



Chilean needle grass

Field Day Fact Sheets

Research Update November 2007

- Biological Control for Chilean needle grass
- Impact of Chilean needle grass on biodiversity in Australian native grasslands
- Including Agricultural Notes from:
 - Chilean needle grass Regional best practice management
 - Long term grazing utilisation and management
 - Slasher cover design to minimise Chilean needle grass spread

Compiled by Charles Grech, Ian Faithfull & David McLaren

Chilean needle grass field day fact sheets November 2007

Published by the Victorian Government Department of Primary Industries
Attwood Centre
475 Mickleham Rd, Attwood Victoria 3049
Telephone: +61 3 9217 4200
Facsimile: +61 3 9217 4299

© The State of Victoria, Department of Primary Industries, 2007.
This publication is copyright. No part may be reproduced by any process except in accordance with the provisions of the Copyright Act 1968.

Printed by DPI Attwood

For further information, visit the DPI Website at <http://www.dpi.vic.gov.au>
or contact the DPI Customer Service Centre on 136 186

Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.
The herbicide trial interim results provided in this publication are intended as a source of information only and must not be interpreted as a recommendation for herbicide use.

Always read the label before using any agricultural chemical products.

For further information contact the Chemical Information Service on (03) 9210 9379.

National Chilean Needle Grass Taskforce



Chilean needle grass Research Update November 2007

CHILEAN NEEDLE GRASS NATIONAL BEST PRACTICE MANUAL

OUT NOW!

Chilean needle grass (*Nassella neesiana*) is considered one of Australia's worst weeds of native grasslands and pasture. Since its introduction to Australia in the 1930s, Chilean needle grass has invaded grasslands, roadsides and farms in Victoria, NSW and the ACT. More recently, it has been found in South Australia, Queensland and Tasmania.

The potential for Chilean needle grass to become permanently established in these regions and invade presently uninfested areas in Australia is of great concern. If allowed to spread unchecked, Chilean needle grass is likely to create huge environmental and economic costs. For these reasons Chilean needle grass has been determined as a Weed of National Significance (WoNS), one of Australia's twenty worst weeds.

Chilean needle grass places a huge burden on land managers. It reduces the carrying capacity of pasture, causes injury to stock and seriously degrades native grasslands. Its unique survival mechanisms and the difficulties of identification make Chilean needle grass a particularly challenging weed to control.

The National Chilean Needle Grass Taskforce recognises the need to contain the spread of Chilean needle grass and to control existing infestations, as well as the need to provide best practice information to those attempting to carry out these often daunting tasks. The *Chilean needle grass best practice manual* is an important link in that chain.

Designed to help provide effective management solutions for Chilean needle grass, the *Chilean needle grass best practice management manual* brings together detailed information about the plant itself, as well as best practice information about existing control and management options. The manual also includes visual aids to enable accurate identification and hygiene measures that will limit spread.

Funded under the Australian Governments *Defeating the Weed Menace* Program with the Victorian Department of Primary Industries hosting its development and production, it has seen input from other State Government Agencies, local governments, Natural Resource Management bodies, community, Universities, and private enterprise.

For further information on the WoNS Chilean needle grass program or to download or order a copy of the Manual visit the Weeds Australia website www.weeds.org.au/WoNS/Chileanneedlegrass/.

Or contact the National Chilean needle grass Coordinator, Kelly Snell, ph 03 5226 4625; email Kelly.snell@dpi.vic.gov.au.



Australian Government
Defeating the Weed Menace



Biological control of Chilean needle grass and serrated tussock



Chilean needle grass Research Update - Nov 2007

Basis

Chilean needle grass (CNG) and serrated tussock are exotic grasses originating from South America that are causing massive agricultural and environmental impacts in Australia. They are classified as Australian Weeds of National Significance and their wide distribution and massive populations now sees them beyond eradication. One reason these species are so competitive in Australia is that they came into Australia as seeds without any of the natural enemies (insects, fungi) that reduce their competitiveness in their countries of origin. Classical biological control attempts to identify natural enemies of these target weeds in their countries of origin that are both damaging and host specific, so that they can reduce the viability of these weeds in Australia.

Aims

1. Get CNG and serrated tussock identified as targets for biological control.
2. Conduct detailed surveys of CNG and serrated tussock populations in South America to try and identify pathogens (fungi) that could be used in a classical biological control program against these weeds in Australia.
3. Undertake research to understand and describe the biology and life-cycles of these potential biological control agents.
4. Undertake detailed host specificity studies to ensure that these potential biological control agents are safe to introduce into Australia.
5. Once the biology, life-cycle and host specificity data has been collected, apply to get these biological control agents released in Australia.
6. Mass rear and release the biological control agents in Australia and monitor their impacts on CNG and serrated tussock.

Results

1. CNG was declared a target for biological control in November 2005. Serrated tussock was declared a target for biological control in July 1998.
2. Several surveys have been undertaken to identify potential biological control agents of CNG and serrated tussock in Argentina in South America (Figure 1.).
3. For CNG, three rust fungi have been identified as potential biological control agents. These are *Puccinia nassellae* (Figure 2 & 3), *Puccinia graminella* (Figure 4 & 5) and *Uromyces pencanus* (Figure 6, 7 & 8). For serrated tussock, three rust fungi are being investigated. These are *Puccinia nassellae* (Figure 9), *Ustilago* spp. (Figure 10) and *Corticium* spp. (Figure 11).

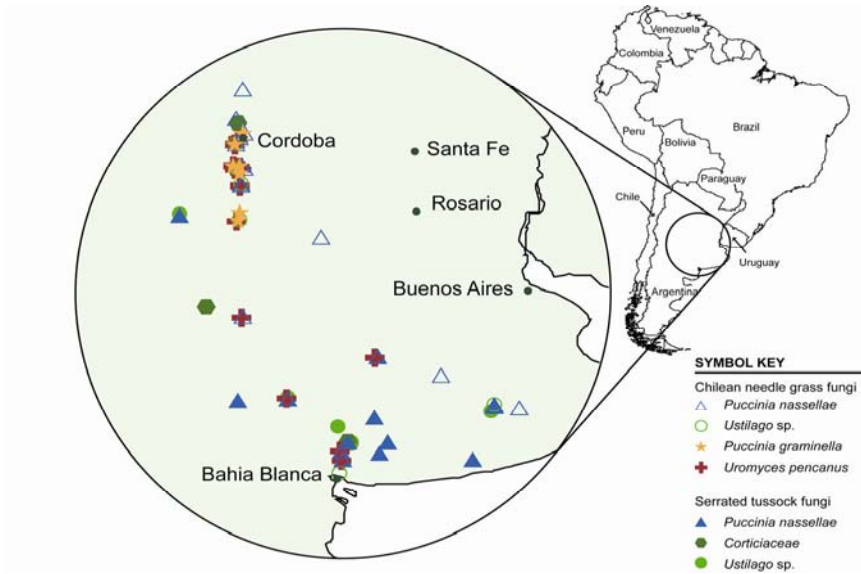


Figure 1. Location of biological control program in South America and locations of fungi collections. Bahia Blanca (arrow) is at approximately the same latitude as Melbourne.

Now that CNG is a declared target for biological control and that three good potential agents have been identified, a detailed host specificity testing program has begun. Due to changes in quarantine accreditation in Australia, airborne pathogens cannot be held in the DPI Frankston quarantine facility. This has delayed testing, as the host specificity testing now has to be undertaken in Bahia Blanca in Argentina. The project has encountered difficulties in getting the Australian native species imported into Argentina for testing. It is anticipated that host specificity testing will be completed over the next three years.

For CNG, three rust fungi have been identified as potential biological control agents. These are *Puccinia nassellae* (Figure 2 & 3), *Puccinia graminella* (Figure 4 & 5) and *Uromyces pencanus* (Figure 6, 7 & 8).



Uredinia on *N. neesiana* (site NT 27)

Figure 2. *Puccinia nassellae* (summer spores).



Telia on *N. neesiana* (site NT 16)

Figure 3. *Puccinia nassellae* (winter spores)

Puccinia nassellae is a rust fungi. The spores land on the CNG leaves where they germinate and produce hyphae (roots) that enter via the leaf stomata (where the leaves take in carbon dioxide and release oxygen). The rust hyphae then enter the leaf tissue and suck nutrients out of the leaves causing the leaves to die and the CNG plant to be less competitive. Severe infestations have been observed killing CNG and serrated tussock plants in Argentina. *P. nassellae* has been identified on both CNG and serrated



P. graminella. Aecia on *N. neesiana*

Figure 4. *Puccinia graminella*



P. graminella. Aecia and telia on *N. neesiana*

Figure 5. *Puccinia graminella*

tussock in Argentina. However, *P. nassellae* on CNG has not attacked serrated tussock and vice versa. Though, taxonomically all *P. nassellae*, the strains behave like different rust species on CNG and serrated tussock. This indicates that the rust is very host specific. Both the summer uredinia spores (Figure 2) and the winter telia spores (Figure 3) have been found on CNG. However, we have not yet been able to get the telia spores to reinfest CNG, meaning that we cannot produce the entire rust lifecycle on CNG. This is still being investigated, but until we understand the entire lifecycle it will be difficult getting permission to release it in Australia.

Puccinia graminella has only recently been identified as a potential biological control agent of CNG in Argentina. The good news with this rust is that it is autoecious (entire life cycle on a single host), it is quite damaging to CNG and it appears to be host specific. *P. graminella* is a definite candidate for biological control but has been difficult to mass produce.



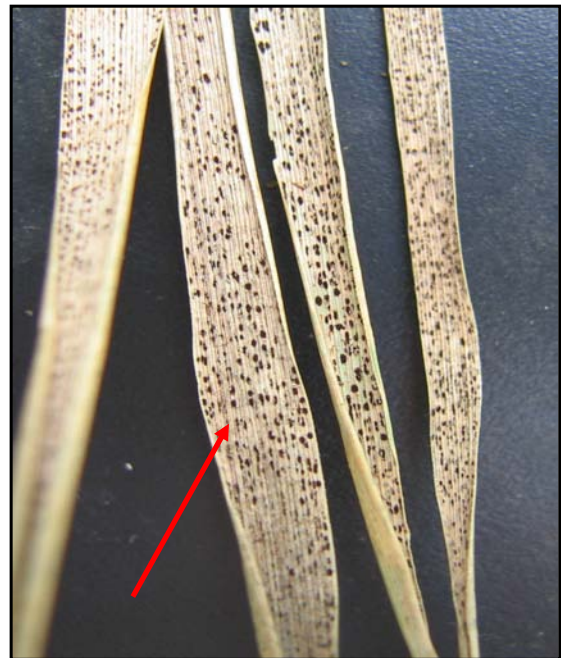
Figure 6. *Uromyces penganus* – uredinia on inoculated plant

The most promising biological control agent on CNG is the rust *Uromyces penganus* (Figure 6). This fungus is very damaging, appears to be highly host specific and is very easy to mass produce. Both summer uredinia and winter teliospores have been identified on CNG in the field. This rust has been shown to attack 6 out of 7 Australian CNG provenances, suggesting it will be an excellent biological control agent.

However, like *P. nassellae*, to date we have not been able to break the dormancy of the overwintering teliospores and re-infect CNG. This project believes it has a reduced life cycle (hemicyclic) with no known pycnial or aecial stages. It is proposed that *U. pencanus* cycles as urediniospores and either persists as latent infections in *N. neesiana* or becomes locally extinct during unfavourable conditions (mainly summer), despite the production of abundant telia that can cover senescent foliage in the summer, as these seem to have become redundant.



Figure 7. *Uromyces pencanus* – uredinia (summer spores) on inoculated plant



Telia on *Nassella neesiana* (site NN3)

Figure 8. *Uromyces pencanus* – telia spores (winter spores)

For serrated tussock, three fungi have been identified as potential biological control agents. These are the rust *Puccinia nassellae* (Figure 9), a smut *Ustilago* sp. (Figure 10) and a Basidiomycete fungus, *Corticium* sp. (Figure 11).

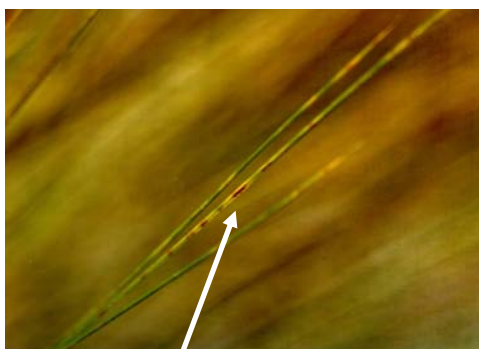


Figure 9. *Puccinia nassellae* infecting serrated tussock leaves in Argentina

Puccinia nassellae has been identified attacking serrated tussock in Argentina and in some instances was observed killing plants. However, this rust appeared to be most effective where serrated tussock plants were receiving shade. It has also proven to be very difficult getting the inrolled leaves of serrated tussock inoculated with the rust. Conventional techniques of inoculation have failed. Excellent attack has only occurred when individual leaves have been unrolled and the rust pustules applied. Another issue is that we don't know the complete rust life-

cycle. Only the summer uredinia spores have been found on serrated tussock to date. Also, preliminary host specificity studies showed a low level attack on an Australian native grass, *Austrostopa aristoglumis*.



Figure 10. The serrated tussock smut, *Ustilago* sp. preventing seed production. The arrows point to millions of dust like smut spores spilling out of the serrated tussock reproductive shoots.

A smut is a fungus that infects a plant and then destroys the plant's seeds. It doesn't kill the plant, but it prevents it reproducing. A smut infecting serrated tussock was found in odd isolated populations in Argentina. However, attempts at culturing this smut have been largely unsuccessful to date. Most smuts infect the target plant at seed germination or during the seedling stage. This has been attempted with serrated tussock, but out of more than 500 plants inoculated, only 3 became infected. The trouble is that you can't tell whether a plant is infected until it flowers, or attempts to flower, the following season. Development of this pathogen as a biological control agent has been put on hold pending further research to determine how it infects serrated tussock.

A *Corticium* sp. fungus has been identified killing serrated tussock plants in Argentina. It is a soil-borne fungus that rots the crowns and roots of serrated tussock. Its biology, life cycle and host specificity is still being investigated.

At this stage the prospects for biological control are much more favourable for CNG than serrated tussock.



Figure 11. The serrated tussock *Corticium* sp. fungus.

Impact of Chilean needle grass on biodiversity in Australian native grasslands



Chilean needle grass Research Update November 2007

Ian Faithfull, PhD student, Ecology & Sustainability, Victoria University, St Albans
Supervisors: Dr Colin Hocking, (VU), Dr David McLaren (DPI)

Basis

A clear need has been identified to better determine and quantify the biodiversity impact of Australia's Weeds of National Significance (WONS). Anecdote, expert opinion and a few limited studies indicate that Chilean Needle Grass (*Nassella neesiana*), one of Australia's twenty WONS, is one of the most significant weed threats to native grasslands, which are amongst the most threatened of Australian ecosystems. *N. neesiana* appears to be reducing biodiversity by 1. occupying inter-tussock spaces formerly occupied by a diverse assemblage of native forbs; 2. out-competing dominant native tussock grasses; 3. replacing native invertebrate food plants and altering food webs; and 4. altering the structure of grasslands, making them less suitable for use by native animals.

A project has been funded by the Australian Government under the Defeating the Weed Menace programme to investigate the biodiversity impact of this grass. The project is focused on identifying major components of the biodiversity at risk from and affected by *N. neesiana* and the ecological mechanisms by which *N. neesiana* invades and causes impact. It is also attempting to determine whether invasion results from major disturbance, rather than from a superior competitive ability of the weed. If invasion is disturbance-dependent, the increasing resources devoted to direct *N. neesiana* control might be better spent on other management actions. The project is also attempting to compare the biodiversity values of rehabilitated areas with those of uninvaded and invaded (unrehabilitated) areas and quantify the effectiveness of new approaches to management.

Aims

The project aims to answer the following questions, by undertaking a series of studies (shown in bold) that are experimental, observational or analytical in nature:

1. Does disturbance & nutrient enrichment facilitate invasion? **Seed inundation & disturbance experiment.**
2. What biodiversity is impacted and how effective are remedial actions? **Floristics and invertebrate survey of invaded / not-invaded / successfully rehabilitated / unsuccessfully rehabilitated areas.**
3. Does *N. neesiana* support fewer species than a dominant native grass that it displaces? **Invertebrate faunistics of *N. neesiana* and Kangaroo Grass *Themeda triandra*.**
4. What is the timescale of the biodiversity impact? **Floristics of transects from invaded to non-invaded areas.**
5. What is the geographical extent and severity of infestations and how are they related to landscape scale disturbance? **Invasion history / invaded site analysis.**

Results

1. The seed inundation and disturbance experiment was set up at Iramoo grassland in St Albans in July. It is a complex trial involving:

Three **pre-treatments** -

Killing of all tussocks of the dominant native grass with herbicide (= full kill); killing half the tussocks with herbicide (= half kill); no kill of existing vegetation (= no kill).

Five **nutrient treatments**:

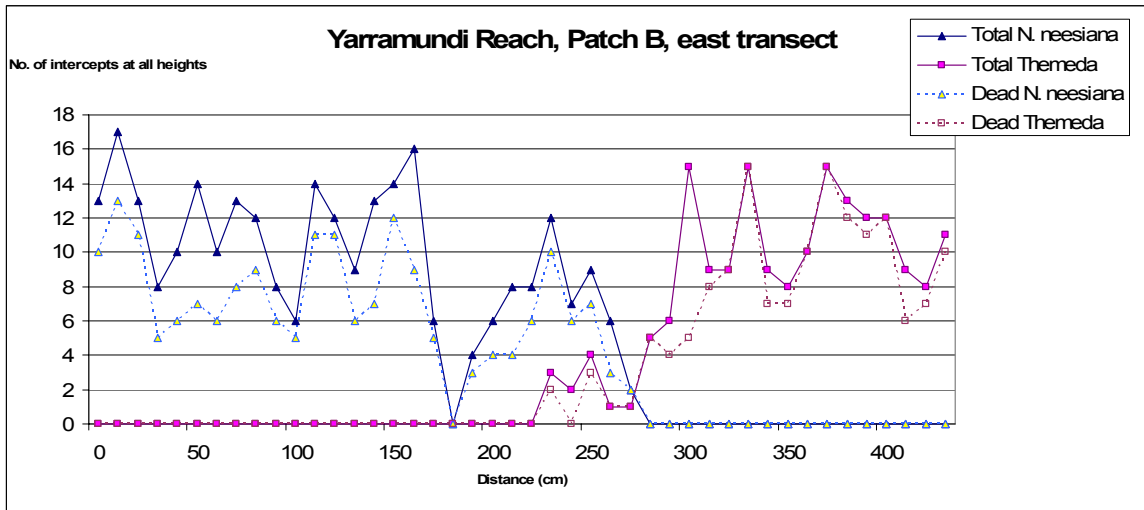
Addition of nitrogen, addition of phosphorus, addition of both N + P, addition of sugar (to immobilise nutrients), no addition of fertiliser.

Two ***N. neesiana* seeding treatments**: 500 seeds per square meter or no seed.

The Iramoo grassland is dominated by Kangaroo Grass (*Themeda triandra*). So far only very minor germination of added seed has occurred. This trial requires supplementary watering due to the very dry spring conditions. The trial is to be assessed at regular intervals to determine the extent to which CNG seedlings become established under the different treatment regimes. After 24 months it is intended to harvest the standing biomass and determine the proportion of CNG.

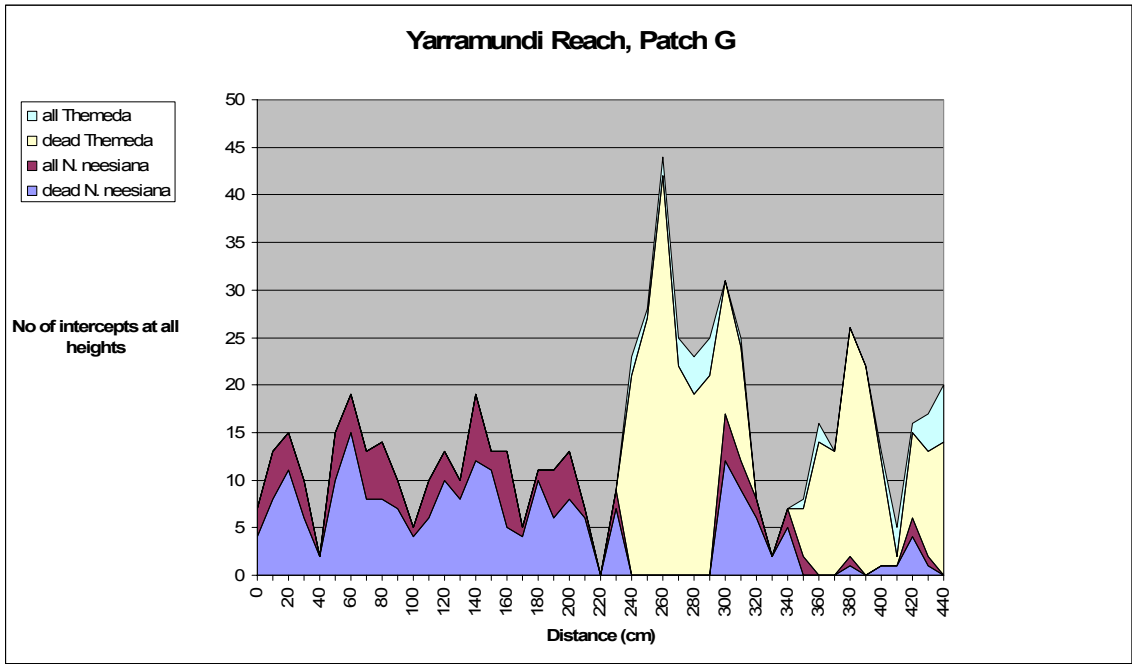
2. CNG tends to grow in patches, but sometimes these have edges that are diffuse or difficult to define. In order to compare the flora within patches to that outside them it helps to have some clear definition of what constitutes a patch boundary. 'Pin-transects' have been used to study this question. The 'pin' is a narrow rod dropped vertically into the sward. At each point along the transect, any plant material that touches the pin is recorded, along with the height of that touch above the ground. This data enables analysis of both the composition and structure of the vegetation. An example of the pin transect diagram is shown in Figure 1.

Figure 1. Pin transect across the edge of a CNG patch in the ACT. Often, as in this case, there is a sharp transition over less than 1m to native grasses. Such patch edges appear to be relatively stable.



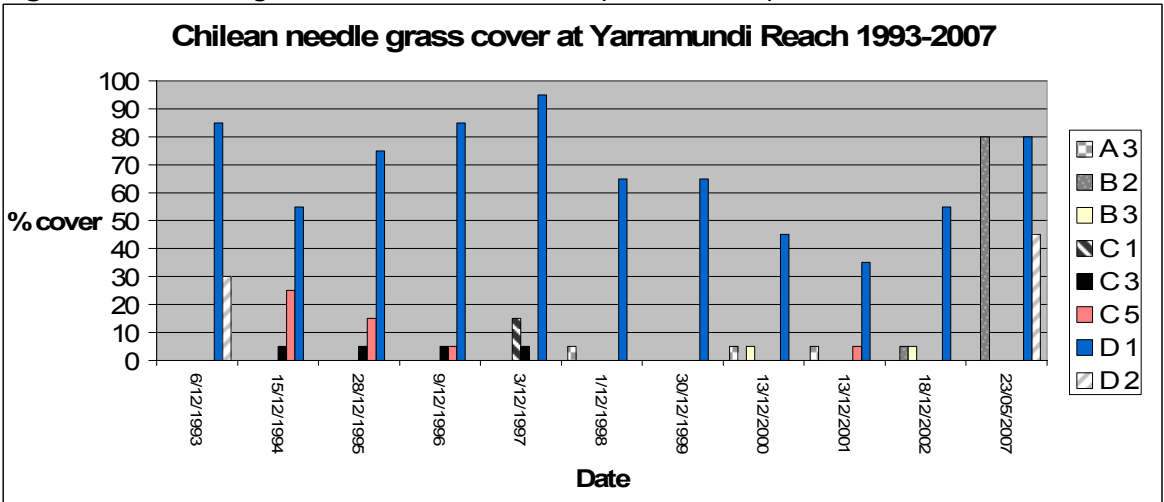
Diffuse boundaries include those where CNG is invading senescent Kangaroo grass (Figure 2). The Kangaroo Grass has a very proportion of dead leaves. The peaks in the graph (Figure 2) indicate near-dead tussocks with small CNG plants invading around them.

Figure 2. Pin transect through senescent Kangaroo Grass being invaded by CNG in the ACT.



3. Various studies are under way to investigate the time scale of impacts. Invasion by CNG does not appear to be especially rapid and some infestations at least are relatively stable, or appear to have decreased in the absence of management. In the ACT there have been repeated surveys of 1 m x 1 m quadrats on permanently marked transects to monitor plant biodiversity. At Yarramundi Reach these have been undertaken since 1993. Compilation of this data and reassessment in May 2007 shows that the percent cover of CNG has fluctuated markedly over a period of years (Figure 3). Grass cover is obviously influenced by seasonal and climatic factors but CNG has evidently disappeared from some quadrats a proliferated in others.

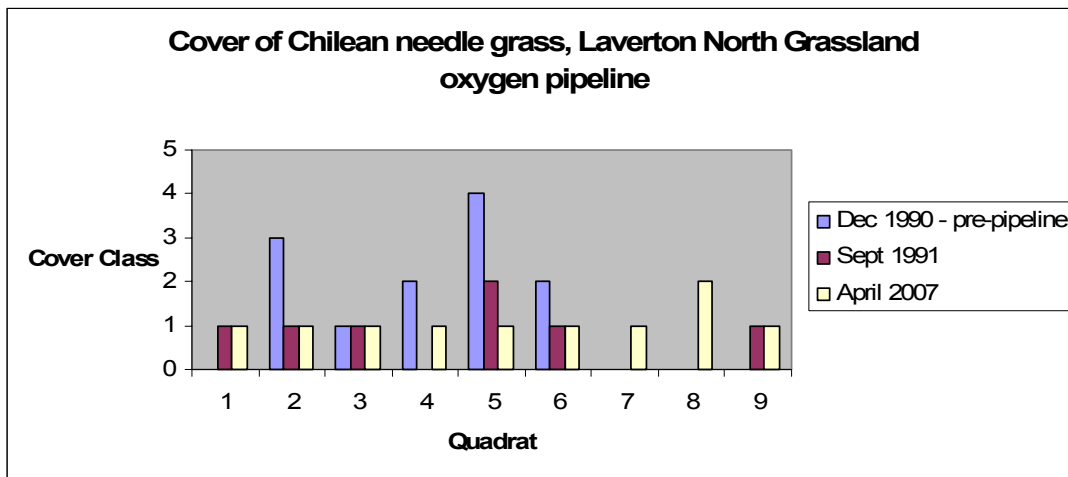
Figure 3. Percentage foliar cover of CNG in permanent quadrats at one site in the ACT.



Disturbance of native grassland resulting in the death of the dominant native grasses might be expected to lead to proliferation of CNG in the disturbed areas, if suitable seed sources are available. Studies along the oxygen pipeline around the edge of Laverton North Grassland, Victoria, indicate that CNG presently constitutes only 5% or less cover in the disturbed areas, approximately the same as it was in the first survey after pipeline

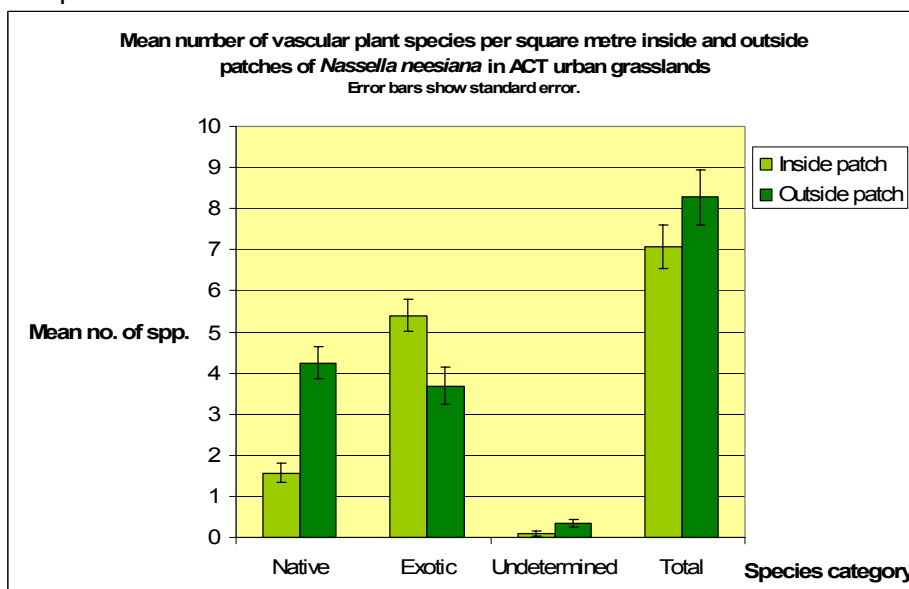
installation, and markedly less than before pipeline construction (Figure 4). However it is not clear to what extent management activity has resulted in CNG suppression in the pipeline areas.

Figure 4. Cover of CNG has not increased in an area severely disturbed by the installation of a pipeline at Laverton North Grassland, Victoria.



3. Floristic studies in the ACT show that *N. neesiana* patches have reduced native plant diversity compared to immediately adjacent areas, outside the patches, that are dominated by native grasses (Figure 5). Similar comparisons in Victorian grasslands have yet to be undertaken.

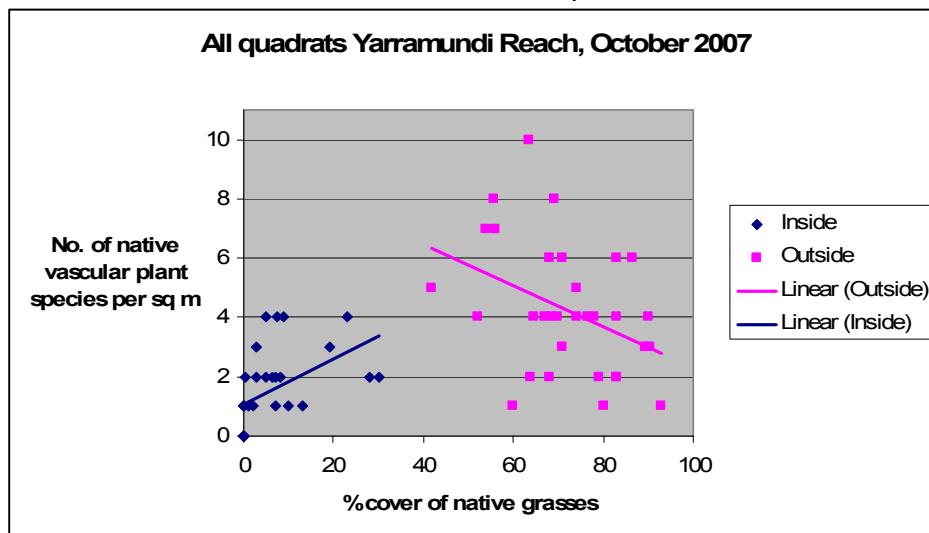
Figure 5. Studies in ACT grasslands show that CNG patches have much lower diversity of native vascular plants than immediately adjacent areas, but have a significantly higher component of other weeds.



The number of native species also varies as the cover of native grasses increases (Figure 6). Inside CNG patches the number of native species tends to increase as the native grass cover increases – i.e. as the proportion of CNG falls. But outside the patches, dense native grass cover often suppresses and excludes other native plants, and the trend is towards reduced diversity when native grass cover is high. This is a well known phenomenon in Kangaroo

Grass (*Themeda triandra*) grasslands that are not regularly subjected to biomass reduction e.g. by burning.

Figure 6. Variation in the number of native vascular plants species with cover of major native grasses (*Themeda triandra*, *Austrodanthonia* spp., *Austrostipa* spp., *Botriochloa macra* and *Poa labillardieri*) inside and outside CNG patches.



Unmanaged, over-mature stands of Kangaroo Grass rapidly lose their native plant diversity. The Kangaroo Grass senesces and tussocks eventually die. CNG invasion appears to occur when the tussocks die, or soon afterwards, if seed is available in the soil. It may be that reduced native plant diversity is an enabling factor for CNG invasion, rather than a consequence of invasion.

4. A range of generalist invertebrate herbivores utilise *N. neesiana* for food. A mistaken idea seems to have developed that insects do not attack CNG in Australia. In fact a range of species have been found eating the plant and utilising it for shelter. For example, several native species of moth caterpillars found on CNG have been reared to the adult stage entirely on CNG foliage (Figure 7). These are all generalist grass feeders and recognised pasture pests, except for the endangered Golden Sun Moth, which was previously believed to be restricted to *Austrodanthonia* spp. A number of native ground weevil species live in CNG tussocks and as adults consume the dead foliage. These also utilise tussocks of *Austrostipa* spp.

The Grass Stem Anthribid (Figure 8) is another generalist that appears to attack any grass with flowering stems of the appropriate diameter and height. It is supposedly a native insect, although no host plants have previously been recorded for it in Australia. Female beetles lay eggs in the stems of CNG, and a diverse range of other exotic and native grasses in Victoria. Kangaroo Grass *Themeda triandra* appears to support markedly fewer herbivorous insects than CNG, although a few specialist species have been uncommonly found on it.

CNG is also readily eaten by kangaroos, and cockatoos dig out the centres of tussock and consume the succulent stem bases (Figures 9 and 10).

Figure 7. Moths with larvae found on CNG. Larval feeding of *Synemon plana* has not been demonstrated but pupal cases have been found protruding from CNG tussocks in areas dominated by the grass.

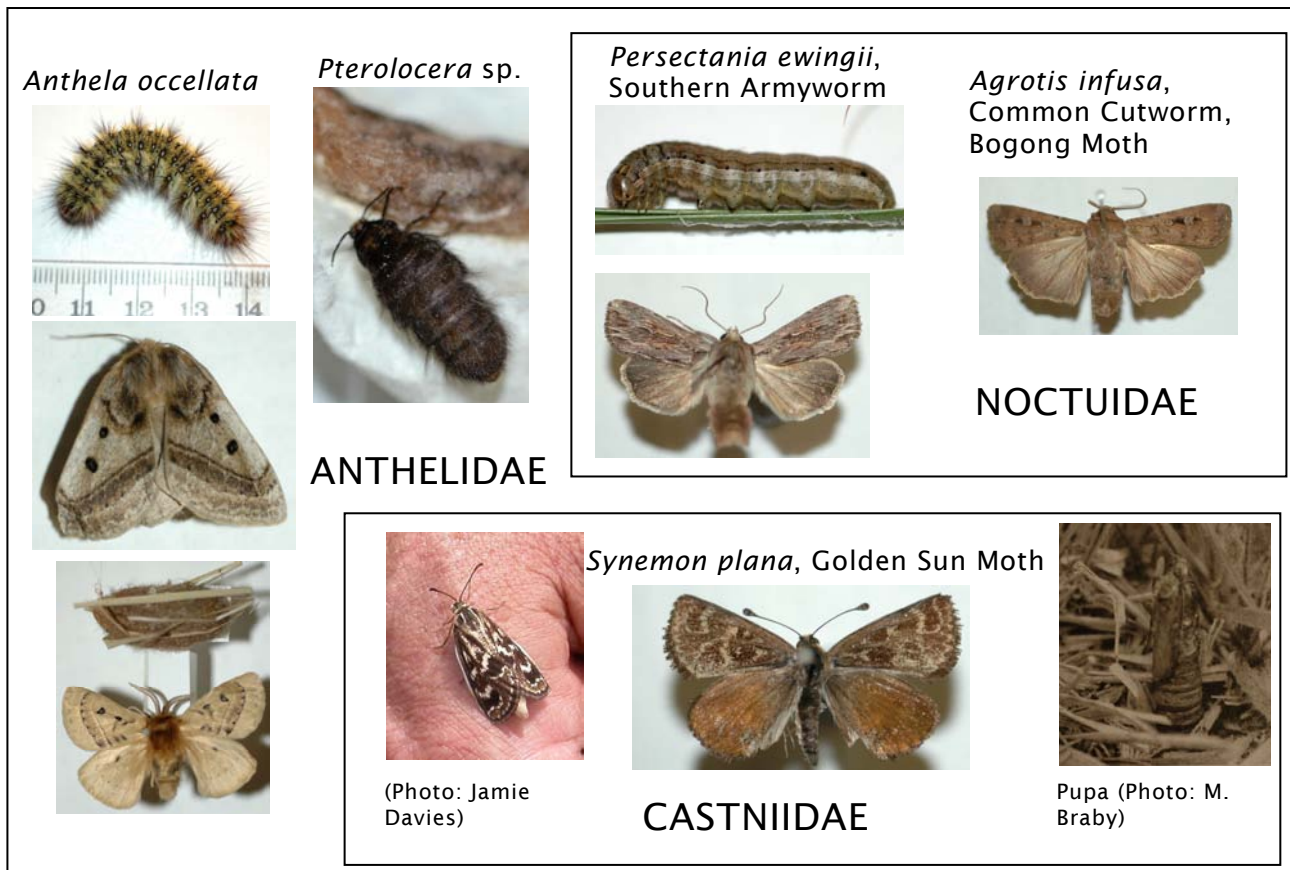


Figure 8. Grass Stem Anthribid, *Euciodes suturalis*, has larvae that bore in the stems of a wide range of grasses including CNG and Kangaroo Grass. [Three pictures on the left from D.R. Penman (1978) *Biology of Euciodes suturalis* (Coleoptera: Anthribidae) infesting cocksfoot in Canterbury. *New Zealand Entomologist* 6(4), 421-425.]

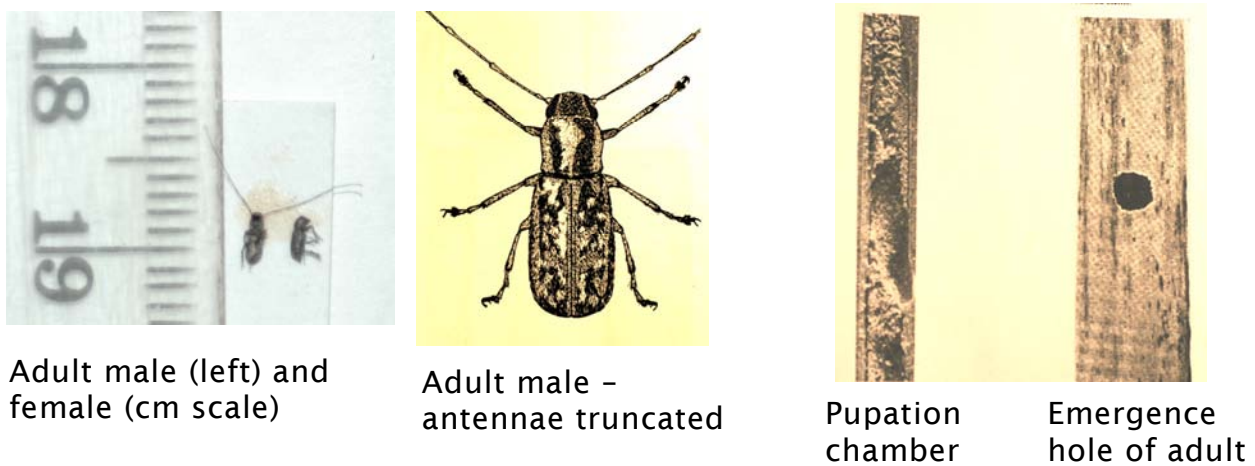
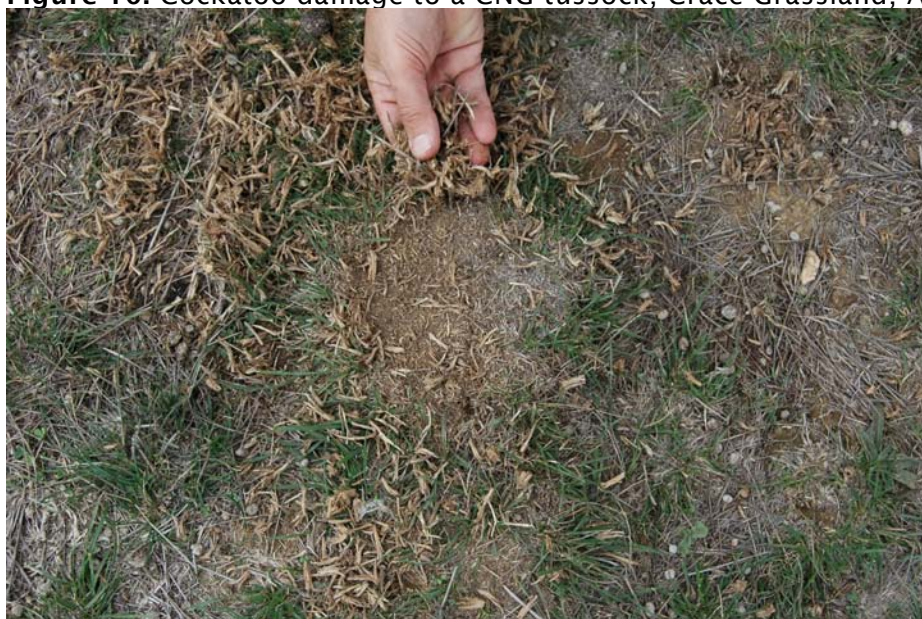


Figure 9. Galahs feeding on CNG, Stirling ACT.



Figure 10. Cockatoo damage to a CNG tussock, Crace Grassland, ACT



5. Various disturbances appear to facilitate CNG invasion. These include soil disturbance and activities that kill native grass tussocks. Recent studies have demonstrated that soil disturbances such as digging are a vital factor in the creation of ‘safe sites’ for the establishment of a range of native grassland forbs. Prior to European occupation of native grasslands, soil disturbance is believed to have been much more prevalent than it is today. There was a range of native burrowing and digging animals such as bettongs that are no longer present. Aboriginal digging for the harvest of yams and other tubers also no longer occurs. So soil disturbance can be detrimental or beneficial depending on whether it will advantage weeds or native plants. Where there is a CNG soil seed bank, it is likely to advantage the CNG.

6. Invasions appear to be able to be halted and stabilised by appropriate management. In the ACT, grazing by kangaroos and managed grazing with cattle is used to reduce grass biomass and may be effectively limiting CNG seed production and spread. At Laverton North grassland in Victoria regular burning appears to have stabilised the CNG infestations by keeping Kangaroo Grass swards healthy. In adjacent, unmanaged areas at Laverton North, such swards are senescent, and active invasion by CNG is still occurring.

Chilean needle grass: Integrating herbicide wipers



Chilean needle grass Research Update -

Nov 2007

Basis and aim

Registered selective chemicals for the control of CNG (e.g. flupropanate) place large restrictions on grazing systems related to long withholding periods and the high cost of chemical.

The use of herbicide wipers enables less expensive knockdown chemicals (e.g. glyphosate) to be applied in a selective manner to CNG – often these chemicals also have short withholding periods. Given that sheep are reluctant to graze flowering CNG, sheep could be used to create a height differential by grazing palatable grasses (e.g. Phalaris) to make wiping even more selective.

Setup

A carpet herbicide wiper mounted on the linkage of a tractor was used to apply the herbicide to 5m x 20m plots of phalaris and cocksfoot pasture infested with CNG (Figure 1). The wiper was driven at 8 km/hr and operated at 20cm above ground level, as both single and double passes (two passes in opposite directions). Treatments were applied during the spring of 2005 and 2006.



The herbicides used through the wiper were glyphosate and flupropanate as well as a mixture of both of these. These two chemicals were also boom sprayed onto other plots at label rates as a comparative application technique.

Certain plots at the trial site were grazed by sheep prior to wiping in 2005 to selectively graze down the desirable grass species (e.g. phalaris; Figure 2), this was not repeated in 2006. Herbicide wiping treatments that contained only glyphosate were the only treatments to be re-applied in spring 2006.

Measures

Vegetative composition measured using 100 point (1m x 1m) pasture comb recording basal observations. Measured at start of growing periods.

Classifications - Chilean needle grass
Desirable perennial grasses
Annual grasses
Broadleaf weeds (perennial and annual)
Legumes
Vegetative litter
Rock
Bare soil

Seed harvests at flowering using quadrat and hand shears. Measured for seed quantity and viability

Results – two years after application

Effect on CNG basal cover

- Plots wiped with either glyphosate or flupropanate had less CNG than the control plots.
- Plots wiped with both glyphosate and flupropanate as a mixture did not have less CNG than the control plots.
- Plots that were boom sprayed with either chemical, separately or in combination, had significantly less CNG basal cover than the control plots.
- Double pass wiped plots generally had the same amount of CNG basal cover as their corresponding boom spray treatment plot (excluding the glyphosate and flupropanate combination).

Effect on other species basal cover

- Plots wiped with a single pass (any chemical or combination) had less desirable perennial grass basal cover than double pass plots.
- Boom spray plots (excluding the glyphosate and flupropanate combination), and double pass wiper plots generally had more desirable perennial grass basal cover than the control plots.



Effect of grazing on wiper effectiveness

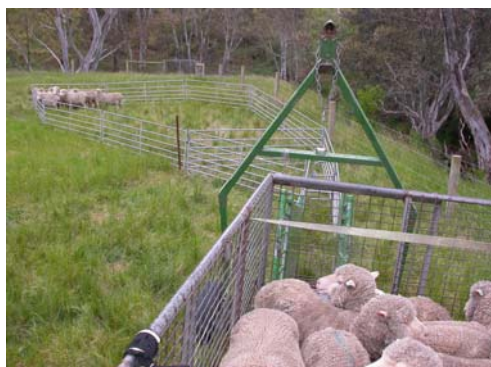
- Grazed plots had more CNG basal cover than ungrazed plots (all combinations of single pass wiping, double pass wiping and boom spraying)
- Grazing did not effect any other pasture composition measures.

Effect on panicle seed viability

- Plots wiped with glyphosate had nearly no viable panicle seeds (Figure 3).
- Boom spray glyphosate plots had no viable seed in the spring of application yet had recovered by the second spring.

Management Implications

- The effectiveness of the herbicide wiper was enhanced by using the double pass method.
- CNG flowers for approximately two weeks, so there is a very limited window in which wiping can be an effective control measure. The exact time of flowering is dependant on seasonal conditions such as rainfall and temperature.
- Wiping at the flowering period will definitely contaminate all equipment used for the procedure – Strict machinery hygiene and brush down protocols need to be in place to avoid transporting viable seed.
- Wiper towing equipment with low ground clearance or narrow wheelbases are likely to reduce wiping efficiency - Wide wheel bases and large wheel diameters are recommended to limit the effects of ground undulation, 'wheel tracking,' and grass squashing under the vehicle.
- This trial has revealed an antagonistic reaction between concentrated mixtures of glyphosate and flupropanate – as such this combination should be avoided when using herbicide wiper applicators.
- Ensure the wiper height is appropriate to the grass height and is not dripping mixed herbicide onto non target species
- Grazing needs to be timed to limit the exposure of livestock to flowering CNG panicle seed, yet not too early to encourage grazing of vegetative CNG stems.



Project manager

Dr Charles Grech

Weed Sciences (DPI Attwood)
475 Mickleham Rd Attwood VIC 3049
Ph (03) 9217 4120



Chilean needle grass: Maintaining Feed Value by mowing and fertiliser application

Charles Grech (Weed Sciences – Attwood)

Introduction

This information note provides practical information about how to increase the grazing feed value and utilisation of mature Chilean needle grass (*Nassella neesiana*, CNG) infestations.

The Issue

CNG is tough fibrous grass that livestock are reluctant to graze in pasture situations where CNG is allowed to grow rank. Once CNG begins to produce seeds, it not only becomes less palatable, but also produces sharp pointed panicle seeds that readily attach to animals and further discourages grazing.

Trial setup and treatments

A scientifically analysed and replicated trial was established in Greenvale to assess the feed value of CNG, as compared to cocksfoot, over a 2 year period (8x10m plots).

The paddock used had an Olsen Phosphorus of 10 mg/kg (7.5mg/kg Bray1) pH 5.3 (1:5 water) and average annual rainfall of 543 mm. The pasture within the paddock comprised of CNG, CF, phalaris (*Phalaris aquatica*), rye grass (*Lolium perenne*) and subterranean clover (*Trifolium subterraneum*)

Certain plots were mown several times using a hand mower to simulate crash grazing and maintain the CNG in a vegetative growth phase. Within these mown plots, some received fertilizer additions, broadcast at the start of the trial period (18th September). Fertilisers used were Single Superphosphate (250kg/ha) and two split applications of urea (totaling 100kg/ha)(See table 1).

Plant samples of CNG and cocksfoot (CF), from a mixed infestation, were analysed using FEEDTEST for Crude protein (CP), metabolisable energy (ME), neutral detergent fibre (NDF), digestibility (DDM) and dry matter (DM). The samples were taken as ‘grab samples’ of each species at different plant growth stages throughout 2 years (See table 2).

Table 1 - CNG feed evaluation treatments

Treatment	Phosphorus fertiliser (kg/ha)	Nitrogen fertiliser (kg/ha)	Mowing
1	Control	Control	N
2	0	0	Y
3	22	0	Y
4	0	92	Y
5	22	92	Y

Table 2 - Feed evaluation sampling times

Sampling event	Season	Growth stage	Sampling date	Clipping date
1	2003 Spring	Vegetative	17 September 2003	24 September 2003
2	2003 Spring	Seedhead development	24 October 2003	27 October 2003
3	2003 Spring	Flowering	19 November 2003	20 November 2003
4	2003 Summer	Seed fall	4 December 2003	-
5	2004 Autumn	Vegetative	31 May 2004	31 May 2004
6	2004 Spring	Vegetative	2 September 2004	14 September 2004
7	2004 Spring	Seedhead development	19 October 2004	22 October 2004
8	2004 Summer	Flowering/Seed fall	1 December 2004	1 December 2004
9	2005 Spring	Vegetative	2 September 2005	-



Figure 1 - Close up view of CNG physiological growth stages (left to right: CNG vegetative, CNG seedhead development, CNG flowering)

Results

Mown vs Unmown

- Mowed regrowth had more protein, metabolisable energy and was more digestible with less fibre
- Cocksfoot generally responded better to clipping
- Unclipped CNG that grew rank had very low digestibility at time of flowering.

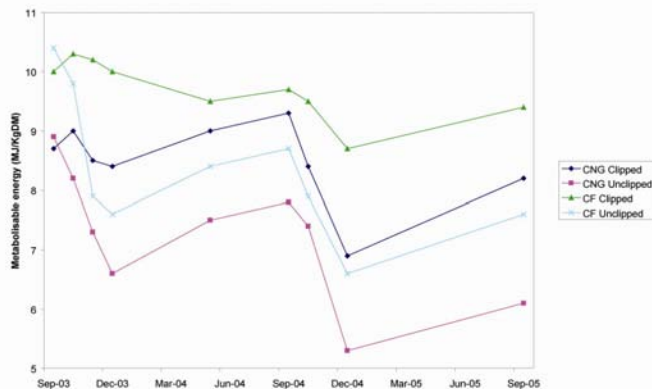


Figure 2 - mowing effects on metabolisable energy content

Nitrogen fertiliser effects

- Fertilised regrowth of both species had more crude protein, metabolisable energy and less fibre during the flowering period following fertiliser application.
- Cocksfoot responded better to nitrogen and had more crude protein, for a longer period than CNG.

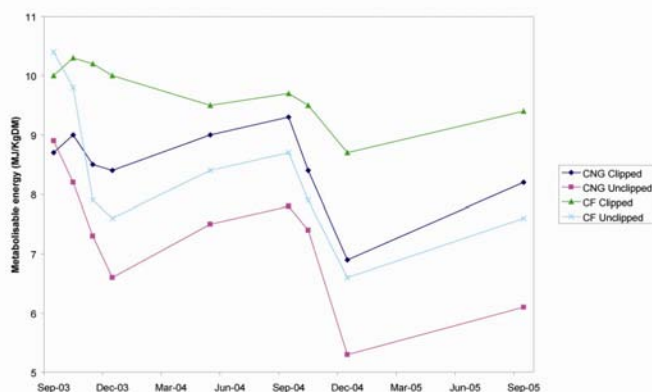


Figure 3 - nitrogen effects on crude protein content

Phosphorus fertiliser effects

- Phosphorus did not have any effect on the feed value of either species.

CNG infestation management implications

CNG feed value is generally less than that of CF

CNG needs to be kept short and vegetative to maintain reasonable levels of feed quality throughout the spring period

Nitrogen fertiliser addition can provide an immediate boost to CNG crude protein content – although

1. *The gain is short term*
2. *CNG feed value did not respond as much as that of CF*

Phosphorus fertiliser addition did not provide any substantial gains in feed value of CNG

Further reading:

Grech (2007) Chilean needle grass: Managing seed production by slashing. AgNote AG1308. Department of Primary Industries, Victoria.

Acknowledgments

Ian and Margaret Souter, John and Allen McKenzie for helping operate the trial and trial site. Funding through Natural Heritage Trust, CRC for Australian Weed Management & The University of New England as part of PhD project – ‘Grazing management for the long term control and utilisation of CNG.’ Photos: Charles Grech.

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.



Chilean needle grass: Soil fertility management

Charles Grech (Weed Sciences – Attwood)

November 2007

AG1309

ISSN 1329-8062

Introduction

This information note provides information about how Chilean needle grass (*Nassella neesiana*, CNG) grows in soils with different levels of soil phosphorus and pH, and how this compares to phalaris (*Phalaris aquatica*) (Figure 1).



Figure 1 - Trial pots of CNG and Phalaris in the glasshouse

The Issue

Weed invasion can often be linked to poor soil fertility or pasture management. Badly managed soils can create conditions that are not favorable for desirable species to grow and this allows other weedy species to invade.

Trial setup and treatments

Soil from a paddock in Greenvale was extracted to a depth of 100mm and used to grow transplanted CNG and Phalaris seedlings under glasshouse conditions in a replicated scientific experiment.

The soil from Greenvale had an Olsen Phosphorus value of 6.1 and a pH (CaCl) of 4.7. Soil ameliorants were added to the Greenvale soil to modify the soil fertility (phosphorus) and pH (Lime).

For the findings described in this AgNote, the experiment consisted of soil phosphorus addition (none, or phosphorus added), and 3 soil pH levels (pH 5, 7 and 9) in a two species (CNG and phalaris) factorial design replicated 3 times.

The experiment measured the plant heights during the growth period and also destructively sampled the plants as seedlings (early tillering) and mature plants (seeding) to determine leaf area, shoot mass and root mass.

Seedling Results

Seedling heights in response to phosphorus

- CNG taller at early seedling stages however Phalaris seedlings caught up by harvest
- Both species grew better/taller when in response to phosphorus

Plant biomass in response to phosphorus

- Phalaris had heavier shoots, longer roots and larger leaf area than CNG (Figure 2)
- Both species had heavier shoots, roots in response to phosphorus
- Both species did have an increased root to shoot ratio in response to phosphorus

Plant biomass in response to soil pH

- Both species had the greatest leaf area at pH 7
- pH did not effect shoot weight, root length, root weight, or root to shoot ratio

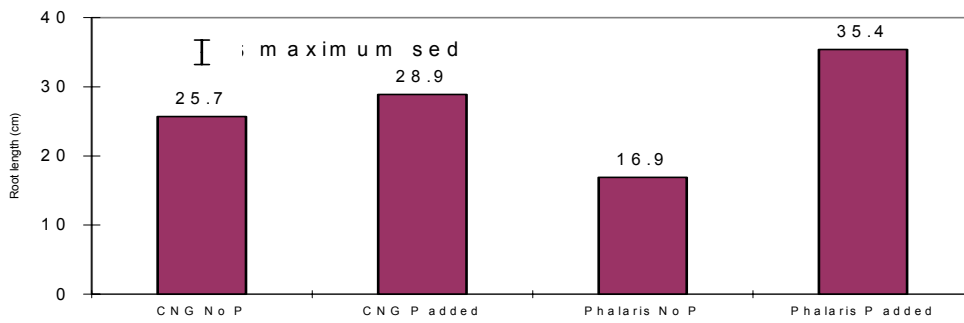


Figure 2 - Effect of phosphorus for each species on seedling root length at harvest

Mature plant Results

Plant biomass in response to phosphorus

- Both species had heavier shoots
- Phalaris had increased root growth (increased root to shoot ratio)

Plant height in response to Phosphorus

- Increased height of both species
- CNG grew taller by the time of harvest
- Phalaris responded more than CNG

Plant biomass in response to soil pH

- Both species grew taller and had heavier shoots in pH 7 or 9
- Phalaris grew taller and had heavier shoots than CNG in response to liming
- CNG generally grew taller than Phalaris by harvest (Figure 3)

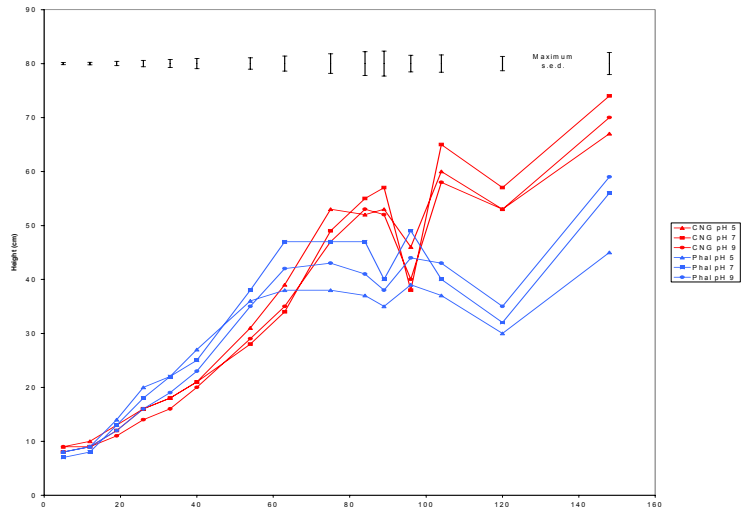


Figure 3 - mature plant height in response to soil pH

Management implications

Phalaris seedling growth was encouraged more by applying phosphorus to the soil when compared with CNG seedlings, however by maturity, the response of CNG to soil phosphorus was greater than that of phalaris, indicating the use of increased phosphorus with phalaris may not be useful of itself in generating increased plant growth responses against CNG.

The growth responses of the two species were similar in soils of differing pH, so as with phosphorus, changing the soil pH is unlikely to be useful management tool for CNG, at least when in a mixed sward with phalaris.

Further reading:

Grech C. (2007) Chilean needle grass: Maintaining Feed value by mowing and fertiliser application. AgNote AG1306. Department of Primary Industries, Victoria.

Grech C., McLaren D.A., Chapman D.F. & Sindel B.M. (2005) Chilean needle grass (*Nassella neesiana*) - Integrated grazing for success. In 'Tussock Terminators Research Forum', Albury, pp. 11-14.

Acknowledgments

Caroline Muir for providing soil for the trial, James Winters (Honours LaTrobe University) for assistance with setup and data collection. Funding through Natural Heritage Trust, CRC for Australian Weed Management & The University of New England as part of PhD project – 'Grazing management for the long term control and utilisation of CNG.' Photos: Charles Grech.

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.



Chilean needle grass: Grazing management and stock class

Charles Grech (Weed Sciences – Attwood)

Introduction

This information note provides practical information about how to use sheep or cattle in Chilean needle grass (Nassella neesiana, CNG) infestations to minimise seed production and the risk of weed spread.

The issue

CNG is considered an unpalatable grass compared to other more desirable native and introduced species. Often livestock are reluctant to graze CNG once the seedhead has emerged from the stem. This means that paddocks are grazed unevenly and enables CNG to set seed, disadvantaging the other grasses.

The panicle seeds of CNG readily attach to the coats of animals, causing skin infections and carcass damage. Animals that are contaminated with seeds are capable of spreading CNG into clean areas on farm, and also across districts.



Figure 1 - CNG panicle seeds in sheep fleece

Legislation

The relevant State legislation related to the spread of noxious weeds is Section 70A of the *Catchment and Land Protection Act 1994*. This section prohibits the movement of prescribed vehicles, machinery, equipment, hay, grain, fodder or livestock onto or off land without taking

reasonable precautions to ensure they are free from noxious weed contamination - specifically seed or any part of the noxious weed which is capable of growing.

Trial setup and treatments

Sheep and cattle were grazed in separate paddocks, as part of a replicated scientific experiment at Greenvale over 2 years (Table 1). Paddocks were stocked at 12 DSE/ha and grazed as a 'set stock' or 'rotational' system. Rotationally grazed stock were moved around a system of four paddocks (fortnightly and weekly moves) whereas set stock animals grazed the same paddock continuously.

Stems of CNG were harvested from quadrats in the paddocks at the end of spring, prior to seeds falling out of the seedhead (standing panicle seed). Panicle and stem cleistogene seeds were then counted for each quadrat.

Table 1 - Grazing treatments

Treatment	Stock	Grazing system
1	None	None
2	Cattle	Set Stock
3	Cattle	Rotational
4	Sheep	Set Stock
5	Sheep	Rotational

Results

Grazed Vs ungrazed

- Grazed plots had less standing CNG panicle seed. (e.g. 472 seeds/m² compared to 8,730 seeds/m²)
- Grazing did not reduce the number of cleistogenes in both years.
- Panicle seed viability was not affected by grazing.
- Broadleaf weed cover was increased in grazed plots. Other species were not affected.
- Pasture that regrew in grazed plots had a smaller proportion of CNG than ungrazed pasture growth.

Sheep Vs cattle

- Cattle graze more standing CNG panicle seed than sheep (one year only).
- Cattle plots had more bare soil and less plant cover than sheep plots.
- The composition of pasture regrowth was similar for cattle and sheep plots.
- Cattle and sheep gained liveweight in similar amounts.
- Cattle are less likely to be contaminated by CNG panicle seed than sheep.

Rotational grazing Vs set stock grazing

- Did not affect CNG seed yield at harvest.
- Did not affect pasture cover or regrowth composition.
- Did not affect animal liveweight gains.

Management implications

Grazing at 12 DSE/ha had a limited effect on reducing CNG seedhead production:

- Stocking rates could be higher to achieve less selective grazing and force stock to graze CNG.
- Stock were reluctant to graze CNG after the seedheads had emerged from the stems.
- Reduced seedhead production only occurred in an area where stock had grazed evenly and effectively prior to seedhead emergence.

EXAMPLE: In a 4 paddock rotational system, the stock will only graze 1 paddock in the period before flowering.

- Grazing needs to be integrated into a whole infestation management plan such that seed is not allowed to mature in non-grazed areas. Other strategies could include spraytopping, slashing, or burning.

Seed spread and Animal welfare:

- Shearing will not remove all CNG panicle seeds. CNG panicle seeds are still likely to be present in the skin and can drop out in transport or into clean paddocks.



Figure 2 - CNG panicle seeds in sheep skin after shearing

- *The fleece and carcass of sheep is likely to become heavily contaminated by CNG panicle seeds if the sheep are not removed from an infested paddock prior to CNG flowering.*
- *Cattle generally carried only a few seeds, but mass infections in the brisket, eyes, and gums have been known to result to when cattle graze mature CNG seedheads.*

Movement of stock and farm vehicles

- *Do not graze sheep in areas of flowering or seeding CNG - they are able to spread CNG 'through the fence' from roadsides or infested paddocks to clean areas of the farm.*
- *Sheep should not be transported without taking reasonable precautions to ensure they are free from CNG contamination.*
- *Avoid driving through seeding CNG infestations as seed will readily adhere on vehicles and machinery.*

REMEMBER: One ute can be contaminated with up to 10,000 seeds!

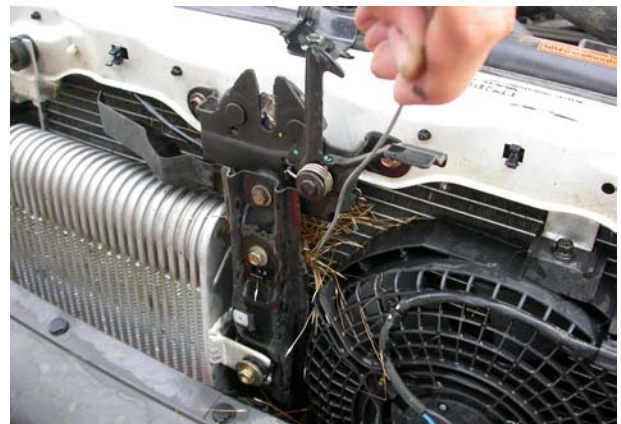


Figure 3 - CNG seeds on vehicle radiator

Further reading:

Grech C. (2007) Chilean needle grass: Managing seed production by slashing. AgNote AG1308. Department of Primary Industries, Victoria.

Grech C., McLaren D.A., Chapman D.F. & Sindel B.M. (2005) Chilean needle grass (*Nassella neesiana*) - Integrated grazing for success. In 'Tussock Terminators Research Forum', Albury, pp. 11-14.

Acknowledgments

Ian and Margaret Souter, John and Allen McKenzie for helping operate the trial and trial site. Funding through Natural Heritage Trust, CRC for Australian Weed Management & The University of New England as part of PhD project - 'Grazing management for the long term control and utilisation of CNG.' Photos: Charles Grech.

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.



Chilean needle grass: Southern Region Best Management Practice

Charles Grech (Weed Sciences – Attwood)

November 2007

AG1310

ISSN 1329-8062

Introduction

This information note provides practical information about how to manage Chilean needle grass (Nassella neesiana, CNG) in winter rainfall grazing zones of Victoria and New South Wales using herbicides and pasture renovation.

The Issue

The growth of Chilean needle grass appears to be sensitive to rainfall, and this sensitivity could be an interaction of temperature and rainfall. It is highly likely that the variation in plant vigour due to climate will strongly affect the success of management treatments. This experiment was aimed at comparing set stocking with strategic grazing of a CNG dominated pasture combined with treatments of chemical control, fertility and pasture rehabilitation to reduce the dominance of CNG in different climatic regions with winter rainfall.

Legislation

The relevant State legislation related to the spread of noxious weeds is Section 70A of the *Catchment and Land Protection Act 1994*. This section prohibits the movement of prescribed vehicles, machinery, equipment, hay, grain, fodder or livestock onto or off land without taking reasonable precautions to ensure they are free from noxious weed contamination - specifically seed or any part of the noxious weed which is capable of growing.

The herbicide trial interim results provided in this publication are intended as a source of information only and must not be interpreted as a recommendation for herbicide use. Always read the label before using any agricultural chemical products.

Trial setup and treatments

The trial consisted of 3 winter rainfall trial sites, located at Greenvale (VIC), Toolleen (VIC) and Goulburn (NSW). Each site had fenced plots where the treatments were applied, within a larger experimental paddock (Figure 1). Each plot received a different combination of treatments including sheep grazing, herbicide and pasture renovation; this was replicated at each site

Grazing

Sheep in the 'set stock' graze plots were grazed at approximately 12 DSE/ha continuously throughout the year. 'Strategic graze' sheep grazed the plots at ~300 DSE/ha for 5 short periods (3 days) per year. Grazing was also excluded from 'lockup' plots as a comparison.

Herbicides

Flupropanate sprayed plots were sprayed using a calibrated boom sprayer at a rate of 1.5l/ha during summer 2002 (Goulburn) or winter 2003 (Greenvale and Toolleen).

Pasture Resowing

Plots that were resown were sprayed with glyphosate (540g a.i./ha) at 2l/ha prior to being direct drilled to introduced pasture species with fertiliser (Phalaris, Cocksfoot, Subterranean clover).



Figure 1 - Greenvale plots

Results

Grazing

- 'Set stock' grazing reduced the desirable grass basal cover leading to bare ground and re-invasion of CNG.
- 'Strategic grazing' plots had less standing CNG seed at the end of spring, and a greater cover of desirable grass species.

Herbicide

- Flupropanate at 1.5l/ha (1117.5g a.i./ha) reduced CNG basal cover over a period of 12 months.
- The selectiveness of flupropanate was variable and resulted in damage to phalaris and perennial ryegrass leading to bare ground.
- The effectiveness and residual activity of flupropanate was varied across the sites and soil types.
- Glyphosate quickly browned out CNG tussocks at all sites although CNG regrew 6-12 months post application.

Pasture resowing

- Dry seasonal conditions limited pasture seed germination, establishment and vigour.
- Desirable grass basal cover was increased by resowing although it did not reduce CNG basal cover.
- Sprayed out plots were re-invaded by CNG or other broadleaf weeds.

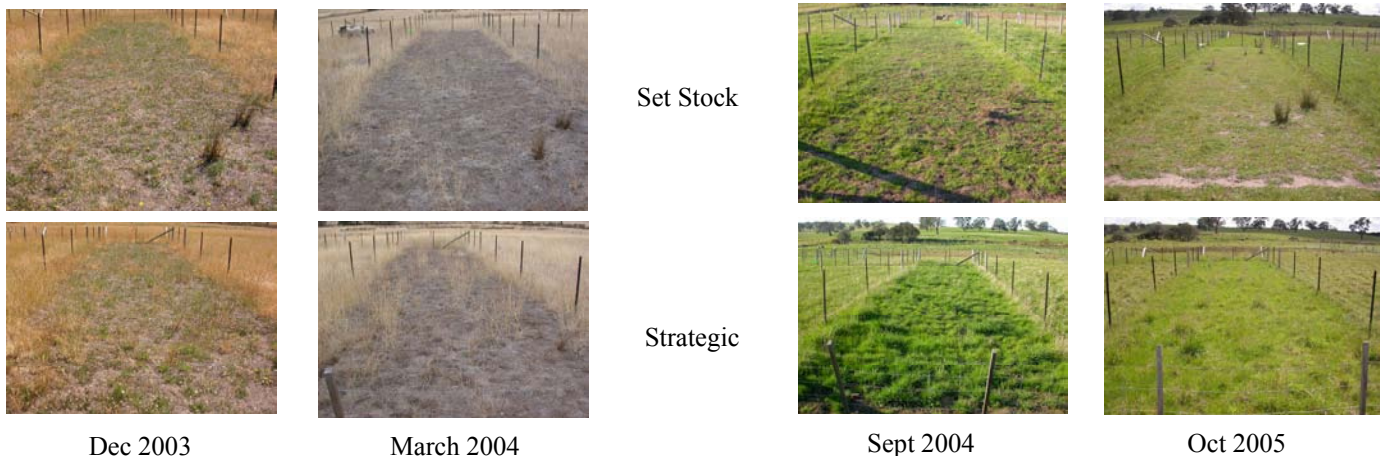


Figure 2 – comparison of 'set stock' and 'strategic' graze plots treated with flupropanate

Management implications

Sheep are reluctant to eat CNG seedheads that have emerged from the stems.

- *Reduced CNG panicle seed production will only occur if sheep are 'strategically grazed' prior to the seedhead emerging from the stems.*
- *Sheep will tend to overgraze paddocks rather than eat CNG after seedhead emergence – Overgrazing occurs because the CNG becomes less palatable than the desirable grasses that are eaten down to the ground.*
- *Grazing needs to be integrated into a whole infestation management plan such that seed is not allowed to mature in non-grazed areas. Other strategies could include spraytopping, slashing, or burning.*

Seed spread and Animal welfare:

- *Shearing will not remove all CNG panicle seeds. CNG panicle seeds are still likely to be present in the skin and can drop out in transport or into clean paddocks.*

DO NOT continually graze areas that have been sprayed with flupropanate:

- *Areas will have reduced ground cover due to dead CNG plants leading to bare ground – this can lead to seasonal fluxes of broadleaf weeds (e.g. thistles) and annual grass weeds*
- *'Strategic grazing' needs to be used to allow desirable species to grow and fill the gaps.*
- *'Continually grazed' areas were quickly re-infested with CNG when compared to those that were 'strategically grazed.'*
- *Adequate pasture and ground cover needs to be maintained to ensure residual activity of the flupropanate in the soil – e.g. such that soil particles do not move or get washed away in floods.*

Further reading:

Grech C. (2007) Chilean needle grass: Managing seed production by slashing. AgNote #AG1308. Department of Primary Industries, Victoria.

Grech C. (2007) Chilean needle grass: Management by fire. AgNote AG1307. Department of Primary Industries, Victoria.

Acknowledgments

Ian and Margaret Souter, the Hickson family and John and Allen McKenzie for helping operate the trial and trial site. Funding through Natural Heritage Trust, CRC for Australian Weed Management & The University of New England as part of PhD project – 'Grazing management for the long term control and utilisation of CNG.' Photos: Charles Grech.

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.



Chilean needle grass: Management by fire

Charles Grech (Weed Sciences – Attwood)

November 2007

AG1307

ISSN 1329-8062



Figure 1 - Burning the CNG plots at Greenvale

Introduction

This information Note provides practical information about using fire to manage Chilean needle grass (*Nassella neesiana*, CNG) infestations as part of an integrated management strategy.

The Issue

CNG is a prolific seeder and has been known to produce upwards of 8,000 panicle seeds/m² as well as stem and basal cleistogenes. This amount of seed production ensures a viable seedbank that enables CNG to persist and re-invade pastures and grasslands after initial control works.

Chemical control options that provide residual control against CNG seedlings are limited and can be expensive. They may also impede the establishment of, or damage desirable vegetation.

Burning can reduce the seedbank of other *Nassella* species by destroying seed and stimulating germination. However mature CNG plants are adapted to fire and generally resprout strongly after burning.

Trial setup and treatments

The effect of fire on CNG infestations was measured by means of a replicated scientific trial in a paddock of CNG at Greenvale.

20 m x 20 m trial plots were each burnt once, using a drip torch at 3 different times of the year. CNG Seedhead production, seedling development and pasture composition were measured over the following seasons. Plots had an average basal cover of 26% CNG, 17% Phalaris/cockfoot and 32% pasture trash.

Table 1 - Burning treatments and dates of burns

Treatment	Burn Time	Date of burn	Growth Stage
1	Control (not burnt)	-	-
2	Early summer	6/12/04	Seedfall
3	Mid summer	12/1/05	Dormant / Post seedfall
4	Autumn	11/5/05	Starting vegetative growth



Figure 2 - Burnt plots – ‘early summer,’ ‘mid summer’ and ‘autumn’ (Left to right).

Results

Panicle seed harvest

- Burning at seedfall reduced CNG panicle seed yield for the season although burns were patchy.
- All burnt plots had similar seed production to the unburnt plot in the subsequent flowering period. (i.e. one year after being burnt).

Seedling stimulation

- By the following autumn, a greater density of CNG seedlings were present in the early and mid-summer burnt plots. However, by spring the unburnt areas had greater seedling density than any of the burnt plots.

Pasture regrowth

- Pasture mass (kg DM/ha) was less in burnt plots than unburnt plots for two years following the burns.
- 'Summer' and 'Autumn' burns had consistently less pasture mass than the 'Seedfall' burns for 2 years following the burns.

Pasture composition

FIRST YEAR

- All burnt plots had a higher percentage cover of annual grasses and more bare soil than unburnt plots.
- Plots burnt in 'Summer' had higher broadleaf weed cover than other burn plots.

SECOND YEAR

- All burnt plots had less plant/vegetative cover than unburnt plots.

Management implications

Time of burning

- *Burning at 'Seedfall' destroyed most CNG seed and is the best time to destroy seed, although seasonal conditions can restrict the potential for burning prior to the majority of CNG seedfall.*
- *Seek appropriate permits and authorities to burn in any periods of fire danger.*



Figure 3 - Fire progressing across 'Summer' burn plot

Pasture regrowth and composition

- *All burnt plots had a lot of bare soil leading to little pasture growth in the following seasons and a risk of broadleaf weed invasion e.g. artichoke thistle, cape weed.*
- *The recovery of desirable plants is minimal after burning of a pasture that has been heavily infested with CNG for a long period. Therefore burning for CNG management should only be considered as part of an integrated weed management program.*



Figure 4 - Regrowth of Phalaris surrounded by CNG – 5 months after 'Summer' burn

Stimulation of CNG seedlings

- *Burning at 'Seedfall' or 'Summer' created more bare ground and resulted in an increased CNG seedling invasion in the following season.*
- *Any area that is burnt needs to receive follow-up treatment to control CNG seedlings as part of an integrated weed management strategy.*
- *Follow up strategies appropriate to this arable situation could include chemical control in conjunction with cropping, or an intensive pasture renovation program.*

Further reading:

Grech C., McLaren D.A., Chapman D.F., Sindel B.M. (2005) Chilean needle grass (*Nassella neesiana*) - Integrated grazing for success. In 'Tussock Terminators Research Forum'. Albury pp. 11-14.

Acknowledgments

The Karmel family and Greenvale Country Fire Authority. Funding through National Heritage Trust, CRC for Australian Weed Management & University of New England as part of PhD study - 'Grazing management for the long term control and utilisation of CNG'. Photos: Charles Grech, Julie McPhee

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.



Chilean needle grass: Slasher cover for reducing Chilean needle grass spread

Ljubomir Erakovic¹, Aleksander Subic¹ and David McLaren²

¹RMIT University, School of Aerospace, Mechanical and Manufacturing Engineering

²Department of Primary Industries, Frankston

Introduction

This information note provides practical information about the design and use of slasher covers to reduce Chilean needle grass (Nassella neesiana, CNG) spread along linear reserves.

The issue

Slashing of CNG is a common occurrence along roadsides and within agricultural areas for purposes of fuel reduction and pasture management.

The movement of tractors and slashers in agriculture and roadside management is a major factor in the spread of CNG. Machinery operators are inadvertently spreading CNG into clean linear reserves and paddocks through daily slashing routines. The potential for weed spread has also increased with the use of vehicles and equipment that travel long distances between jobs.

Slashing has also been known to encourage the formation of dense flat CNG swards as upright plants are eliminated.



Figure 1 - Assessing CNG seed contamination to a slasher at Sunbury.

Legislation

The relevant State legislation related to machinery hygiene is Section 70A of the *Catchment and Land Protection Act 1994*. This section prohibits the movement of prescribed vehicles, machinery, equipment, hay, grain, fodder or livestock onto or off land without taking reasonable precautions to ensure they are free from noxious weed contamination. CNG is a proclaimed noxious weed throughout Victoria and Australia.

Trial setup and treatments

A RMIT Mechanical Engineering Masters project sponsored by the Commonwealth Weeds of National Significance program investigated slasher modifications to reduce weed spread. A model was developed using Computational Fluid Dynamics (CFD) to assess the best possible shape for a slasher cover to reduce CNG spread. The design changes are simple to build and make no changes to the original slasher (fig 2.) A linear reserve site severely infested with CNG was

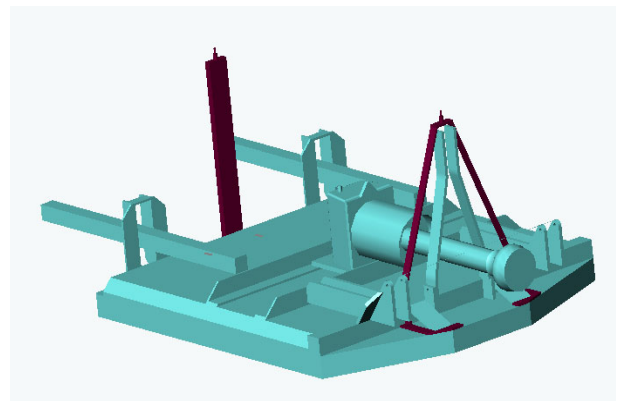


Figure 2 - Design changes (brown) to slasher deck (blue) for attachment of slasher cover

selected at Sunbury to investigate slashing CNG (Fig 1). Three 200 meters transect lines of CNG were chosen to assess slasher CNG seed hygiene performance with and without the slasher modifications. The number and density of CNG plants and number of panicle seeds per plant was assessed before slashing. The trial occurred during peak

seeding in summer. This enabled an estimation of the total potential number of CNG seeds in the areas being slashed.



Figure 3 - Slasher with fitted cover being trialed at Sunbury

Results

- A “proof of concept” slasher cover has been developed to reduce slasher CNG seed contamination and spread (Figures 2 and 3).
- Within each 200 meter transect being slashed at Sunbury were approximately 1.5-2.0 million CNG panicle seeds.
- Without a cover, more than 16,000 CNG seeds were recovered from the slasher deck (Figure 4, Table 1).
- Adding a cover to the slasher resulted in a 99% reduction in CNG contamination with only 122 CNG seeds being recovered from the slasher deck (Table 1).

Table 1- Number of CNG panicle seeds recovered from slasher deck after slashing 200 meters of dense seeding CNG

Slasher modification	Number of recovered CNG seeds from slasher	% CNG seed reduction.
None	16,212	0
Cover	122	99

Management implications

- **When CNG is slashed at seeding, slashers can become major vectors for CNG seed dispersal.**
- **A slasher cover and other modifications can reduce CNG seed collection on the slasher deck by more than 99%.**
- **Land managers and slasher contractors are encouraged to fit covers to their slashers to reduce weed spread.**
- **Slasher operators/contractors should be trained in CNG/weed identification and machinery hygiene.**
- **Slasher operators/contractors should have workplans to slash “CNG/weed” areas last and to protect ‘clean’**

areas and avoid working in weather when seeds will stick to machinery.

- **Slasher operators/contractors should have appropriately located and monitored brushdown points where contaminated machinery is cleaned.**



Figure 4 - CNG panicle seeds on slasher after slashing without cover

Further reading:

Baldyga, N. & Grech, C. (2006) ‘Machinery hygiene guidelines for roadside managers – Minimising the spread of Chilean need grass.’ DPI Victoria. ISBN 74146 610 5.

Grech C., McLaren D.A., Chapman D.F. & Sindel B.M. (2005) Chilean needle grass (*Nassella neesiana*) - Integrated grazing for success. In ‘Tussock Terminators Research Forum’, Albury, pp. 11-14.

Grech C. (2007) Chilean needle grass: Managing seed production by slashing. AgNote AG1308. Department of Primary Industries, Victoria.

Tyers, G., Grech, C. & Baldyga, N. (2004) ‘Machinery Hygiene,’ Department of Primary Industries, Victoria, Landcare Note LC0425.

Acknowledgments

The Weeds of National Significance program through the Natural Heritage Trust for funding the project. The Hume City Council for use of their slasher and trial site management. The CRC for Australian Weed Management.

Photos: David McLaren.

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.



Chilean needle grass: Managing seed production by slashing

Charles Grech (Weed Sciences – Attwood)

Introduction

This information note provides practical information about the timing of slashing of Chilean needle grass (Nassella neesiana, CNG) infestations to minimise seed regeneration and risk of weed spread.

The issue

Slashing of CNG is a common occurrence along roadsides and within agricultural areas for purposes of fuel reduction and pasture management.

The movement of tractors and slashers in agriculture and roadside management is a major factor in the spread of CNG. Machinery operators may be inadvertently spreading CNG into clean paddocks through daily routines. The potential for weed spread has also increased with the use of vehicles and equipment that travels long distances between jobs.

Slashing has also been known to encourage the formation of prostrate CNG swards as upright plants are eliminated.

vehicles, machinery, equipment, hay, grain, fodder or livestock onto or off land without taking reasonable precautions to ensure they are free from noxious weed contamination.

Trial setup and treatments

The ability of CNG to regenerate a panicle seedhead after slashing was measured over two seeding periods in a replicated scientific trial at Greenvale.

Trial plots were slashed each year using a tractor linkage slasher at different times and combinations of growth stages. Total seed production was assessed at the end of spring, when the seed would have normally matured.

Table 1 - Treatment structure of trial

Treatment	Slashing frequency	Slash time	Physiological growth stage
1	None		
2	Single	Oct	Panicle swollen/emerging
3	Single	Nov	Panicle emerged/flowering
4	Single	Dec	Seedfall
5	Double	Oct & Nov	Combinations of above
6	Double	Nov & Dec	Combinations of above
7	Triple	Oct, Nov & Dec	Combinations of above



Figure 1 - Tractor slashing flowering CNG at Greenvale

Legislation

The relevant State legislation related to machinery hygiene is Section 70A of the *Catchment and Land Protection Act 1994*. This section prohibits the movement of prescribed



Figure 2 -CNG panicle seeds on slasher after slashing at seedfall

Results

- All treatments significantly reduced panicle seed production at the time of harvest.
- Slashing at ‘seedfall’ had the greatest risk of spreading viable CNG seed on the equipment used.
- No CNG panicle seed regrew from swards that were slashed at ‘seedfall’ in 2004, or ‘flowering’ in 2005. Minimal seed regrew after ‘swollen’ stage in 2005.
- The viability of panicle seed, including those that regenerated after slashing, was quite high and not affected by the time of slashing or time combinations.
- CNG Seeds that were slashed prior to flowering had a low viability and would not have contributed to the soil seedbank
- CNG seeds that were slashed at seedfall were almost 100% viable and will contribute to the soil seedbank
- Slashing during the swollen panicle stage in 2004 resulted in increased CNG seedlings and basal cover in 2005.

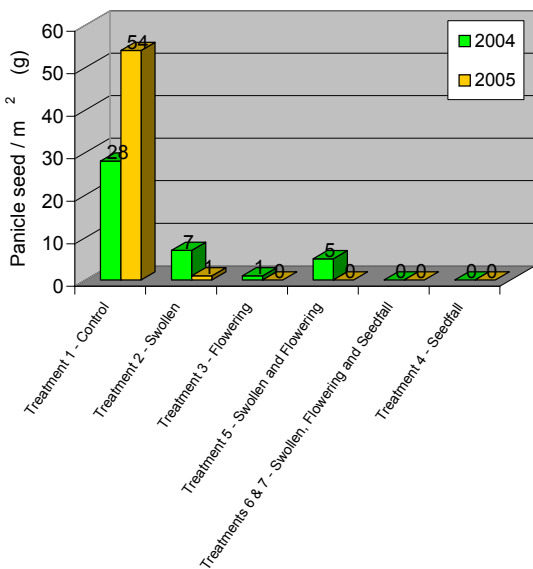


Figure 3 - The amount of CNG panicle seed that regrew per square metre after slashing at different plant growth stages, compared to the amount produced in an unslashed (control) area

Management implications

Findings from this investigation showed that to minimise panicle seed regrowth, and the risk of transporting viable seed, CNG needs to be slashed at the flowering stage.

CNG flowers for approximately two weeks, so there is a very limited window in which slashing can be an effective control measure.

The exact time of flowering is dependant on seasonal conditions such as rainfall and temperature.

Multiple, or early slashings reduce the need to slash all CNG infestations during the flowering period.

Slashing will deliver enhanced benefits if it is part of an integrated management strategy utilising:

operators/contractors trained in weed identification and machinery hygiene

mapped and monitored weed infestations

workplans to protect ‘clean’ areas and avoid working in weather when seeds will stick to machinery

appropriately located and monitored brushdown points where contaminated machinery is cleaned

appropriate engineering controls e.g. slasher covers



Figure 4 - Manual brushdown of slasher

Further reading:

Baldyga, N. & Grech, C. (2006) ‘Machinery hygiene guidelines for roadside managers – Minimising the spread of Chilean need grass.’ DPI Victoria. ISBN 74146 610 5.

Grech C., McLaren D.A., Chapman D.F. & Sindel B.M. (2005) Chilean needle grass (*Nassella neesiana*) - Integrated grazing for success. In ‘Tussock Terminators Research Forum’, Albury, pp. 11-14.

Tyers, G., Grech, C. & Baldyga, N. (2004) ‘Machinery Hygiene,’ Department of Primary Industries, Victoria, Landcare Note LC0425.

Acknowledgments

The Karmel family and Hume City Council for trial site management. Funding through Natural Heritage Trust, CRC for Australian Weed Management & The University of New England as part of PhD – ‘Grazing management for the long term control and utilisation of CNG.’ Photos: Charles Grech, Natasha Baldyga

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.