Grassy Groundcover Gazette
News, updates and on ground action Aug 07

Paul's Piece

Hello again. This update comes with the GGRP just a few months out from our final sowing of the thirteen sites. I pose the question once more - how did we get here so quickly? I will give a very brief rundown of what's been happening to-date. In general, most of our sites have come on really well in the past three months. In fact, I'm confident that the second year sowings - which covered up to 4000m^2 - will establish successfully over the next 12 months (Figure 1). At present, many plants and species are still emerging and most are still very small seedlings. However if these survive the next summer (and I'm confident most will), then these areas will be covered with a number of direct-seeded grassland species. This represents quite an achievement.

Figure 1 Grasses and wildflowers seem to be competing well in the 2 year weed control plot at Neville Oddies.

In terms of the weed control treatments we are looking at, it seems the areas that received two years weed control are still much weedier than the area where we scraped off topsoil - have a look at the picture in Jess's article of the Laharum site. However there are other sites, such as Neville Oddies Chepstowe and The Dennis's Colac sites, where the two year weed control

Figure 2 Fantastic coverage of grasses and forbs at Daryl Barbers Minyip site. This is on the scrape plot.

areas still have a great array of sown species competing successfully on them. It will be of considerable interest to see if these sown species in the 'weedier' plots are able to persevere and compete adequately with the competitive weeds over the coming years.

At the moment Jess and I, along with a number of fantastic people who have been assisting us, are frantically finalising seed processing and preparing sites for the upcoming September sowing. Seed activities revolve around weighing seed-lots, testing seed-lots, combining and then mulching seed-lots. Most of this is reasonably unpleasant and sweaty work!

In regard to site preparation, we've had to make sure the sites have been sprayed out, and that the areas we are going to scrape are ready for the contractors. This means hoping that the weather is kind to us. We learnt a bit from our scrapes last time, and this year we will be making sure that we go deep enough and get all the loose material cleaned off the top as this will hold a lot of weed seed (Figure 3).

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Figure 3 Note the heavy weed load that emerged from the topsoil pushed back from the scrape at our Laharum site.

In September we'll be again hoping the weather is kind and that we can get onto sites with our machinery to sow - and that this will be followed by good spring rain! I hope we will be able to conduct at least two field days in the months following our sowing so we can gather those interested in the techniques we are investigating and show them some of our outcomes to-date.

Officially the GGRP comes to the end of its funding period in November of 2007. However, GAV and several of our CMA partners are committed to ensuring our we can maintain and monitor sites so we can continue to gather information, conduct field days and even initiate related research projects. For example, we are ready to begin a joint project with Allan Yen and Amanda Kobbelt of DPI, looking at whether invertebrate species will colonize our restoration sites.

All this is very exciting and just shows what the energy and enthusiasm of all our GGRP people have made possible.

Paul

She's ba-ack ...

G'day GGRP peoples,

After having a break recently I'm all fired up getting ready for sowing which we plan to begin in September. Having just completed a round of monitoring I'll give a quick summary of what's going on at each of the western sites:

Laharum

20 of the 90 species sown here have emerged with the most recent arrivals being the bulbine lilies, *bulbine bulbosa*. This number probably doesn't sound as impressive as it should however with many of the species sown we don't expect them all to germinate at once. The idea being that we replenish the seed bank when sowing and allow the site to go through a natural succession process. In Paul's PhD trial work at Burnley college the *Pimelea*'s for example didn't emerge until three years after sowing. As with most of the sites the scrape is looking far better than the non-scrape with minimal weed cover.

Laharum: scrape vs no scrape – a pretty clear result

DPI Hamilton

20 of the 58 species sown here have emerged with Paul & I nearly jumping out of our skins to find many plants of *leucochrysum albicans*, a rare and endangered plant of the plains grassland. Also both chocolate and bulbine lilies coming through here at the moment.

Leucochrysum albicans

Chatsworth

11 of the 40 species sown have emerged with the most recent again being the chocolate and bulbine lilies of which they seemed to be coming up everywhere. Also *kennedia prostrata* germinated well over the hot and dry summer both here at Chatsworth and in Hamilton. Most exciting for me though was the discovery of one *lomandra* or matt rush seedling.

Moyston

13 of the 60 species sown here have emerged. Moyston has perhaps been our most disappointing site this year as it appears to exist in a real rain shadow and has been dry as a bone until a couple of months ago. Hence it rained just in time for the winter weeds to get a real head start. However there's hope for the scrape. Paul & I are considering re-sowing the non-scrape this year at this site. After the fires it was actually a really good seed collection season for this area and we should have enough seed to do it.

Swansonia procumbens

Minyip Dirt & Minyip Barber

Both these sites are looking fantastic with 27 of 63 species sown emerged. (These sites make a good comparison being down the road from each other and sowed with exactly the same seed mix, one is ex-cropping one is ex-grazing). Darryl Barber's trial site in particular is a real success story. Most exciting recent emergents are at last count 20 broughton peas or *swansonia procumbens*, another rare and endangered plant of this region.

Well done everyone for being real sticklers for site preparation. Everything's on track for our final and biggest sowing yet for the project. I'll be down the shed for the next month madly trying the finish the weighing and mulching and mixing of seed. See you soon!

Jess Gardner, Greening Australia (Vic) Grassy Groundcover Restoration Project

Minyip Barber

Mike O'Rizer – Who is he?!

PART 1 – ARBUSCULAR MYCORRHIZAL FUNGI

The word 'mycorrhiza' literally means 'fungus root' (myco = fungus, rhiza = root). In practice, the term 'mycorrhiza' refers to an association between a plant and a soil dwelling fungus that is usually, but not always, of benefit to both the plant and the fungus. Such a relationship is symbiotic or mutualistic.

In grassland communities, three main types of mycorrhizal fungi are distinguished. These are arbuscular mycorrhizal fungi (AMF), sometimes called VAM fungi because many of them have storage structures called vesicles, orchidoid mycorrhizal fungi (OMF) and ericoid mycorrhizal fungi (EMF). This article is to introduce you to AMF.

PERSONAL DETAILS:

Age

AMF are incredibly ancient. They are believed to have been present in Ordivician times (460 million years ago) when the only land plants were mosses and lichens. It is

likely that they facilitated the colonisation of land by plants.

Job

AMF are very common and occur throughout the world in association with most vascular plants as well as some bryophytes. AMF assist their host plants to acquire nutrients, in particular phosphorus, and to improve access to soil water. They may also confer disease resistance against soil borne pathogens. In return, the AMF acquires its sugars, derived from photosynthesis, from the host plant. The site of nutrient exchange is thought to be the arbuscule (Figure 1), a highly branched hyphal modification that invaginates the plasma membrane of the plant root cell, a bit like a hand inside a rubber glove. They store sugars in spores and, if present, vesicles.

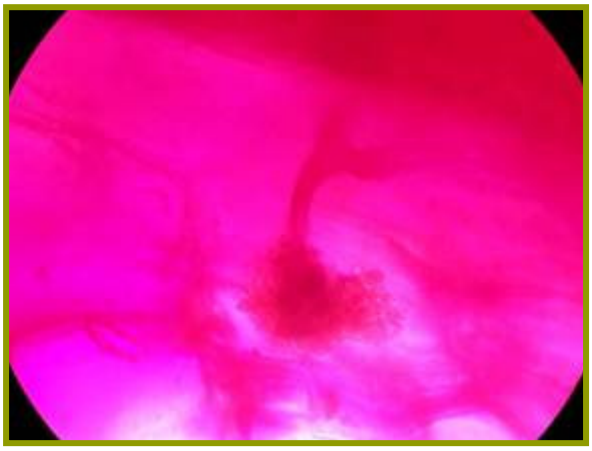

Figure 1: A highly magnified image of an AMF arbuscule(and hyphae) in Kennedia prostrata (Running Postman). These structures are thought to be the site of nutrient exchange between the AMF and its plant host. Image Paul Gibson-Roy.

Looks

AMF structures are present in the soil and in the roots of host plants but they cannot be seen by the naked eye. Under the dissecting microscope, it is possible to see their hyphae and spores in association with the roots of host plants once soil has been carefully washed away (Figure 2).

Under the compound microscope and after plant roots have been made transparent by 'clearing' and fungal structures have been stained, it is possible to see hyphal structures, arbuscules, vesicles and spores within the roots of plants.

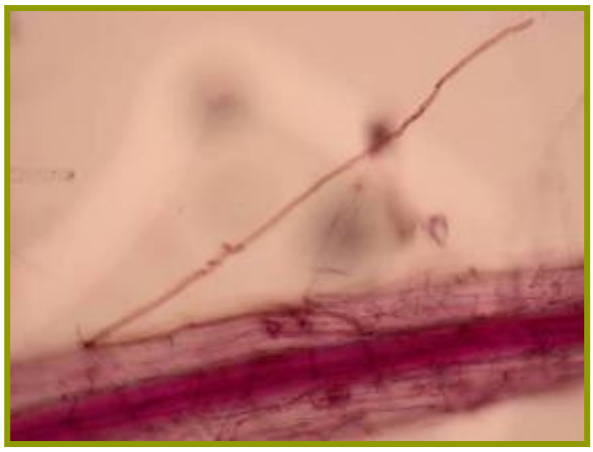

Figure 2: Mycorrhizal root system washed carefully to reveal internal and external hyphae on Themeda Triandra. Image Paul Gibson-Roy.

Personality

Friendly, generous and sharing but sometimes opportunistic.

Hobbies

AMF ramify through soil and plant roots to form complex subterranean mycelial networks linking plants and other fungal hyphal systems.

Worst Nightmare

Ramifying happily in a wheat field and then being sprayed with fungicide.

Jenny Bear

More Information

Go to www.ffp.csiro.au/research/mycorrhiza/vam.html

Figure 3: A vesicle and hyphae seen a Themeda triandra root cell. Image Paul Gibson-Roy.

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Effect of early harvest on Chocolate Lily seed yield

In our seed collection efforts, we have been attempting to find ways that best utilise our time resource, while not impacting on the quality of the seed we collect. You may have noted that over past editions we have mentioned collecting seed before it has fully ripened on plants by taking a section of stem. I was interested in looking at a particular species we had growing in production boxes to investigate if this technique did indeed allow us to harvest more efficiently while not wasting our seed resource. Marjorie conducted a fine piece of research and details her findings looking at one of the lilies (Arthropodium). Paul

Chocolate Lily (*Arthropodium strictum*) is a widespread and beautiful spring-flowering species that occurs naturally in grassy plant communities in south-eastern Australia (Figure.1). It is a component of most of the seed mixes sown at the GGRP sites and the species is grown in a number of the seed production areas associated with the project (Figure 2). Although the species usually produces ample seed, both in the wild and in cultivation, the seed is difficult to collect efficiently. The seeds are produced in capsules (Figure 3) that mature and open sequentially, with only a few of the capsules on a plant open at the one time. Once a capsule opens, most seed quickly falls from the plant. An earlier study of Bulbine Lily (*Bulbine bulbosa*) found that when whole fruiting stems are harvested and slowly dried, immature seed capsules continue to develop and produce seeds of similar number, size and germination capacity to capsules that mature on intact inflorescences (Delpratt, 2007).

Figure 1 Chocolate Lily (Photo: Chris Findlay)

We wanted to know whether:

- immature Chocolate Lily seed capsules continue to develop after harvest;
- there is a significant difference in the number of viable seeds collected from inflorescences harvested at two levels of maturity -
  - 1-2 seed capsules starting to open
  - 3-4 seed capsules starting to open;
- there are viable seeds in seed capsules that do not open after harvest.

All inflorescences were harvested from plants growing in a seed production area at Burnley Campus. Ten inflorescences were harvested with 1-2 capsules starting to open and ten were harvested with 3-4 capsules starting to open. Each inflorescence was placed in a separate brown paper bag and stored at approximately 20°C. The number of loose seeds was counted weekly for 12 weeks. At the end of 12 weeks, the seeds that were still in closed or partly open seed capsules were extracted from the capsules. All seeds were sieved to see if there was a consistent difference in size between:

- loose seeds;
- seeds from seed capsules that were open but not empty;
- seeds from opening seed capsules (starting to open but still full);
- seeds from closed seed capsules.

Samples from each class were tested for viability using tetrazolium.

RESULTS

- The seed capsules did continue to mature after harvest when stored attached to their stem in dry conditions at around 20°C.
- 90% of loose seeds had fallen out of the seed capsules by the 4th week (Figure 4).

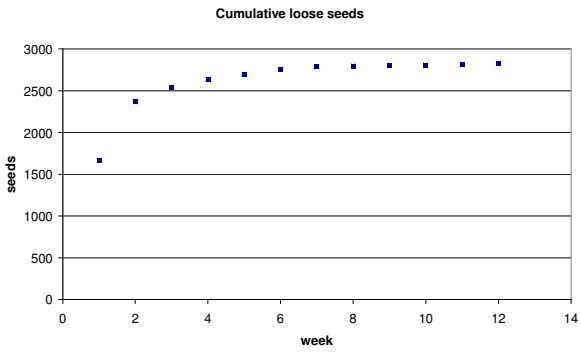

Figure 4 Number of loose seeds collected each week from all treatments.

Although there was a wider range in seed size for loose seeds (more large and more small seeds) there was no significant difference between the average size of loose seeds and seeds from closed and partly open capsules (Table 1).

After twelve weeks drying, the seeds that remained in partly open or closed capsules comprised nearly 20% of the total viable seeds (Table 1).

Table 1 Summary of size and viability results.

Class	Mean size (mm)	Mean % viable	No. filled seeds	% of total viable seeds
Loose	1.5	96	2540	81
Open/partly full	1.6	100	433	14
Opening/full	1.7	97	81	3
Closed	1.5	100	53	2

Figure 2 Chocolate Lily seed production boxes (Photo: Paul Gibson Roy)

DISCUSSION

To increase the efficiency of harvest, many species are harvested before their fruit are fully mature. The fruit are left on the stem for a period of dry storage to allow the fruit, and their enclosed seeds, to continue to develop before being collected. However, the risk is that the seed lot may contain too high a proportion of seeds that have not completed their development. We found that as long as at least one seed capsule is starting to open, Chocolate Lily inflorescences can be harvested before they are fully mature.

Stored in dry conditions on the stem, most of the seed capsules will open, yielding mature viable seeds. It may be safe to harvest at an even earlier stage, but this was not tested in this experiment.

Most of the capsules release their seeds within the first month after harvest and even those relatively few capsules that failed to open after twelve weeks contained viable seeds.

Figure 3 Chocolate Lily seed capsule (Photo: Paul Gibson Roy)

Further study is needed to determine whether seeds sown in the capsule germinate under field conditions. However at this stage the recommendation for field sowing is to sow closed and partly open Chocolate Lily seed capsules along with loose seeds, as the seeds they contain are very likely to be viable and may germinate and establish once the capsule breaks down.

Marjorie Hall, John Delpratt and Paul Gibson Roy

REFERENCE

Delpratt, C. J. (2007) "*The influence of harvest method on seed yield, seed size and germination capacity of Bulbine bulbosa (R. Br) Haw. (Liliaceae)*", in *Seeds: biology, development and ecology* (Eds, Adkins, S. W., Ashmore, S. and Navie, S. C.) Wallingsford, UK, Wallingsford, UK, pp. Chapter 4.

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