Navua sedge research and development prospectus

FNQROC Navua Sedge Select Committee

September 2019

Contents

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All communications to t.sydes@fnqroc.qld.gov.au

Background

The Navua Sedge Select Committee is a Board directed initiative of the Far North Queensland Regional Organisation of Councils (FNQROC). The select committee was established to collate a universal understanding across councils of the opportunities; obligations; resource requirements; economic impacts and control biology relating to Navua sedge to better inform the commitments local government make in both the short term and long term.

The Select Committees primary purpose was to develop a Navua sedge research and development prospectus outlining key gaps knowledge and management tools which could be addressed through research or science and management knowledge sharing.

In addition to this the FNQROC independently compiled a series of recommendations for local government on options and approaches to management to be considered in a regional context.

Purpose

This research and development prospectus outlines knowledge and information requirements and gaps across the themes of understanding impacts; invasive biology; control biology; herbicide; weed hygiene and risk management ; and management strategies & tools; for the management of Navua sedge.

The prospectus is intended to assist local governments and partners direct their future investment into the highest priority research and communication activities; equally the prospectus might assist identify further opportunities for industry and partners to continue field trials and investment.

Acknowledgements

The select committee would like to thank the landholders and industry experts who gave freely of their time to share their experiences and insights into the impacts and management of Navua sedge.

Select committee process

The select committee process was conducted over a 12 month timeframe. The committee was comprised of local government representatives from Cassowary Coast, Hinchinbrook and Tablelands including elected representatives, senior managers and operational/coordination level alongside policy and research representatives from Biosecurity Queensland (appendix 1).

The primary business of the group was to receive deputations from relevant stakeholders and subject experts from research and industry sector representatives and landholders (appendix 2). The conversations enabled individual stakeholders to table relevant observations, experience, technical advice and recommendations to the committee for consideration. The outcomes of these expert conversations were then collated and summarised prior to tabling to the FNQROC Board for endorsement. The process for the establishment and delivery of the committee is outlined in sequence below:

Select committee establishment

- Select committee scope of enquiry endorsed by FNQROC Board.
- Select committee nominations sought from participating councils.
- Terms of Reference and sitting process established by select committee.
- Stakeholder and subject matter experts identified by select committee.

Select committee sitting one

- Stakeholder and subject expert conversations.
- Select committee summary process.

Summary and collation of outcomes

- Feedback from stakeholders and experts.
- Feedback from select committee.

Submission to FNQROC Board

- Endorsed by the FNQROC Board, 9 December 2019

Understanding impacts

The select committee were presented with a wide range of general productivity, economic and environmental impacts from Navua sedge which would benefit from further quantification. Establishing clear metrics around the nature of these impacts and their interactions is probably most effectively delivered through a benefit-cost analysis relevant to the impacted sectors. Outcomes of the analysis could provide direction to strategic management on-ground through the provision of a stronger evidence base.

Research brief	Rationale
General A range of key questions relating to the impacts of NS on production in both grazing and sugar cane production remain unanswered or are not able to be quantified. **Environmental** Impacts on environmental areas and assets in current range and potential range are not known or anecdotal. **Economic** Impact of NS nematode relationship on rotational cropping (i.e. root crops and fallow legume crops) is not known. Impacts on real estate value of agricultural land in impacted areas are not known or anecdotal. Councils are very interested to understand the most effective means of responding to NS in lands and corridors in their jurisdiction. A range of hidden/unknown costs and future risks are anticipated by industry but not well understood. **Mental Health** In the course of the conversations with industry representatives and individual landholders it was clear that the complexities of NS impacts and management are likely to contribute to stress and subsequent mental health issues.	**General** Quantifying NS impacts in economic, productivity and land value terms would assist design management approaches; inform benefit cost analysis and provide solid figures for strategic planning and decision support. **Environmental** There may wider regional/state risks which can be mitigated if likely impacts on environmental assets are identified or understood. Current options for selective control of NS in the Wet Tropics pose a risk to aquatic ecosystems (if label conditions are not adhered to). Flow on impacts from increased herbicide use may have implications for water quality/GBR and product regulation. **Economic** Land value impacts have local and regional implications. Crop diversification in the cane industry might be impeded by productivity or crop compatibility impacts posed by NS. The impact on pasture (for grazing) is not fully understood. Further economic evaluation is required. **Mental Health** Social impacts such as mental health are not often considered in the development of management strategies for invasive species management. They are an important consideration and could also be included within benefit: cost analysis; or within health related studies within the impacted sectors.

Key themes for investment

Economic or productivity focused research or data compilation regarding:

- Productivity/ viability under different densities and management regimes.
- Impact across different land uses.
- Devaluation risk for impacted properties.
- Productivity loss.
- Tipping points.
- Linear impact.
- Additional costs.
- Potential impacts of NS on future crop diversification in cane lands.
- Bundled or accumulative costs of management.

Environmental or economic research could inform risk management regarding:

- Direct impacts on environmental assets (inside and outside of current extent).
- Flow-on impacts to water quality/aquatic biota/GBR and related herbicide risk.
- Land value impacts in rural land.
- Crop diversification impacts in cane industry.

Opportunities should be sought to:

- Include NS related health considerations in any rural studies or support programs.
- Identify support programs in other management examples (GRT, prickly acacia) where invasive weeds are known to contribute to or compound social welfare or health issues.

Invasive biology

Navua sedge exploits many strategies which make it a highly successful invasive plant and a complex management target. These include broad habitat suitability in tropics, rapid seed to maturity rates, prolific seed production, long seed longevity, easily dispersed seed, resistance to herbicide (particularly in mature plants) and ability to compete with pasture above and below ground. Given the complexity of NS as a management target continuing and expanding investigation and trials into habitat preferences and response to management could assist to design strategies to better understand NS's key traits in order to either exploit or avoid the cultural requirements of the plant. There are a range of opportunities to make management gains by communicating current management knowledge and observations; or by continuing development and expansion of new knowledge, tools and technology.

Research brief	Rationale
Invasive biology Environmental and production parameters (and their interactions) which guide habitat preference are not well documented or understood. Invasive biology and integrated management options are not well documented or articulated into practical information for producers and land managers. The development of long term management strategies requires a complex level of integration to be effective at a property level. New tools which deploy emerging technology in detection and treatment might assist manage risk in production systems. The seed longevity of NS in water is not known or understood. Some managers run both and cane and cattle production and may have insights to bridging knowledge between impacted industries.	**Invasive biology** A more detailed understanding of environmental parameters will have practical and strategic application across risk management and the application of control programs. Complex decision making is required by producers to design and implement long term strategies to manage risk and maintain productivity concurrently; targeted synthesis and communication of management tools will assist to inform these decisions. New tools and technology could be integrated into current management approaches. Seed longevity is an essential attribute to inform management and spread prevention strategies. Knowledge sharing between the cane and grazing industry may assist to identify new approaches to management.

Key themes for investment

Applied research and management communication is required to:

- Identify environmental and production/management parameters which assist or impede NS establishment.
- Synthesise current management knowledge and strategy into end-user specific decision support tools.
- Test feasibility of remote sensing, AI and UAV in delivering management strategies at a property scale. (Roadsides could benefit from similar applications).
- Species distribution and habitat suitability models could provide some level of risk forecasting for regions, locations beyond the current extent of NS.
- Identify effective soil health, pasture management and vegetation/infrastructure management (roadsides) to suppress ND growth or reduce habitat suitability.
- Establish seed longevity in water; and subsequent dispersal risk/potential.

Extension or engagement opportunities exist to:

- Compile or share knowledge of management approaches and strategies across the cane, grazing, horticulture, road side and reserves.

Control biology

Although it is broadly accepted that new herbicide control tools will assist in NS management, it was also identified that a range of knowledge and practice gaps exist in the use of current herbicides in tandem with other management strategies. Articulating field based technical knowledge into extension materials and decision support products could assist to deliver better efficacy out of current tools. Communication of control biology may also assist producers identify new management tools and approaches during different life cycle stages of NS and at different management/production scenarios.

Research brief	Rationale
Control biology The current suite of herbicides available to industry requires supporting information and management decision support products to be effective. Investigation into the relationships and interactions between soil health, habitat suitability and herbicides is in its early stages but is considered by most to be of high importance given the highly competitive and successful strategies of NS as an invasive plant. NS requires current management practice to extend beyond business as usual into a more informed and proactive management context. Promise is shown in biocontrol options for Navua sedge; this is considered by most as a high value investment which could return significant benefits to management.	Long term management currently depends on intuitive and risk-based decision making which is likely to be more complex than what many traditional or established management approaches can accommodate. Management of NS requires a redesign of production systems and management of infrastructure. In cane production the control of NS cannot be incorporated into existing weed control regimes and requires a supplementary herbicide application. Biocontrol has progressed beyond proof of concept and in the long term may provide an essential control tool to reduce the impact of Navua sedge across multiple land uses.

Key themes for investment

Synthesis of current research and management tools and approaches is required to:

- Support industries and sectors to develop decision support tools or approaches relevant to risks and practices in their area of operation.
- Synthesise herbicide application regimes into integrated management extension tools.

Applied research and control biology communication is required regarding:

- Herbicide efficacy
- Managing withholding periods
- Controlling mature plants
- Controlling seedlings
- Allelopathy
- Selectivity

Ongoing applied research is required:

- To identify and develop biocontrol options to support current management efforts.

Herbicide

The lack of effective and industry compatible herbicides consistently rated as the most significant impediment to management in the grazing industry in conversations with the select committee. Developing complimentary or new herbicides to work alongside halosulfuron and glyphosate would broaden the toolbox for effective management; and reduce the current level of exposure to off-target and misuse risk currently faced by the industry.

Research brief	Rationale
Herbicides and registration Current withholding period for halosulfuron is an impediment to management in the grazing industry. Not having a universally effective herbicide is a significant impediment to management. Management of mature plants (stools) is a specific challenge for current herbicide tools. The cane and cattle industry have different approaches to herbicide use. BMP use of herbicide is not always adhered to due to the efficacy and limitations of current registrations. Herbicides, control options and management approaches present significant challenges to land managers.	Landholders universally identified lack of effective herbicide options as a significant barrier to management. New product registrations are sought as a matter of urgency by most producers. There are risks associated with off-label use and application of currently registered herbicides. Current herbicide options do not satisfy the management needs of producers.

Key themes for investment

Applied research is required to:

- Identify and register a range of complimentary herbicides suited to management context and land use.
- Optimise herbicide efficacy in control of mature plants.
- Reducing the current 10 week withholding period for halosulfuron through evidence of tissue (fat) persistence in stock rather than environmental persistence.
- Identify and address the current exposure of risks presented by off-label product use.

Weed hygiene and risk management

The prolific production and longevity of Navua sedge seed presents a range of challenges for managers in both keeping it out of production systems and managing spread risk within property boundaries. Risk of spread during control activities is particularly high and is further compounded by issues with access during the wet season growing period. Developing clear guidelines and advice on existing knowledge of seed longevity, stock gut passage times and hygiene practice would assist to reduce some of these risks. Further studies into seed dormancy, dispersal in water and successful hygiene strategies could further refine risk management. Investment into new survey and control tools from remote aerial platforms may assist some management situations where wet season access is difficult; or where weed spread by control vehicles is significant.

Research brief	Rationale
Weed hygiene and risk management Current weed hygiene strategies and implementation are not adequate to address the risk faced by many producers; spread within property boundaries, by stock, or during management activities is particularly difficult to manage. Effective gut passage times are not currently guiding hygiene and quarantine of stock to the extent they should. Fodder poses a risk which is not currently addressed effectively; interregional transport of fodder poses a transmission risk; fodder production systems are at risk to NS impacts. There are significant gaps in capacity and tools to aid early detection and response which is essential to prevent rapid escalation of unmanageable densities.	Pre boundary and post boundary hygiene risks require different strategies to manage. Roads and watercourses present significant hygiene and vector risks and are a primary concern to landholder with clean paddocks or low densities. An increased knowledge of forecasting and managing risks would better support early action and intervention in many situations. NS produces significant quantities of long-lived seed; current strategies to manage the risk are not adequate to prevent spread.

Key themes for investment

Practical guidelines are required to assist producers/land managers design and implement effective weed hygiene measures detailing:

- Seed gut passage times.
- Spelling periods required prior to sale or introduction of stock.
- Strategies to reduce hygiene risks within internal boundaries.
- Spread risk on machinery and during slashing operations.
- Linking hygiene to infrastructure (access, fencing management) and new control tools (aerial or UAV platforms).
- Develop clear guidelines for management of spread via gut passage (sale/spelling of stock) and production/ transport of fodder.

Identify/facilitate/resources and opportunities for:

- Knowledge and practice exchange across cane and grazing industries.

Management strategies and tools

Using current herbicides to control Navua sedge in pastures requires both spelling and withholding of stock. This requires careful planning across a range of time scales because efficacy is strongly influenced by timing of application and target plant health. It is therefore crucial that management regimes are well planned in advance and the down-time in production is anticipated. The current registration of halosulfuron Sempra ™ is supported by NuFarm's grazing pasture manual which provides direction on its use for this purpose. However even with this detailed interpretation of label recommendations there are many variables which might influence success of control efforts and many scenarios where herbicides might be used. There is scope for development of a much more extensive control manual (or sector specific manuals) which incorporates the full range of herbicide, cultural and pasture (or other desirable vegetation) management considerations and cues for each of the sectors managing Navua sedge. In addition to the technical considerations of management there is a strong case for the inclusion of decision support tools which can aid in optimising management regimes to deliver the least impact on production or ensure costs are relative to the benefits they deliver.

Research brief	Rationale
BMP and strategic management It is likely that some issues with the efficacy of current herbicides are the result of timing of application or knowledge gaps in the role of target plant health; herbicide mode of action; and interactions with other management regimes. Pasture and soil health management approaches and knowledge to mitigate the impacts of NS are in early stages of investigation; this is of significant importance to accredited chemical free producers. NS management has many variables. Gaps in applied and technical knowledge are obstacles to management.	More comprehensive and applied knowledge of herbicide mode of action, fate, efficacy, application and timing is required for effective use of current tools. Pasture management is crucial to NS suppression and resilience to invasion; however hygiene protocols must be used alongside the full suite of management tools. Long term management planning tools and applied information would assist graziers and growers.

Key themes for investment

Communication of applied technical information regarding;

Control biology in herbicide managed situations

- Application.
- Timing.
- Mode of action.
- Target plant health.
- Target plant life stage.
- Herbicide flower/seed interactions.
- Managing off-target and off-site risks.

Pasture management

- Pasture health/competition.

Strategic management

- Risk reduction.
- Prevention strategies.
- Integrated management.

Management strategies and tools continued

Research brief	Rationale
Management strategies, tools & approaches for landholder/managers There are significant challenges for graziers in balancing the benefits and costs of management with the benefits gained in productivity. There are a broad range of management tools and approaches in development, under trial or in use across a range of land uses and localities. There is a risk that effective tools and approaches and prerequisite risk management is not in place because of lack of easily accessible information. Landholders require more support from within industry to implement effective control strategies; impacts from NS go beyond production and extend to mental health and welfare issues for severely impacted producers. Application of emerging management tools in AI, UAV and remote sensing present some opportunities to improve management outcomes in grazing systems.	NS poses a wicked problem for graziers (once established). Current label rates equate to 20-30 weeks spelling of pastures - there are very few producers who can meet the regime required by label rates and return a profit in the short term; however if the pasture is not restored then the productivity is not viable in the long term. There are a range of best practice approaches and options for management of NS but they require resource levels beyond the means of many producers. There are tipping points or thresholds at which economic/productivity recovery is potentially not feasible/possible. Remote survey, detection, and herbicide application could reduce spread risk within impacted properties by removing ground-based traffic (elements of this work may also have application in cane production and roadside management). Bringing current management tools and approaches into more readily accessible forms will aid to; • Communicate and maintain currency of best management practice. • Support extension activities which are currently heavily reliant on individuals in the industry. • Enable the transfer of cross-sector knowledge, management approaches and tools.

Key themes for investment

Industry support is required to maintain or build networks to provide technical and peer support across producers.

Applied research or professional assistance is required to assist producers:

- Identify, test and apply AI, UAV and remote sensing technologies into management and monitoring.
- Make informed decisions regarding management options which require de-stocking of production areas.
- Understand the compound stresses and subsequent risk of welfare and mental health issues imposed by significant NS management issues.
- Provide support for industry champions to deliver extension and communication across industry.

Synthesis of current research and management tools and approaches is required to:

- Develop sector specific best management practice manuals. (Cattle, cane, council).
- Develop new and novel approaches to management which are able to integrate new technologies and tools with current BMP.
- Assist landholders in designing and optimising long-term management strategies.
- Develop landholder/land use relevant tools or techniques which can aid in early detection and rapid response to incursions in production systems before they escalate to infestations.
- Continue to build on a community of practice amongst industry to ensure latest developments and BMP is communicated across impacted sectors.

Appendix one – Select committee representatives

Beck Morello	Biosecurity Queensland
Councillor Jeff Baines	Cassowary Coast Regional Council
Councillor Kate Milton	Hinchinbrook Shire Council
Damon Sydes	Cassowary Coast Regional Council
Matt Buckman	Hinchinbrook Shire Council
Scott Morrison	Tablelands Regional Council
Travis Sydes (Chair)	FNQROC
Tudor Tanase	Tablelands Regional Council
Wayne Vogler	Biosecurity Queensland

Appendix two – stakeholder expert panel

Bernie English	Qld Dept. Agriculture & Fisheries
Brett Scott	Cattle producer and cane farmer, Hinchinbrook
Greg Binney	Cattle producer, Tablelands
Kunjithapatham Dhileepan	Biosecurity Queensland
Lawrence Di Bella	Herbert Cane Productivity Services Ltd.
Lionel Fuller	Cane farmer, Hinchinbrook
Peter Sheahan	Cattle producer, Hinchinbrook
Rob Pagano	Cattle producer, Tablelands
Scott Morrison	Tablelands Regional Council
Wayne Vogler	Biosecurity Queensland