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Native grasses make new products – a review of current and past uses and assessment of potential

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Native grasses make new products

A review of current and past uses and assessment of potential

by Ian Chivers, Richard Warrick, Janet Bornman and Chris Evans

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Native grasses make new products: a review of current and past uses and assessment of potential
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Foreword

The project, ‘Native grasses make new products’ assessed the feasibility of commercially exploiting new products derived from Australian perennial grasses. Although used selectively for targeted purposes such as land restoration, landscaping and lawns, today these grass seeds remain unexploited as commercially cultivated crops for food grains, animal fodder, fish food, nutritional additives, cosmetics, and pharmaceuticals.

There exist more than 1,100 species of perennial grass native to Australia. Before European settlement, these grasses covered vast areas of Australia, but have since been drastically reduced in area, with many species sparsely distributed and representing only a small fraction of their previous habitat. The seeds of many of these grasses are edible and are known to have comprised a significant portion of the traditional Aboriginal diet. Many of the grasses are deep-rooted, drought and heat tolerant and compatible with the natural biodiversity of the region; thus, they have the potential to contribute to Australia’s agricultural productivity in a sustainable way.

Using a supply chain approach, the project sought to identify species of native perennial grass that could be cultivated on a large scale and that possess characteristics and multiple-use properties with potentially strong and unique market value. A First and Second Priority listing of potential native grasses were carried out, and a SWOT analysis done on the First Priority list of grasses.

This report is an addition to RIRDC’s diverse range of over 2000 research publications and it forms part of our New and Emerging Plant Industries RD&E program, which aims to conduct research, development and extension for new, emerging and other core funded plant industries that contribute to the profitability, sustainability and productivity of regional Australia.

Most of RIRDC’s publications are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

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Images

Cover image of Australian native rice (*Oryza meridionalis*) from Ray Byers, Adventure Productions, Weipa, Queensland.

Images of *Dactyloctenium radulans, Eragrostis dielsii, Whiteochloa cymbiformis* and *Yakirra australiensis* from Sharp and Simon (2002) AusGrass – grasses of Australia, ISBN 0 643 06861 9, published by Australian Biological Resources Study, Canberra.

The larger image for *Whiteochloa cymbiformis* is from Petheram and Kok (2003).

Images of *Echinochloa turneriana, Eragrostis eriopoda, Oryza rufipogon* and *Panicum decompositum* from Native Seeds Pty. Ltd. Cheltenham, Vic.

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Introduction

As a grassland for many millions of years, Australia has developed many species of grasses. Indeed it can be considered to be extremely grass diverse, having around 27% of the total world grass genera despite having only around 5% of the total world land area. Furthermore, there are many grass genera that are endemic to Australia i.e., do not occur elsewhere, such that of the total number of grass genera in Australia, 30.5% are endemic (Linder et al., 2002). This indicates a high degree of endemism compared to the grass flora of other continents (Clayton, 1975) and suggests both that grasses have been in Australia for a very lengthy period and that the continent has not been subjected to infestations by other grasses from distant shores.

Aboriginal Australians have been present in the continent for many tens of thousands of years. It has long been the dogma of European Australians that the Aboriginal occupants of Australia lived more or less hand-to-mouth with feasts occurring only when a large animal was killed and near starvation occurring in the period between feasts. The prevailing view through most of the colonial period was that the Australian flora offered little value for food or opportunity for development. Typical of this attitude was that expressed by Crawfurd (1868) “There is probably not one of the roots tubers, bulbs and fruits that would ever be touched by those who could get a supply of wholesome grain or cultivated food-roots”. To most of the earlier explorers their lack of familiarity with the foods and Aboriginal peoples provided them with an attitude that Australia was depauperate in useful plant and animal species and that the Aboriginal population and its knowledge base was of little concern.

What has not been widely acknowledged by early explorers and botanists was the dependence of the Aboriginal populations on grains of various kinds in order to fill the gap between feasts.

Unfortunately, most of the early expeditions which intersected with Aboriginal populations did not include botanists, and records of those expeditions are redolent with phrases such as “treeless plains of deep grass” and “park-like” conditions but with little detail or plant descriptions. Occasionally, references are made by explorers such as Major Thomas Mitchell (1820’s and 1830’s) to Aboriginal activities such as field burning or cutting and piling of grass seedheads and stems into “hay ricks” where “the ricks or haycocks, extended for miles…. The grass was beautifully green beneath the heaps and full of seed”. Regrettably there was little or no plant identification, or even interpretation as to the reasons why those activities were occurring. What is clear now is that those “ricks or haycocks” were what we now call windrows of cut stems, where the grass seedheads were cut off, laid on top of each other in orderly rows and left for a certain period of time in order to ripen the seed for grain. Eventually members of the tribe, usually the women, would return to the ricks, lift them up and collect the grain that had fallen through the dead stems on to the ground. This grain was then cleaned by winnowing and, at some time in the future, cooked. Unfortunately, the practices of grain collection were not well recognised as part of the food production habits of Aboriginal people and the plants from which they derived those grains were largely unidentified.

Disappointingly, despite being surrounded by grasses which they acknowledged as being of high grazing quality, many of the explorers did little to distinguish between those grasses and we are left today with the task of trying to imagine what those grasslands looked like and what value they provided both for grazing of herbivores and as grain sources.

Records of the use of plants as foods by Aboriginals were not common from the early European exploration events. Whether this was a deliberate omission, or just an oversight, is not relevant. What it means is that there are relatively few references that provide accurate detail as to actual Aboriginal usage of grains. Those that do exist and have been able to be located, have been examined in this review.

The most influential of the earlier botanists, Fred Turner, who was the Government Botanist for the Colony of New South Wales in the 1870’s to 1890’s, wrote extensively about Australian grasses and

made a number of almost casual observations about species that had known grain use. He also expanded upon those known species with a number of others that he thought as likely to provide a useful grain for consumption. His view, which was overlooked by most, was that “it seems a most feasible thing that out of (the then) 360 species of grasses found on this continent, some could be cultivated that would yield good grain without its attendant drawbacks, in the way of parasitic fungi, especially in some parts of Australia where wheat and other cultivated cereal are often a precarious crop”.

This review has gathered as many reports of expeditions and archaeological/anthropological studies as could be found to develop a list of species with a known Aboriginal usage for food. What is clear is that the record is strongest from the arid and semi-arid zone, possibly as these areas had the most extant Aboriginal culture in the 1930’s through to the 1960’s when most of these anthropological studies were being undertaken. There are very significant gaps in the literature with no research reports from those areas of Australia where Europeans had become dominant earlier. Unfortunately by the time it was thought important to record more about the habits or practices of Aboriginal communities that had allowed their successful adaptation over many thousands of years to the entire Australian continent, many of those same communities had been severely reduced.

It is highly likely that there are edible and previously-used grasses that are not included in the list of species for which strong records exist. This is likely to be the result of the lack of studies having been undertaken on the habits of Aboriginal populations across all climatic and geographic zones. The lack of data may have occurred for several reasons, possibly a lack of qualified observers, or a lack of remaining Aboriginal people, or a disinterest in this topic by contemporary researchers. Whatever was the case, there is only a very imperfect picture of Aboriginal use of grasses for purposes other than pasture available for review in 2015.

A further limitation to this study is the complete omission of the extensive ‘grey’ literature that exists within current Aboriginal populations. This literature cannot be readily accessed through a desktop study such as this but would be invaluable to gather together. This review has to a limited extent picked up these records through the substance of lengthy consultations with Aboriginals about their plant use in their regions. We acknowledge that this is an inadequate substitute for consultation with Aboriginal Australians but it is the closest we are able to reach given the scope of this study.

Current use of native grasses for grains or other purposes

Grain Use

There is only limited use of Australian native grasses for grain use either in Australia or elsewhere.

Wild Rice

Australia is home to a number of species of grasses within the genus *Oryza*. These are known to have been used for grain by Aboriginal Australians and some communities still use them as such. There is a small cottage-scale production of these grains that occasionally makes it to local markets, but the scale of production is very small (Wurm et al. 2012).

Little or no development has occurred on these species, although Japanese rice breeders have collected them over recent decades and have undertaken cross-breeding work to try to integrate the novel characteristics of the Australian species into commercial *Oryza sativa* lines (Ishikawa et al. 2012).

A program at QAAFI (part of the University of Queensland) is exploring these species and attempting to make a substantial collection of naturally occurring types in the State of Queensland (Dayton, 2014). At this stage no collections are being made through either Western Australia or the Northern Territory where these species are also found. Indications from the QAAFI project are that there are new species occurring, that they possess novel, and potentially beneficial, attributes and that there is substantial diversity within the natural population (Henry, 2015).

Wild Sorghums

There are a number of locally endemic species of sorghum that, like wild rice above, have been used for consumption by Aboriginal Australians. The species *Sorghum macrospermum* has been recorded as being consumed by those with access to this very isolated crop (Shaw, 2015). Shaw also suggests that *Sorghum laxiflorum* may prove even more beneficial, being semi-annual, rooting at the node, and possessing an enormous grain filled panicle. Where it occurs it produces a near mono-culture and thus it is a competitive and vigorous crop. The grain from this grass is barbless and can be used for all the uses of millet such as flour, beer, stock feed, poultry industry and for domestic birds (pets, rare finches). There are a number of other naturally occurring species within Australia for which there is no record of usage.

Attributes of some of these species, but particularly, *S. macrospermum*, have been bred into sorghum crops by breeders in the USA. These are likely to be part of new styles of *Sorghum* that will reach the market in the coming decade.

Alpine Rice

There is a developing use of the species *Microlaena stipoides* as a grain to be sold as Alpine Rice, but which has not as yet reached the market. Information about this crop can be obtained on the website www.alpinerice.com.au. This grass is not a true rice in the *Oryza* genus but is relatively closely related to that genus.

Development of this crop has been happening for a decade or more and has been, in part, supported by RIRDC and GRDC.

The grass is a long-lived perennial of the cooler regions of Australia, which offers a dual purpose use with high quality grazing for stock and a highly nutritious grain for human consumption. The experience with this crop is that it is very hardy when established, requires little fertilizer, can produce

large volumes of edible fodder, can yield grain at reasonable (though not high) rates per hectare and will be highly profitable for producers. Production will be located in the southern zones of Australia where cooler conditions are suited to its growth.

The scale of production is still small but is expanding. Since production will be moderate, this grain will more than likely remain as a niche crop. Yields are such that this is not a crop that will replace major cereals, rather it is a crop that will sit alongside Wild Rice, Quinoa and Chia for consumers. It has a very good nutritional profile that places it in the high value markets that are seeking products that are gluten-free, high in protein, of appealing texture and high satiety.

This crop can serve as a model for the potential use of native grasses by offering a dual purpose use for farmers, providing both good, persistent grazing and a valuable grain crop. As a pure grain crop it would not be economical to produce, but as a long-term, hardy perennial pasture grass with the opportunity to harvest a grain crop when conditions suit, it does fit into the economic equation for mixed farms in the cooler, more moist environments.

Use for purposes other than grazing and grain

There has been use of native grasses for purposes other than grazing of livestock or grain for human consumption though not on a large scale. Of particular interest to this review are not the uses for aesthetic or biodiversity purposes, rather the medicinal or therapeutic uses. There is currently no widespread use of the medicinal and/or therapeutic properties of the grasses.

Literature Review

The principle function of the literature review was to determine which grass species have a substantial record of use for grain or other purposes. Since there has not been any recent use of these grasses other than for pasture, rehabilitation or amenity, this became a search for records of Aboriginal use of the grasses. Largely, these records are those within the discipline known as “ethnobotany” and are mainly a record of those plants that are/were regularly used by Aboriginal communities for food, or for other purposes.

To say that this recording of usage by Aboriginals has been all-encompassing, systematic and focussed would be an exaggeration. In contrast, the key features of these studies are their lack of breadth and their episodic nature.

The earliest records, such as by Major Thomas Mitchell, cannot be heavily relied upon as the botanical skills available to those explorers were limited. Similarly, reports such as those of Coghlan (1898) describe the use of grass seeds to make a “damp paste (that) is either eaten raw, or mixed in an unsightly mass and cooked in hot ashes” with no identification provided on the grass species. More extensive works by Maiden (1889) and Turner (1895 and 1921) whose botanical skills were substantial are considerably more useful.

There are several reports of expeditions to northern South Australia and central Australia conducted by Cleland, along with either Johnston or Tindale, through the late 1930’s with the latest in this series published in 1959. Specht published on Arnhem Land, NT uses in 1959.

Apart from the literature-based study by Allen published in 1974 there was no activity until a flurry of projects in the 1980’s and 1990’s by O’Connell, Cane, Smith and Wightman. These projects focussed on Aboriginal communities in central Australia (O’Connell), the Western Desert (Cane) and Northern Territory (Smith and Wightman). Since that time there has been only superficial mention of Aboriginal use of grasses for foods or other purposes in reviews. The conclusion that can be drawn from the spread of dates of these studies is that this is a field that has not received consistent effort.

Nor is it a field that has had wide geographic coverage across Australia with the great majority of the continent not having any report made on the use of grasses. It is more than likely, according to Tindale, who utilised recordings of grinding stones as inferring the use of grains, that the deliberate harvesting of grass seeds (and potentially also wattle tree seeds) was widespread throughout a very broad swathe of Australia.

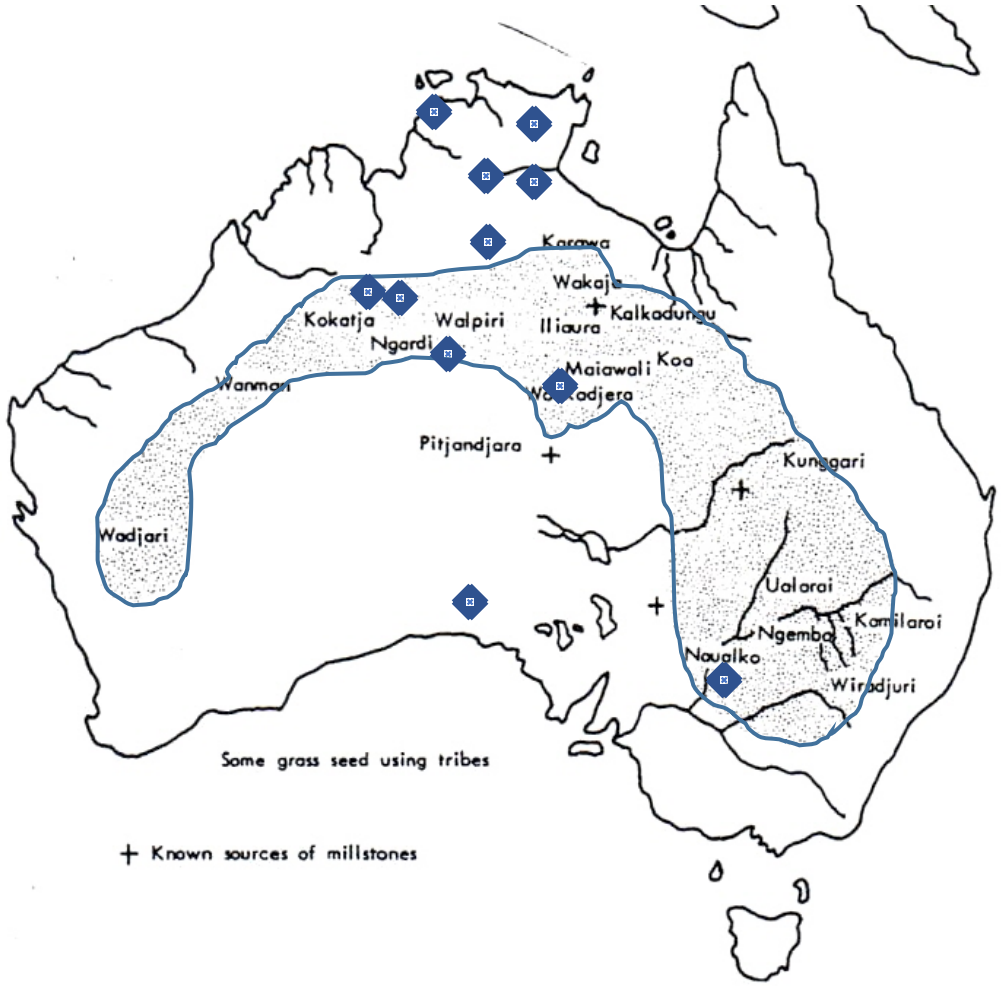
Tindale described a large area, now known as ‘Tindale’s Arc’, where grinding stones were considered as prevalent. The map, taken directly from Tindale (1974) “Aboriginal tribes of Australia” shows the area he considered where a reliance upon grass seeds as a source of food was evident. Both contemporary and older evidence (Hiatt, 1968) suggests that grinding stones are much more widespread than reported by Tindale and as such, the use of grass seeds for food is likely to have been more widespread than suggested in this map.

What is clear from the map is both that this is a very extensive area, covering around 30% of the continent, and that it does not include some

Fig. 31. Grassland areas exploited by aborigines as important sources of grain food with some of the names of tribes.

of those areas identified by other ethnobotanists as having a grass-seed-utilising culture.

The locations from which studies have been made which are included in this literature review have been placed in the following map, alongside a more defined version of Tindale's Arc.



The locations of a number of the ethnobotanic studies that have been undertaken fall well outside Tindale's Arc suggesting that the food use of native grasses by Aboriginals was even more prevalent than was first considered.

The other aspect that is very obvious is that these studies do not include vast areas of Australia, and *ipso facto*, large numbers of different aboriginal language groups/ communities. There are some studies (Hiatt, 1968; Rae et al. 1982; Clarke, 1986; Zola and Gott, 1992) of mostly southern Australian aboriginal communities that provide no evidence of the use of grass grains for food, but provide substantial evidence of the use of other plants for food. Thus the use of grasses for grain was not a universal habit of aboriginal communities, but probably reflects the relative availability of other more-convenient food types.

Aboriginal language groups/communities. We have no way, through a literature search in 2015, of determining whether or not other communities also consumed grass seeds as grains. What seems likely

to these authors is that the use of grasses for food was a well-established practice of a number Aboriginal communities, and for that reason it is likely to have been a practice of nearby communities in which those same grasses were present.

Collation of Species Lists

Our approach has been to collate those species that have been noted through the various ethnobotanic studies examined in this review. From the list of species collated, the most frequently recorded species are clearly those that are certain to have been used and have been assembled as the priority list. A second group of species have received only one or two records of use, and thus assembled as the second priority list. This is not to say that they have no merit as potential foods, but that the case for their having been so used in the past is less clear.

Other sources of information

Several papers have been prepared that are not ethnobotanic, but which are more of an exploration of opportunities within the Australian grass flora. Typical in this group are the two papers by Conover and Geiger (1984) which look at agronomic issues facing the commercialisation of Channel Millet (*Echinochloa turneriana*) as they saw this species as "recognised as a promising forage and grain crop for arid regions". This species only occurs once on the species lists generated by searching the ethnobotanic literature but was of sufficient interest for two American scientists to undertake a series of detailed germination studies to facilitate its wider use and to publish those studies in a peer-reviewed journal. Furthermore, several other papers on the agronomics of this grass were published around the time of these papers by Conover and Geiger. Additionally it was listed in a world-wide study "Under-exploited tropical plants with promising economic value" by the National Research Council (U.S) (1975). For these reasons it has been included on the priority list.

Turner's reference from 1895 includes a mixed list of species. For some species in his text he provides assurances of Aboriginal use, while for other species he only suggests that they should be considered for use as grains. The former has been included on the priority list while the suggestion-only species are included in the second priority species.

Some well-informed sources have also been contacted to obtain their recommended species and these are included in the references.

Use of native grasses for medicinal or therapeutic purposes

Records of Aboriginal use of native *grasses* for these purposes are present, but even more scant than that for food use.

A number of larger reviews have been conducted on the use of Australian native plants for medicinal purposes. Indeed there has been considerable interest and investigation into the use of Australian plants for novel active compounds that would be useful medicinally. Substantial reviews such as Jones et al. (2007) and more localised studies such as Packer et al. (2012) discuss many different plant families and the efforts that have been made to exploit their active compounds, but tellingly do not include any mention of the grasses.

Other records indicate the use of crushed stems and roots of certain species of *Cymbopogon* (lemon-scented grasses) for medicinal purposes (Wightman et al., 1991, 1992 a and b), *Chrysopogon* (ribbon grasses) and *Triodia* (spinifex) for the treatment of skin sores, coughs, infected eyes and as a skin hardener (Lazarides, 2002). Some grasses (*Triodia* and *Eulalia* sp.) were burnt to produce a medicinal smoke (Wightman, 1992). Usually the authors of these papers comment along the lines of Smith (1991) that “this report does not deny or affirm the efficacy of any of the plants used as medicines”.

The most documented use, other than food, for native grasses is that of the use of certain species of spinifex (*Triodia* spp) for conversion into adhesives.

In summary, the general impression from the literature is that Australian native grasses are not likely to be sources of active compounds for medicinal purposes. This in itself deserves more attention through evidence-based research to fully explore if there is the potential specifically for Australian native grasses.

Species Lists

First Priority Species

Current Scientific Name	Common name(s)	Number of references
Dactyloctenium radulans	Button grass	4
Echinochloa turneriana	Channel Millet	1 ethnobotanic and 5 non-ethnobotanic
Eragrostis dielsii	Mallee lovegrass	3
Eragrostis eriopoda	Woolybutt grass	5
Oryza rufipogon	Native rice	3
Panicum decompositum	Native Millet	9
Whiteochloa cymbiformis	Native Panic or Boat Panic	3
Yakirra australiensis	Bunch Panic	4

Since these species received several references for being used as food, they are the subject of the SWOT analyses to follow.

Second Priority Species

Current Scientific Name	Common name(s)	Number of references
Alloteropsis semialata	Cockatoo grass	1
Aristida arida		1
Astrebla lappacea	Curly Mitchell grass	2
Astrebla pectinata	Barley Mitchell grass	1
Austrostipa spp	Spear grasses	1
Brachiaria gilesii	Hairy-edged armgrass	1
Brachiaria milliformis		1
Brachiaria piligera	Hairy armgrass	1
Brachiaria praetervisa	Naked armgrass	1
Brachiaria subquadripara	Armgrass millet	1
Digitaria brownii	Cotton Panic	1
Diplachne fusca	Beetle grass	1
Echinochloa colona	Awnless barnyard grass	1
Eragrostis laniflora	Woolybutt grass	1
Eragrostis leptocarpa	Drooping lovegrass	1
Eragrostis parviflora	Weeping lovegrass	1
Eragrostis pilosa	Lovegrass	1
Eragrostis tenellula	Delicate lovegrass	1
Eulalia aurea	Silky Browntop	1
Leersia hexandra	Native rice grass	1
Microlaena stipoides	Weeping grass	1
Oryza australiensis	Native rice	1
Panicum effusum	Hairy Panic	2
Panicum trachyrachis	Coolibah grass	2
Paspalidium jubiflorum	Warrego grass	2
Paspalidium rarum	Rare paspalidium	1
Paspalum sp.	Paspalum	1
Phragmites australis	Common reed	1
Rytidosperma bipartita	Mulga grass	1
Setaria sp.	Setaria	1
Setaria pumila	Pigeon grass	1
Sorghum macrospermum		1
Sporobolus actinocladus	Katoora	1
Themeda avenacea	Tall Oat grass	2
Themeda triandra	Kangaroo grass	1
Tragus australiensis	Small burrgrass	1
Triodia basedowii	Spinifex	1
Triodia irritans	Spinifex	1
Triodia longiceps	Spinifex	1

Triodia pungens	Spinifex	1
Walwhalleya proluta	Coolah grass	2
Yakirra pauciflora		1

Those native species with known, or inferred, poisonous characters

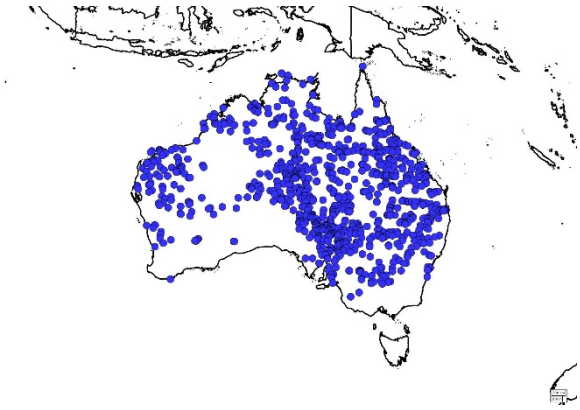
Some species are well known to contain poisonous compounds. Even these do not retain that toxic nature throughout their entire lifecycle, with many species being poisonous for only a brief period during their growth. It should also be noted that many of the introduced fodder and pasture grass species could be placed on the list below.

The following table gives those native species for which there is some suggestion of a toxic period during their life. The table also attempts a level of confidence around the data. The information is largely taken from Lazarides (2002).

Species	**Toxin/Symptoms**	**Affected stock**	**Confidence of reporting**
Brachiaria gilesii	Oxalates/Nitrates	Sheep	High
Brachyachne convergens	Prussic acid	Sheep, horses, claves	High
Chloris truncata	Prussic acid		No field reports
Chloris ventricosa	Prussic acid		No field reports
Dactyloctenium radulans	Nitrates	Young sheep and rams	Moderate
Echinopogon spp	Not known	Sheep, cattle, goats	Moderate
Panicum decompositum	Not known	Sheep	Low
Panicum effusum	Photosensitisation	Sheep, pigs	High
Panicum queenslandicum	Photosensitisation	Most livestock	High
Triraphis mollis	Prussic acid	Rams	High

Swot Analyses

Dactyloctenium radulans (Button grass)



Attributes

An annual grass that grows to around 200 mm. Can form a full cover on moist soils. Grows on all soil types.

Natural Distribution (from Australia's Virtual Herbarium)

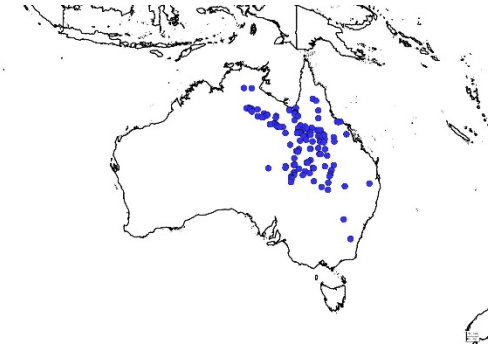
Very widespread distribution, but a rare or threatened species in the N.T.

Photographs

SWOT

Strengths Easy to establish as a crop Produces a lot of seed each season Requires little rainfall to establish and grow	**Weaknesses** Annual habit means it will not provide high quality fodder after flowering
Opportunities Annual summer cropping systems Will use less water than other larger crops e.g., sorghum	**Threats** Have been intermittent reports of toxicity to hungry cattle and sheep when grazing pure stands

Echinochloa turneriana (Channel Millet)



Attributes

Large annual grass that responds quickly to inundation events following cyclones. Produces copious seeds/grains that are easy to harvest.

Natural Distribution (from Australia's Virtual Herbarium)

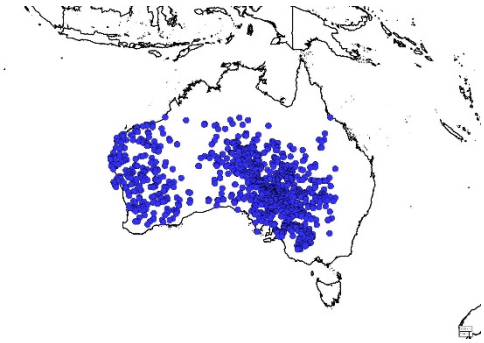
Relatively narrow natural distribution, being focussed around those areas subject to annual inundation following tropical cyclones.

Photographs

SWOT

Strengths A strong annual crop that produces large amounts of grain Easy to establish Very easy to harvest with conventional equipment Can establish and reproduce on one inundation event	**Weaknesses** Annual growth habit means it will require annual sowing event and will not provide out-of-season green forage
Opportunities As a replacement crop for those areas in which conventional crops are not completing production due to reduced rainfall Could be treated as an opportunity crop by allowing some seed to fall prior to harvest	**Threats** Unknown grain qualities

Eragrostis dielsii (Mallee Lovegrass)



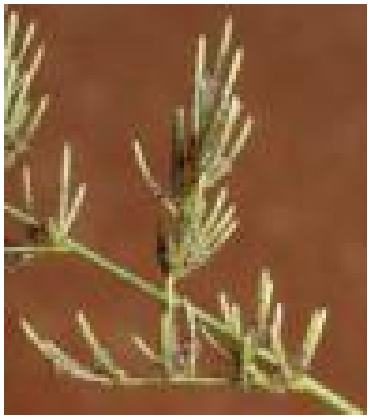
Attributes

An annual or short-term perennial grass that remains close to the ground (only up to 0.5 m tall).

Natural Distribution (from Australia's Virtual Herbarium)

Widely distributed throughout central and western Australia. Found in desert regions of Australia and through some of the higher rainfall zones of Western Australia and South Australia.

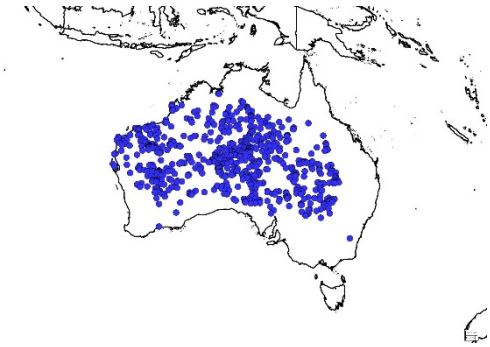
Photographs



SWOT

Strengths High drought and heat tolerance Can establish readily with minimal rainfall	**Weaknesses** Difficult to harvest owing to its short stature and lack of separation of seeds and foliage Does not produce a lot of foliage for grazing animals
Opportunities Annual cropping in response to single rainfall events	**Threats** No knowledge of the grain attributes

Eragrostis eriopoda (Woolybutt grass)



Attributes

A perennial grass with extreme drought and heat tolerance. Able to grow on shallow soils and on sandy loam soils. Commonly found as one of the first grasses to return to burnt areas in the Pilbara.

Natural Distribution (from Australia's Virtual Herbarium)

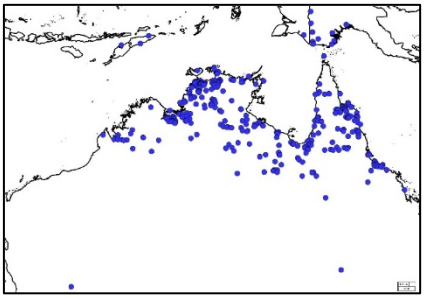
Widely distributed through the arid interior of Australia. Not found in the more moist areas.

Photographs

SWOT

Strengths Very hardy perennial grass adapted to desert zones Very easy to harvest Will produce grains with minimal rainfall from mature plant bases	**Weaknesses** Seed/grain is very small
Opportunities Dual purpose grazing and grain systems Could be grown for grazing and opportunity cropping under suitable conditions	**Threats** Will be competing directly with introduced crops like Teff (they are the same genus)

Oryza rufipogon (Native Rice)



Attributes

A perennial grass that is related to commercial rice (Oryza sativa). Grows on the fringes of waterholes and lagoons across the north of Australia. Often occurs next to closely related Oryza species and species identification may be an issue.

Natural Distribution (from Australia's Virtual Herbarium)

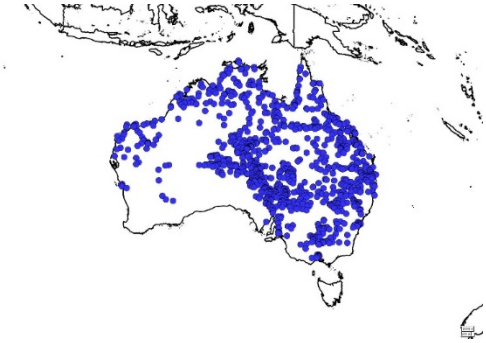
Distributed across the northern tropical regions of Australia in areas subject to summer storms and seasonal inundation

Photographs

SWOT

Strengths Wide array of species and ecotypes are known to occur, allowing large potential for selection of desirable attributes. Being related to commercial species suggests adaptation to crop conditions will be relatively simple.	**Weaknesses** Some of the plants may be totally water-reliant for growth and reproduction.
Opportunities Suitable characteristics could be incorporated into commercial rice types through conventional breeding to improve heat, salinity and drought tolerance. Other types may be useable as crops in their own right.	**Threats** The growth of commercial rice in northern Australia is commencing and poses a threat through pollution of the genetics of the natural rices.

Panicum decompositum (Native Millet)



Attributes

A long-lived and hardy perennial grass with a very strong history of use as a grain for food.

Natural Distribution (from Australia's Virtual Herbarium)

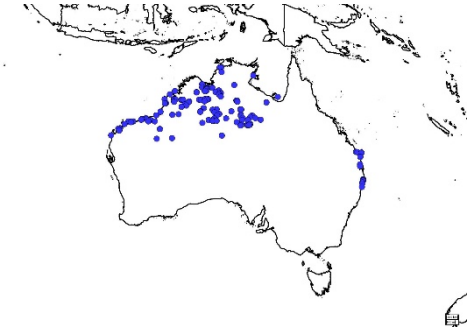
Found throughout all inland areas of Australia

Photographs

SWOT

Strengths Long history of use Readily harvested with conventional equipment Hardy perennial that offers good grazing Easy to establish Occurs naturally as a monoculture	**Weaknesses** Seed does not ripen uniformly Seed is not retained for long in the seedhead
Opportunities Could work as a dual purpose crop, either as a dedicated cropping area in better rainfall zones or as an opportunity crop is lower rainfall zones Can be utilised widely across Australia Grain can be useful for flat breads	**Threats** Will be competing with grains such as Teff

Whiteochloa cymbiformis (Native Panic)



Attributes

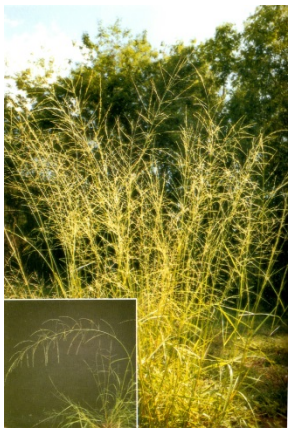
A large erect annual or perennial grass up to 2 m high which produces high volumes of soft and palatable fodder when green.

Natural Distribution (from Australia's Virtual Herbarium)

Mostly coastal distribution with interesting separation between Queensland coastal populations and N.T. and W.A. populations.

Also found in desert conditions of northern Australia

Photographs



SWOT

Strengths Readily harvestable grains as are held well clear of foliage Can be managed for perenniality under more moist conditions Good fodder values	**Weaknesses** Small grain size
Opportunities Potential dual grazing and grain opportunity Highly likely to have salt tolerance	**Threats** Will be competing with Teff

Yakirra australiensis (Bunch Panic)

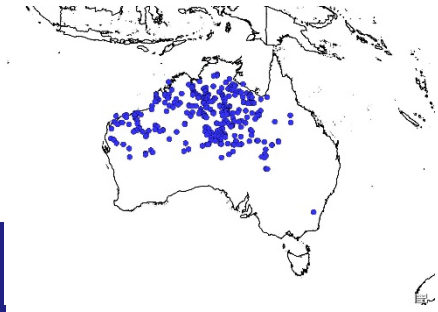
Attributes

A relatively short annual or short-lived perennial. Was previously considered as part of the Panicum genus and behaves much like Panicum decompositum

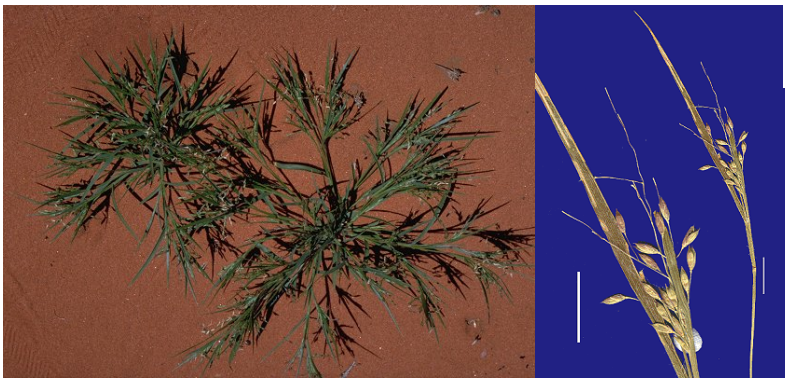
Natural Distribution (from Australia's Virtual Herbarium)

Distributed throughout much of the arid regions of northern Australia, but also found in the wetter Kimberley region.

Occurring on lighter soils in the Channel country of Qld.



Photographs



SWOT

Strengths Relatively easy to harvest due to separation of seedheads and stems. Seemingly profuse seed/grain production	**Weaknesses** Relatively little known about this species other than its ability to produce edible grains
Opportunities Possibly useful for dual purpose grazing and grain crops	**Threats** Insufficient knowledge is available to know of threats

Conclusions

This report has shown, especially through the SWOT analysis, the high value potential of exploring Australian native grasses for food markets. Other usages have also been noted, such as for medicinal or therapeutic purposes, although information for native grasses in these areas is scant.

More extensive knowledge-based use of native grasses will serve to diversify landuse (both economic gain from grain production from land not currently able to produce crops and acting as a safety net or buffer against adverse seasons affecting conventional grains), open new market opportunities, and, where appropriate, preserve cultural heritage.

The report also highlights the strong possibility that there are likely many more edible grasses than those which we found, but that data is lacking, emphasising the need for additional investigative effort and in particular for working with Aboriginal communities.

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Native grasses make new products – a review of current and past uses and assessment of potential

By Ian Chivers, Richard Warrick, Janet Bornman and Chris Evans

June 2015

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This project assessed the feasibility of commercially exploiting new products derived from Australian perennial grasses. Although used selectively for targeted purposes such as land restoration, landscaping and lawns, today these grass seeds remain unexploited as commercially cultivated crops for food grains, animal fodder, fish food, nutritional additives, cosmetics, and pharmaceuticals.

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