

Indigenous Food Research Park

Native grains update – December 2021

Welcome to the third and final newsletter for 2021. Another year of challenges and changed circumstances. Along with lockdowns and travel restrictions we have had mild temperatures and great rains which has been great for plant and animal life alike.

While Angela Pattison has been on maternity leave, the Grasses for Grains team has been following up on her great work with presentations, student projects and grant proposals. Read on for the details.

In the news...

Aunty Kerrie Saunders has continued to develop her native grain threshing and grinding knowledge and skills which were recently showcased at the Wuyagiba Bush Study Hub and with a superb short video:

<https://www.facebook.com/hashtag/goodforcountrygoodforpeople>



Left: Darren Swain, Russell Stewart, David Thompson, Nathan Axelsson, Kerrie Saunders (Yinarr-Ma), Les Knox (local Elder) and Angela Pattison sitting down to a lunch of homemade salad and native grains bread at The University of Sydney, Plant Breeding Institute, Narrabri Courier

<https://narrabricourier.com.au/2021/12/13/local-native-grains-team-looks-to-the-future/>

Right: Kerrie Saunders, Ellen Wong, Fran Abedi, Angela Pattison, and Ali Khoddami displaying their native grains food creations, Narrabri Courier

<https://narrabricourier.com.au/2021/04/06/native-grains-project-draws-on-traditional-knowledge-modern-research/>

Presentations...

Tina Bell and Rebecca Cross presented to WA Landcare Network in February. You can find the details here with a link to the recording provided in the document:

<http://www.landcarewa.org.au/wp-content/uploads/2021/02/WALN-Landcare-Checks-In-8-Feb-2021-Native-Grasses-1.pdf>

Rebecca Cross joined with Bruce Pascoe for the Climate Action Show in June on Community Radio 3CR. Their presentations were under the banner of Regenerative Land Management – The Sustainable Way. The show was produced by Kay Wennagelec.

<https://www.3cr.org.au/climateaction/episode-202106211700/bruce-pascoe-and-rebecca-cross-regenerative-farming>

As part of National Science Week, Kamillaroi/Gomeroi woman and bush tucker expert Kerrie Saunders shared her knowledge together with Gumbaynggirr descendent and RMIT PhD candidate Luke Williams and Worimi man, farmer, and academic Joshua Gilbert on bush tucker. They were part of an online panel event presentation by the ACT National Science Week Coordinating Committee and the Royal Society of Victoria, hosted by Gamilaraay astrophysicist Karlie Noon.

Claudia Keitel took part in the first virtual Sydney Centennial Parklands Science Week event “From Swamp to Scrub”, a beautiful virtual tour from Sydney’s East to West aimed at 5 to 10-year-olds and their families. Her video was an interview about the team’s work on Native Grains and was viewed about 200 times. Claudia was also invited to contribute the Indigenous Science Week online webinar on Global Indigenous Engineering together with David Harrington, and presented similar content, but aimed at adults. More than 120 people attend the webinar from Australia and overseas. Unfortunately, these events were not recorded or do not remain online, so we can’t share them with you.

Ali Khoddami presented our work (virtually) at the 71st Australasian Grain Science Conference (AGSA 2021) in August. The Australasian Grain Science Association provides a forum for Australasian grain scientists, students, nutritionists, and others with an interest in grain science, to advance the knowledge and understanding of grain science and the grain industry. It serves individuals in the grain food and allied industries, the agrifood sector, research, and education (<https://www.ausgrainscience.org.au/>). The abstract is presented below.

Nutritious Australian native grains and their potential application in the western diet

Ali Khoddami, Claudia Keitel, Tina Bell, Rebecca Cross, Angela Pattison

The grain from Australian native plants was an important part of traditional Aboriginal diets. However, the introduction of new agricultural crops to Australia by British settler-colonisers and their ongoing genetic improvement, as well as traditional owner’s exclusion from land and resources, has heavily reduced the utilisation of native plants by Indigenous people, and native grains have generally been overlooked in Western agricultural systems.

Australian native food plants are biodiverse, largely perennial, and can tolerate different environmental conditions such as heat and drought. There is enormous potential for them to have an impact on the Australian grain industry through their incorporation as a sustainable, regenerative, and low-input alternative into the current grain production system.

As part of a recent initiative by the University of Sydney (‘Native grains from paddock to plate’), a team of researchers from different disciplines worked with local Aboriginal communities around Narrabri to identify the best harvesting and threshing techniques for a range of native grains of various morphologies and grain sizes. Moreover, nutrient profiles, milling quality, and incorporation of a proportion of native grain flour into food products (bread) have been tested.

Several Australian native grains demonstrated valuable properties, such as good sources of protein, fat, fibre, and minerals. The incorporation of flour from native grains into bread also displayed encouraging physical properties. The output from the current research has the potential to benefit Australian farmers, consumers, and, most importantly, Indigenous communities and Country.

Tina Bell presented our work (virtually) on germination of grass seed at the Australasian Seed Science Conference 2021 in September (<https://seedscience2021.com.au/>). The abstract is presented below:

Native grasses as a traditional and emerging source of food

Tina Bell, Angela Pattison, Claudia Keitel, Ali Khoddami, Rebecca Cross

Grain from native Australian grasses have been used by Aboriginal people as a source of nutrition for millennia. Paradoxically, we are only just beginning to realise the potential of bringing native grasses into modern agroecosystems, food markets, and diets. Our recent research involved a paddock-to-plate approach including collecting information about the entire marketing chain – harvesting, threshing, and milling grain, and creating and marketing food products – for a range of edible native species, including grasses. Adding to the compendium of information being amassed for native grains, we also measured the nutrient profiles of selected species and tested their flour properties and performance in baked products.

For seed germination studies we investigated the effectiveness of pre-germination treatments – heat, aerosol smoke and soluble compounds in smoke – that can be applied easily in-field and are cost-effective (e.g., burning prepared areas). We found that method of seed collection, storage and provenance all have a role in germination success of native grasses. While some of this information about seed germination requirements may not be new, the reinterpretation of such knowledge for growing and harvesting seed using alternative farming options (e.g., polyculture or ‘food ecosystems’) is critically important.

As the potential of a native grain industry unfolds, a critical element is to acknowledge the cultural importance and understanding of local plant species of local human communities. We are doing this by involving local Aboriginal communities around Narrabri, NSW in all aspects of project design and management, and reporting of results as they emerge. This type of engagement is equally as important as the findings of our research to the scientific community and more widely. The aim is for this new knowledge to be used by Aboriginal communities to establish native grass enterprises to generate economic and social opportunities.

Rebecca Cross has had an incredible run of presentations recently where she has discussed our Native Grains work. These seminars are important for raising the profile of our work allowing other groups to see what we have achieved so far and the huge potential that lies ahead. For example, in 2021, we have been approached by convenors of the EPIC CRC, Plant Food Manufacturing CRC, and the One Basin CRC to discuss the potential of being involved in these large interdisciplinary funding bids.

- Rebecca Cross and Naama Blatman (October 2021) ‘Indigenous land practices and reclamation across the urban-rural divide’, School of Geosciences Thinking Space Seminar Series.
- Caves S & Cross R (November 2021) ‘Loosening the grip of settler-colonial agriculture’, IAG Rural Geography Study Group Seminar.
- Rebecca Cross and Katie Moore (November 2021) ‘The Development of the native grains consortium’, Poche Centre Annual Showcase.

Indigenous land practices and reclamation across the urban-rural divide

Rebecca Cross and Naama Blatman

Land rights are crucial to recognizing and enacting processes that advance Indigenous sovereignty in Australia. In giving back land, land rights affirm Aboriginal cultural authority and protocol, afford certain political power, and enable economic enterprise and community development for Aboriginal landowners. The NSW Aboriginal Land Rights Act 1983 saw the formation of the Aboriginal Land Council of NSW and of Local Aboriginal Land Councils (LALCs) who hold and manage reclaimed land as its proprietors.

The work of LALCs in managing and activating land has specific geographic attributes in rural versus urban areas. At the same time, there are similarities between these contexts that are derived from the nature of the Land Rights Act and the historical and contemporary realities of Aboriginal communities in NSW. In this presentation we explore the limitations and opportunities for economic and cultural self-determination afforded via land rights by looking at the strategies of and emerging opportunities for two LALCs, one located in Western Sydney focused on residential and mining development, and the others in NW NSW focused on agricultural development of native grains. In so doing, we surface some of the political challenges prompted by the Aboriginal Land Rights Act and consider our own positionalities and roles as non-Indigenous academics working in this space.

Research...

A review by Anna Drake, Claudia Keitel and Angela Pattison has recently been published in *The Rangeland Journal*. A literature review from Anna's Honours research work formed the basis of this publication:

The use of Australian native grains as a food: a review of research in a global grains context

<https://doi.org/10.1071/RJ21030>

Australian native grains have an extended history of human consumption; however, their place in diets was disrupted when colonisation triggered a shift away from traditional lifestyles for Aboriginal people. Despite being time- and energy-intensive to harvest, the inclusion of native grains in diets is thought to have offered considerable adaptive advantage by assisting human occupation of arid and semiarid zones. Ethnographic evidence has shown that Aboriginal people developed specialised tools and techniques to transform grain into more edible forms. Research on native grain consumption has mainly been conducted from an ethnographic perspective, with the objective of furthering understanding of Aboriginal societies, instead of the agricultural or food science significance of these plant species. Consequently, a research gap in all aspects of Australian native grains in modern food-production systems from the paddock to plate has emerged and is being filled by research projects in multiple parts of the country due to surging interest in this food system. There is a critical need for Aboriginal communities, land managers, food industry professionals and research institutions to come together and set a research agenda that ensures cultural protocols are respected, research investment is not unnecessarily duplicated, and the results are targeted to places where they will be of most benefit to people and the planet.

There have been several Honours and Master research projects that commenced or were completed this year. Olivia Burges started her Master of Agriculture and Environment project with Tina Bell and

Malcolm Possell in June 2020 and completed in July 2021. The details of her research are summarised below:

An analysis of chemical characteristics found in Australian bushfire ash and their effects on native grass germination

Olivia Burges

Australian native grass species are well documented for their low germination success and are often characterised as needing fire cues to stimulate this growth. As the likelihood of bushfires is increasing due to climate change, understanding these fire cues is integral to the regeneration of Australian native grasses. The effects of heat and smoke on seed germination have been researched to varying degrees, however, the effects of ash have not been researched in detail. This project aimed to fill this gap in knowledge.

Mixtures of leaf litters was burned under controlled settings to produce ash samples. These were then examined to find any patterns in chemical characteristics. It was found that pH and electrical conductivity (EC) both increased with the ratio of smaller decomposing litter in the ash mixtures. However, elemental analysis was less obvious. Carbon content followed similar patterns to pH and EC, however differences in nitrogen were not easily identified. Calcium, magnesium, and sodium levels were similar among all ash samples produced.

When the ash treatments were applied to several species of native grasses, differing effects on germination rates were observed. Three of the five species tested responded to ash treatments negatively, resulting in overall low rates of germination. However, one species responded to ash treatments positively with high proportions of germination. Whilst patterns in chemical characteristics were found, they could not be linked to germination with complete certainty. Further comprehensive chemical analysis of ash is required to discern how bushfire ash influences germination of native grasses.



Germination of *Panicum decompositum* on water agar plates made with 'ash solution' (left) and different coloured solutions made from ash resulting from combustion of different mixes of litter – leaves, twigs, decomposing matter (right).

Joshua Geldart completed his Honours research project as part of his Bachelor of Science in Agriculture. He investigated the recovery of four common grass species after cutting and burning. He was supervised by Tina Bell.

Regreening the land: stimulating growth with simulated disturbances

Joshua Geldart

The regrowth capacity of five native grass species was determined by measuring changes in aboveground biomass. Treatments were applied to simulate expected types of disturbance, for example, 'Low Cut' simulated intense grazing, 'High Cut' simulated harvesting of seed or less intense grazing, and 'Cut & Burn' simulated grazing and fire. The study was separated into two trials: a field study, to evaluate the effect of simulated grazing intensities on five palatable native grass species – *Capillipedium spicigerum*, *Microlaena stipoides*, *Poa labillardierei*, *Sorghum leiocladum* and *Themeda australis* – growing in the field; and a pot study to evaluate the effect of cut and burn treatments on three of the five species.

The absolute growth rate (AGR) and relative growth rate (RGR) of each treated plant was calculated, and differences among and within species compared. Other indices, such as root:shoot ratio, specific leaf area (SLA), leaf area index (LAI), and light use efficiency (LUE) were derived; and soil composition, ground area (GA), basal area, solar irradiance (Q) and root biomass were measured. No significant differences were found among species for AGR, implying that each species accumulated similar quantities of biomass per day. The RGR associated with the undisturbed plants was significantly slower compared to the RGR associated with cut plants. No significant differences were found among the cut and burn treatments however they had a higher RGR compared to undisturbed plants. Root biomass was affected by treatments, and root:shoot ratios were higher in cut plants compared to undisturbed plants.

Taken together, this study has demonstrated the versatility of native grasses under conditions of disturbance. This indicates that they would be useful for several purposes; as a supplement or substitute for improved pasture, to improve soil and to reduce erosion in the landscape.



Applying cutting treatments to *Poa labillardierei* at Mt Annan Botanic Garden (left) and 'Low Cut' treatment of *Microlaena stipoides* (right).

Ali Khoddami supervised an Honours research project by Andrea Zanatta as part of her Bachelor of Science and Bachelor of Advanced Studies (Food and Agribusiness) degree.

An investigation on brewing conditions on the bioactive and functional properties of native Australian herbal infusions

Andrea Zanatta

Herbal tea consumption is rising, owing to its bioactive and functional properties, health benefits, and unique fragrances. Herbal tea is often consumed hot or cold, depending on tea type, personal habits, and cultural traditions. It has been established that the brewing conditions directly impact

the bioactive properties and overall tea quality. Ancient Australian plants have recently been re-discovered for their uniquely Australian taste, enhanced functional properties, and prominent antioxidants, offering new solutions as healthy ingredients in tea. Briefly, the research sought to evaluate the impact of brewing conditions (time and temperature) on the bioactive compounds of native herbal infusions, pH, and colour.

Native tea samples from Anise Myrtle (*Syzygium anisatum*), Tasmanian Pepper Leaf (*Tasmannia lanceolata*), Kakadu Plum (*Terminalia ferdinandiana*), Strawberry Gum (*Eucalyptus olida*), and Lemon Myrtle (*Backhousia citriodora*) from different suppliers were analysed at alternate brewing temperatures; 25, 70, 90°C, and at different steeping times; 3 and 10 minutes. Results revealed that brewing at 90°C for a longer brewing time (10 min) led to the formation of native teas rich in bioactive compounds, high in phenolics, and with antioxidant activity. On the other hand, higher temperature created significant changes in colour parameters, which may present technical challenges to manufacturers and consumer acceptability. In addition, significant differences were observed among suppliers; due to critical factors such as environmental growing conditions, the genetic make-up of the plant and cultivar.

This study was the first to research the effects of alternate steeping methods on the bioactive and functional properties of native infusions; however, future research in this area is needed. It is recommended that future studies conduct a comprehensive brewing investigation to determine the optimal brewing time specific to each tea.

Claudia Keitel supervised an Honours project by Anastasia Adinda as part of her Bachelor of Science and Bachelor of Advanced Studies (Food and Agribusiness) degree.

Ancient seeds and ancient fermentation: exploration of Acacia and Kurrajong tempeh

Anastasia Adinda

Despite having many health benefits, Australian native ingredients still only occupy a small portion of the market. The newfound popularity of fermentation and functional foods has resulted in the potential for the application of tempeh fermentation on Australian native seeds. This project is aimed to determine the viability of tempeh fermentation on the seeds of three species of Acacia (*Acacia adsurgens*, *Acacia microbotrya* and *Acacia victoriae*) and Kurrajong (*Brachychiton populneus*). These seeds were inoculated with *Rhizopus oligosporus* spores at 0:1, 1:2, 2:1 and 1:0 native seeds to soybeans ratio. White mycelium was found to grow on the three Acacia species, but not on Kurrajong. *Acacia adsurgens* tempeh was found to have the best growth of mycelium with a significantly whiter exterior (56.6) compared to other 1:0 native seeds to soybean tempeh (30.6-36.1), despite no significant difference in their spore count. On the other hand, microbiological analysis showed that there was a significantly greater Log₁₀ CFU (colony forming units) in tempeh with 2:1 (5.29) and 1:0 (5.31) native seed to soybean ratio compared to the control (4.36). Texture analysis revealed a significant difference in the work required to cut through tempeh with 2:1 native seed to soybean ratio (2.13 N.mm) compared to the control (1.94 N.mm) due to some of the native seeds remaining very hard after cooking and fermentation. In conclusion, Kurrajong seeds were unable to support mycelium growth whereas Acacia seeds showed promise, but still were best used in combination with soybeans to produce tempeh.



Representative samples of pure *Acacia victoriae* (left) and *A. adsurgens* (middle), both demonstrating good mycelium growth, and Kurrajong (right), with poor mycelium growth, after 48 hours of fermentation.

Ellen Wong is an Honours student supervised by Rebecca Cross and Sophie Webber and her cultural mentor is Katie Moore. Ellen presented her research at the Geographical Society of NSW Honours/Master conference in November and was awarded the Jim Rose Award for Best Paper on a Human Geography topic. She also presented her work at the Sydney Indigenous Research Network's (SIRN) conference, 'Garabarala', in November. Ellen has recently started a paid internship with Warndu, a South-Australian based Indigenous-owned native foods enterprise. Congratulations Ellen!

Decolonising food? The political potential of the Australian native food industry

Ellen Wong

This presentation examines the Australian native food industry as a window into settler-colonial relations and processes of decolonisation. Grounded by a decolonial praxis, this research draws on the experiences of actors from Indigenous and non-Indigenous led enterprises to examine the multiple ways in which the native food industry perpetuates and challenges histories and continuities of settler-colonialism. Drawing from interviews with key informants, I show that, presently, the native food industry upholds colonial legacies which have and continue to legitimate the exploitation and dispossession of Indigenous land and knowledges. Although seemingly well-intentioned, non-Indigenous efforts to improve Indigenous ownership and representation in the native food industry often have the perverse effect of perpetuating colonial control. I show that, in resistance to ongoing exploitation, Indigenous actors and "white allies" illuminate the decolonising and Indigenising potential of an Indigenous-led industry in their fight for food sovereignty. In following the tradition of critical decolonial scholarship, I turn the gaze to the responsibility of white actors in the native food industry. I caution against 'palatable' framings of decolonisation which reconcile settler guilt yet do nothing to advance the self-determined agenda of Indigenous peoples. Ultimately, I contend that in order for decolonisation in the native food industry to avoid slippage into metaphor, material transfers of land, capital and political power are required.

Yalu!

The IFRP team