussock grasses, when compared at the same level of cover (Scanlan *et al.* 1996). However, Bartley *et al.* (2014) indicated that increases in deep rooted perennial grasses are needed to reduce total annual runoff and sediment yields.

To better understand the existing knowledge, the project ran an Indian couch Think Tank with DAF and CSIRO rangeland specialists. Knowledge gaps were identified, including the impact of Indian couch on soil function and biodiversity, water infiltration and run-off and the contribution of litter to landscape recovery. Anecdotal observations indicate that there is very little litter cover provided by Indian couch pastures and the litter is not well retained when compared to native grass pastures. Additionally, the question of whether Indian couch causes a decline in land condition or invades a landscape as a result of declining land condition was highlighted. Furthermore, it was agreed that the assessment of landscape function impacts of an Indian couch dominated pasture relative to an intact native pasture would be confounded by management. The project aimed to answer a specific question and in doing so uncovered many unanswered questions on the effect of Indian couch on landscape function.

Production impacts

An early study conducted by Jones (1997) in north Queensland on a grey sodosol soil showed that although Indian couch had similar nutritional qualities relative to native grasses, yields and steer gains were higher under heavy grazing. Production differences under light grazing could not be ascertained, as field conditions did not allow for this. In addition to this scientific work, producer anecdotes were also reported, with producers nearer the coast not being averse to Indian couch, but those in drier areas concerned about production losses during drought.

To investigate the production impacts of Indian couch, the current project established five native pasture and Indian couch 'paired' sites: two in the Burdekin catchment and three in the Burnett-Mary catchment, covering a range of soil types and geologies. For each pairing, sites were either adjacent or within very close proximity to one another, with similar, if not the same, rainfall conditions. Detailed pasture measurements were collected over two years (2018/19 and 2019/20) as per the Swiftsynd protocol (Day and Philp 1997). In the Burnett-Mary area, an assessment of the peak yields for Indian couch relative to native pastures showed an overall production loss of 12%. The order of magnitude difference was associated with soil type, with production losses of 23% on black basaltic soil and 38% on brown basaltic soil. A production gain of 11% was shown for Indian couch on a lighter textured soil (gradational loam), although high levels of legume were also contributing to yield. In the Burdekin area, production gains based on peak yields for Indian couch relative

to native pasture were 48% on a sedimentary red earth and 11% on a red basalt soil. However, results were confounded by the presence of native 3P and other grasses growing in the Indian couch site on the sedimentary soil, as well as Indian couch growing in the native site on the basaltic soil.

Management options

This project is collecting feedback from producers in the Burdekin, Fitzroy, and Burnett-Mary catchments using a series of producer group workshops. The workshops are designed so an exchange and discovery of information occurs. In brief, research findings are presented to producers, such as those presented in this paper. Producers are then split into smaller groups to workshop specific Indian couch management questions. The small groups then report back, and a final discussion takes place to ascertain the key learnings.

Other research findings presented to producers include the results from controlled seed ecology trials and separate student projects that have taken place. One study has shown Indian couch is not sensitive to grazing, with grazing treatment alone not being enough to control the spread of Indian couch (Macor 2019). Controlled seed ecology studies have shown Indian couch seed to be a long-term persistent seed (Simon Brooks, *pers. comm.*), have moderate field viability (50-70%; Shane Campbell, *pers. comm.*), and lack a hard seed coat; with possible higher susceptibility to fire when compared with native pyrophytic plant *H. contortus* (Cuzens 2020).

An amalgamation of all information will be used to identify best case options for managing and controlling Indian couch invasion in pastures. A key factor to developing management guidelines is the consideration of a range of options to suit the many different circumstances that exist. A 'brains trust', made up of producers and scientists, will be used to test the management options identified by the project. The project has identified five themes to present to the brains trust: prevention, reduction, reversal, management of well-established Indian couch pastures, and control where targeted elimination is preferred.

Conclusions

Indian couch continues to spread throughout Queensland's grazing lands, with a potential invasion area in the order of 14 million hectares. This represents 50% of the combined area of the Burdekin, Fitzroy, and Burnett-Mary catchments. Further spread of Indian couch will only lead to more opportunities for this grass to replace original species under grazing and a transition to a less reliable feedbase which is more susceptible to drought. This in turn could have deleterious effects, both economic and ecological for Queensland rangelands. Future validation of Indian couch best case management options will assist in learning how to halt the spread.

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Conflicts of Interest

The authors declare no conflicts of interest.

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