Integrated management of mown vegetation in eastern Australia

Sheldon C. Navie[1,2], Steve J. Hampton[2] and Nick Bloor[3]
[1] School of Land, Crop and Food Sciences, The University of Queensland, St Lucia, Qld 4068, Australia
[2] Grow Solutions Pty Ltd, 167 Church Road, Eatons Hill, Qld 4037, Australia
[3] Technigro Pty Ltd, 2–10 Rudman Parade, Andrews, Qld 4220, Australia
Corresponding author: s.navie@uq.edu.au

Summary Vegetation along roadsides and in public open spaces in Australia is currently managed by repeated mowing cycles, with some control of weeds using herbicides. This management regime is not only prohibitively expensive and labour intensive, mowing activities can also have negative impacts on public safety and the environment. Integrated Vegetation Management (IVM) projects are currently being undertaken in order to develop situation-specific strategies to reduce ongoing maintenance costs for the management of mown vegetation on roadsides and in public open spaces in eastern Australia. These strategies are designed to improve the management of existing plant populations, and/or alter the composition of vegetation to species that are most appropriate to a given situation. They involve the timed application of plant growth regulators and/or low rates of herbicides, in combination with mowing and weed wiping activities, in order to deliver the best results depending on the situation and composition of the vegetation. The objective is to develop a cost-effective and more sustainable model for managing mown vegetation, while improving the quality of managed areas. Reduction in mowing activities will also provide a range of additional benefits to the community and the environment (e.g. improved safety, less interruption to use of facilities, reduced carbon emissions and reduced weed seed spread).

Keywords Integrated vegetation management, roadsides, herbicides, plant growth regulators.

INTRODUCTION

Over the past 50 years, intensive mowing activities and the application of non-selective herbicides have been the predominant methods used to manage roadside vegetation (Berger 2005).

There is currently little known about the economics of managing mown vegetation or the actual life-cycle costs of vegetation management activities in Australia. An overall increase in environmental knowledge and regulation, coupled with an increased focus on safety, has prompted implementation of vegetation management methods that are reactive but often prohibitively costly.

Current practices are not sustainable. Mowing is costly, dangerous, time consuming, needs to be repeated often and has lead to weed seed dispersal, which increases the cost of ongoing management. In many cases, these responsive management activities have exhausted the limited available resources especially at seasonal growth peaks during the busiest times of the year.

Rising costs, more stringent environmental laws and standards, and increased public interests, have necessitated the exploration of more sustainable and environmentally responsible methods with which to manage such vegetation. Innovative methods that incorporate new technologies must be developed that meet the goals of both asset owner and asset manager and incur lower ongoing maintenance costs.

Resources dedicated to repetitive vegetation management activities could have been devoted to implementing more sustainable processes as part of an integrated strategy.

Internationally, over the last few decades, some vegetation managers have recognised the need to better manage the plant communities in question. Vegetation managers in countries such as the USA, Canada and Mexico have developed a decision-making process known as 'Integrated Vegetation Management' (Berger 2005). This holistic approach requires an understanding of the life cycle, seasonal cycle, species composition, and population dynamics of the vegetation under a range of environmental conditions.

The aim of this paper is to introduce and summarise a research project that is currently underway in eastern Australia. This will be achieved by explaining the need for this type of research, outlining the approach that is being undertaken, and highlighting some of the outcomes that are likely to be realised.

THE INTEGRATED VEGETATION MANAGEMENT PROJECT

Adopting this approach, a collaborative research project is currently being conducted in Australia, entitled The Integrated Vegetation Management Project (IVMP). Drawing on current knowledge and practice,

both nationally and internationally, the IVMP will evaluate and confirm best practice methods in order to resolve specific issues with managing mown vegetation in Australia.

The overriding strategic aim of the IVMP is the sustainable management of all classifications of mown vegetation and the improvement of vegetation, currently composed largely of undesirable 'weedy' species, to a situation where it is dominated by desirable, more manageable, species.

Scientific research, involving practical field trials, is being conducted in order to identify and test a range of best practices, technologies and tools with the following objectives:

1. An environmentally, socially and economically sustainable model for managing mown vegetation in public open spaces;
2. Proven strategies for improving the quality of managed areas;
3. Proven strategies for the cost-effective management of mixed species;
4. Cost effective strategies for managing areas populated by predominantly undesirable grasses; and
5. Identification of the plant species most appropriate for each given situation.

A review of international literature on IVM and scientific study is being combined with practical field trials to identify the most appropriate vegetation management practices in Australia for:

- Mown open spaces (urban and non-urban);
- Mown roadside vegetation (urban and non-urban); and
- Amenity turf and sporting turf environments.

An internationally experienced project team is focussing on three vegetation classifications that will best represent species composition across all managed environments. These classifications are:

1. A desirable monoculture;
2. A mixed species community of predominantly desirable grasses; and
3. A mixed species community of predominantly undesirable grasses.

The IVMP is trialling integrated strategies using plant growth regulators, herbicides and nutrition, in combination with mowing and other activities, to determine the combination of activities that best suits the species composition present in each classification.

The core strategy of the IVM process is the sustainable management of all these classifications of mown vegetation. This will often involve the improvement of communities composed of undesirable species into communities composed of desirable, more manageable, species.

Potential benefits Many potential benefits can be realised through the implementation of a successful IVM program. These include benefits to vegetation managers, the general public and the environment. Benefits to asset owners/managers include:

- Decreased costs for vegetation management;
- Reduced mowing activities/safer operation;
- Decreased labour costs;
- Reduced equipment and maintenance costs; and
- The opportunity for staff to complete other work.

Benefits to the general public include:

- Improved quality of amenity and sporting turf;
- Facilities more often available for use when required;
- Improved visibility on and around roads and footpaths;
- Fewer distractions for motorists;
- Reduced possibility of mowers throwing debris;
- Reduced risk of accidents.

Environmental benefits include:

- Reduced carbon emissions;
- Reduced waste;
- Reduced biomass;
- Improved erosion control;
- Reduced weed seed spread; and
- More efficient water use

PROGRESS TO DATE

The first step in the process is to better understand the vegetation that is currently being managed, and determine which species are desirable in certain situations. By drawing on local industry knowledge and conducting field surveys, much has been learnt about the grass species composition of mown vegetation and which are desirable to vegetation managers (S.C. Navie unpublished data). Although the species may vary from situation to situation, the major undesirable and desirable grasses in mown vegetation in eastern Australia are listed in Tables 1 and 2. In general, the list of desirable grasses includes those species that are deliberately cultivated in turfed areas, while the list of undesirable grasses includes those that invade such areas.

This information was vital when deciding on the specific direction of the project. It was the basis for the field trials, and gave a focus for which species should be selectively encouraged and which should be selectively discouraged.

Field trials In May 2008, screening trials of a range of chemicals began at the QDPI&F research facility at Redlands in Brisbane, Queensland. The chemicals tested in these trials were products considered to have potential in assisting in the management of the main

Table 1. Common undesirable or 'weedy' grasses of mown vegetation in eastern Australia.

Common name	Scientific name
Bahia grass	*Paspalum notatum* Flueggé
Common paspalum	*Paspalum dilatatum* Poir.
Crowsfoot	*Eleusine indica* (L.) Gaertn.
Elastic grass	*Eragrostis tenuifolia* (Rich.) Hochst. ex Steud.
Green panic	*Megathyrsus maximus* (Jacq.) B.K.Simon & S.W.L.Jacobs
Parramatta grass	*Sporobolus africanus* (Poir.) Robyns & Tournay
Rhodes grass	*Chloris gayana* Kunth
Setaria	*Setaria sphacelata* (Schumach.) Stapf & C.E.Hubb.
Sheda grass	*Dichanthium annulatum* (Forssk.) Stapf.
Vasey grass	*Paspalum urvillei* Steud.

Table 2. Common desirable grasses of mown vegetation in eastern Australia.

Common name	Scientific name
Blue couch	*Digitaria didactyla* Willd.
Buffalo grass	*Stenotaphrum secundatum* (Walter) Kuntze
Carpet grasses	*Axonopus* spp.
Green couch	*Cynodon dactylon* (L.) Pers. and hybrids
Kikuyu	*Pennisetum clandestinum* Chiov.
Seashore paspalum	*Paspalum vaginatum* Sw.
Water couch	*Paspalum distichum* L.

undesirable grass species. The trials were conducted to evaluate the phytotoxic effects of these chemicals on 28 desirable turfgrass species and cultivars.

Field efficacy trials are also being conducted over two growing seasons. These sites include public open spaces such as parkland and roadside sites that border environmental areas within the Brisbane, Gold Coast and Sydney regions. The focus of these field trials was to evaluate the efficacy of selected growth regulators and herbicides in managing major problematic grass species in open space reserve situations, with particular emphasis as to their effects on growth regulation, seed-head suppression and species composition.

The results of these initial field efficacy trials are encouraging, with several of the treatments providing seed-head suppression or selective control of the main target weed species at these locations (i.e. Bahia grass and common paspalum). If these control options are able to be provided to asset owners and those managing mown vegetation, they have the potential to provide significant and broad-ranging benefits. As an example, in situations where areas are dominated by an undesirable species such as Bahia grass, the trial data suggest that there is a range of environmentally responsible, sustainable strategies available to significantly reduce mowing requirements during the peak growing season. Further to this, in situations where areas are dominated by desirable species, the trial data suggest that there are strategies suitable for use in the removal of undesirable *Paspalum* species using either unscheduled or Schedule 5 herbicides with a far greater degree of human and environmental safety than the arsenate-based products currently used. These chemicals also have the potential to provide viable options for the selective removal of these invasive grasses from high value native grasslands, such as those found in conservation areas.

FUTURE WORK

The final year of the project will involve a three-pronged approach:

1. Evaluation of programs for the best performing treatments (i.e. selecting the most promising methodologies and evaluating these in programs conducted in field situations where Bahia grass and common paspalum dominate the vegetation cover). The purpose here is to make options available for commercial use as quickly as possible.
2. Optimisation of other chemicals that international experience and scientific literature identify as having potential, but may not have performed well in trials to date. This poor performance has been identified as being possibly due to the product rate selected or application interval. These products require further evaluation for efficacy against Bahia grass and other *Paspalum* species.
3. Evaluation of products in shortened programs for efficacy trials on a broader range of identified problem weed species, possibly including Rhodes grass, setaria, green panic and Sheda grass.

Further to this, aligned project and extension work is to be conducted in separate aligned trials with asset managers, including Gold Coast City Council and Powerlink Queensland. These trials will evaluate the integration of IVMP strategies into current mowing operations to assess the cost/benefit of modifying the current mown vegetation management practices.

PROJECT OUTCOMES

Three key outcomes have been identified and the methodology for the evaluation, measurement and

assessment of the project against these outcomes are as follows:

1. Develop strategies to deliver a 25% reduction in the cost of managing mown vegetation, when compared with conventional practices currently in use;
2. Provide proven strategies that offer a quantifiable reduction in the risk for all stakeholders (i.e. asset owner, manager, user); and
3. Deliver proven strategies that offer better environmental management and resource usage outcomes than current practices, measured by reductions in carbon emissions, vegetation biomass and erosion.

The project outputs will include the development of:

- A model for better managing mown vegetation in open spaces, such as parks, roadsides and amenity turf;
- New technologies and expanded registrations of herbicides and other chemical products for the turf and amenity horticulture industries;
- Categorisation of the optimal plant species for certain situations; and
- A decision tree to assist asset managers.

Specific outputs created by the work being undertaken will include:

1. Best practice guidelines;
2. New application guidelines; and
3. New and expanded chemical registrations.

ACKNOWLEDGMENTS

The authors wish to recognise and thank the project partners, Brisbane City Council (BCC), Gold Coast City Council (GCCC), Horticulture Australia Ltd. (HAL) and Technigro, and industry supporters, Bayer and Syngenta, for their sponsorship of this project. We would also like to recognise the other members of the project's Technical Team including Dr Henk Smith, Mr Jyri Kaapro, Mr Rod Wood, Dr Fred Yelverton and Mr Travis Gannon. The phytotoxicity trials were conducted at the Queensland Department of Primary Industries and Fisheries (QDPI&F) research facility at Redlands, while the field efficacy trials were conducted by Mr Peter O'Connell of Valencia Ecosystems Pty. Ltd.

REFERENCE

Berger, R.L. (2005). 'Integrated roadside vegetation management: a synthesis of highway practice'. (Transportation Research Board, Washington DC, USA).