Part 2: REPORT ON THE EFFECT OF HERBICIDE TASKFORCE® ON PASTURE SPECIES WHEN APPLIED TO CONTROL CHILEAN NEEDLE GRASS (*Nassella neesiana*) IN PASTURE

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Executive Summary

A survey was conducted in late August early September 2012 to quantify the apparent reduction in Perennial ryegrass presence in pasture following the application of Taskforce® herbicide in autumn and winter. It provided a 'snapshot' of the pasture damage and showed a mean Perennial ryegrass (*Lolium perenne*) presence of 80% in cores (3 Sites) of unsprayed pasture. This contrasted with a mean presence of 29% for sprayed pasture and represented an overall 51% reduction in Perennial ryegrass from the herbicide application ot the three sites.

In November 2012, the sprayed sites (3) were re-sampled taking double the number of cores (100) from the same transects sampled in August. The presence of grass, weed, (all living rooted plants) damaged Perennial ryegrass and bare ground was recorded and calculated as percent presence.

At Site 2 (four months post spraying) it is clear that residual activity of the herbicide is ongoing. There is now 39% less presence of Perennial ryegrass in cores (from 54% in August to 15% in November) from the sprayed pasture. This represents a 79% loss in Perennial ryegrass over the survey period. (In August unsprayed pasture had 72% presence of Perennial ryegrass in cores). At this site *Danthonia spp.* presence fell from 34% in August to 18% presence in November, an overall loss of 47%. In line with Taskforce® label information this is considered a likely expectation for *Danthonia spp.* and confirms residual activity of the herbicide is ongoing.

At Sites 3 and 1 (seven and six months post spraying) there is an improvement in Perennial ryegrass recruitment with an 8% and 37% presence in cores respectively. This represents a 66% and 168% increase in presence overall. Perennial ryegrass recruitment is explained by August seedlings (Site 1) and recently sown seed (Site 3) and expansion of Perennial ryegrass 'clumps' at both sites.

Cores of bare ground and cores with only weed or dead Perennial ryegrass are considered non productive. The total presence of these was grouped to illustrate the non-productive cores with 27%, 53% and 40% presence for Sites 1-3 respectively. This is considered a high proportion of pasture to be out of production.

An unexpected benefit occurred at Site 1. Recently weaned calves had selectively grazed the sprayed portion of the paddock removing all seed heads including those of Barley grass. Reasons for this preference is unclear but may be related to sugar content of the grass.

Flowering Chilean needle grass was found in the sprayed area at Site 2 and reported. Resistance is not suspected but it should be monitored.

In conclusion, Perennial ryegrass is compromised along with other grass species beyond the expectation of the Taskforce® label. However, given the requirement to control Chilean needle grass, when whole paddocks are sprayed farmers are forewarned to be mindful of reduced stock carrying capacity and follow up pasture management requirements.

On the positive side, blanket spraying presents an opportunity to re-sow the paddock. Careful consideration should be given to the new pasture mix in relation to rainfall, paddock aspect and grazing objective. The new pasture mix should provide for quality pasture and persistence.

With five years freedom from Chilean needle grass and with good management this should be a major step to overcoming the Chilean needle grass problem. Care should be exercised when re-sowing, for example; seed should not be broadcast unless seed rate is at least doubled and trampled in with large mobs of sheep. Preferably seed should be direct drilled with cross drilling. In the interest of avoiding re-contamination by Chilean needle grass a strong emphasis on limiting exposure of the soil seed bank should be exercised.

Introduction

Taskforce® has recently been introduced to New Zealand to control Chilean needle grass in permanent pastures. A number of sites were sprayed in Hawke's' Bay during last autumn/winter 2012.

Following application, farmers have noted considerable deterioration to their pastures and primarily an apparent reduction in Perennial ryegrass (*Lolium perenne*) together with a significant loss of pasture cover and pasture production.

In late August a survey was conducted at 3 sites to provide a 'snapshot' of current pasture damage and quantified the loss of Perennial ryegrass and other pasture species to the applied herbicide at that time.

A follow up survey was conducted in November 2012 to determine any changes in pasture cover since August.

Methods

One hundred, 50mm diameter by 70-100mm deep, tiller cores were extracted from sprayed pasture at three sites (**Table 1**). A 'blind throw' technique was used to ensure no selection of a sample site was made.

Sample transects lines were 20-50 metres long and on the same line as the August sample. The inter sample/core space is approximately 750mm. Two transect lines were more or less parallel to each other and approximately 1-1.5 metres in from the centre line separating the sprayed and unsprayed pasture. The transect line had been previously marked (August) with pegs.

Tiller cores were examined individually for rooted 'live' pasture plants using a semi destruct process with each 'hit' being recorded. (Mitchell and Glenday 1958, Daly et al 1999; Smith, 1993 et al; Slay et al 1999). When required 'difficult to identify species' (generally due to the small portion of rooted material) were extracted from the core and identified using magnification. A photographic record was maintained during identification to support data and observations.

'Hit'= Any rooted plant, bare ground or trash

The percentage presence of each rooted species occurring on cores was calculated.

Results

Effect on Perennial ryegrass at individual sites

A change in the Perennial ryegrass content of sprayed pasture was observed (Table 1).

Site 1: There is a substantial increase in Perennial ryegrass from 22% presence in cores in August to 59% in November (+37%) **(Table 1 and Figure 1).** This is considered to be in part the value of apparent recruitment observed in August

Site 2: There is a substantial deterioration in the presence of Perennial ryegrass from 54% presence in cores to 15% (-39%) (**Table 1 and Figures 3 and 4**). 13% of cores had dead Perennial ryegrass. *Danthonia spp.* is also severely checked with only 18% presence in November compared with 34% in August.

The apparent ongoing mortality of *Danthonia spp.* and Perennial ryegrass suggests continued residual activity of the herbicide. However it is noted that this was the last site to be sprayed. As a result of plant death there is a large component of dead matter in the sward.

More importantly the observed green material in cores is made up of very weak green tillers surrounded by many dead tillers representing the high dead matter content recorded on cores.

Site 3: Perennial ryegrass had increased marginally from 12% presence in cores to 20% presence **(Table 1 and Figure 3)**. Pasture seed had been sown at some stage between sampling times. Increases in the presence of *poa pratensis*, Crested dogstail, *Poa annua* and resident and new white clover had all helped to reduce the bare ground component. However, this site is 'generally' by far the most damaged site

Table 1: Percent of Perennial ryegrass in cores at each site in August (Sprayed and unsprayed) and % difference. Percent of Perennial ryegrass in November and % difference increase/decrease compared with August sprayed.

	August			November	
Site	**'Unsprayed' August**	**'Sprayed' August**	**Difference (%) August 'Us' V 'Sp'**	**'Sprayed' November**	**Difference (%) Aug 'Sprayed'. V Nov 'Sprayed'**
1	90	22	- 68	59	+ 37
2	72	54	- 18	15	- 39
3	78	12	- 66	20	+ 8
Means	80	29	- 51	31	

During field sampling some die back of Perennial ryegrass was observed at Site 1 **(Plate 1)** but this is more noticeable at Site 2 (**Plate 2**) and was still occurring. At Site 3, *Poa pratensis* is well developed **(Plate 3)** and the Perennial ryegrass at this site was considered a locally adapted ecotype, note deep purple colour of tiller base **(Plate 4).**

Plates 1 - 4: At Site 1, *left,* live ryegrass and dead ryegrass in centre.
Above *right* Site 2: Damaged and live tillers.

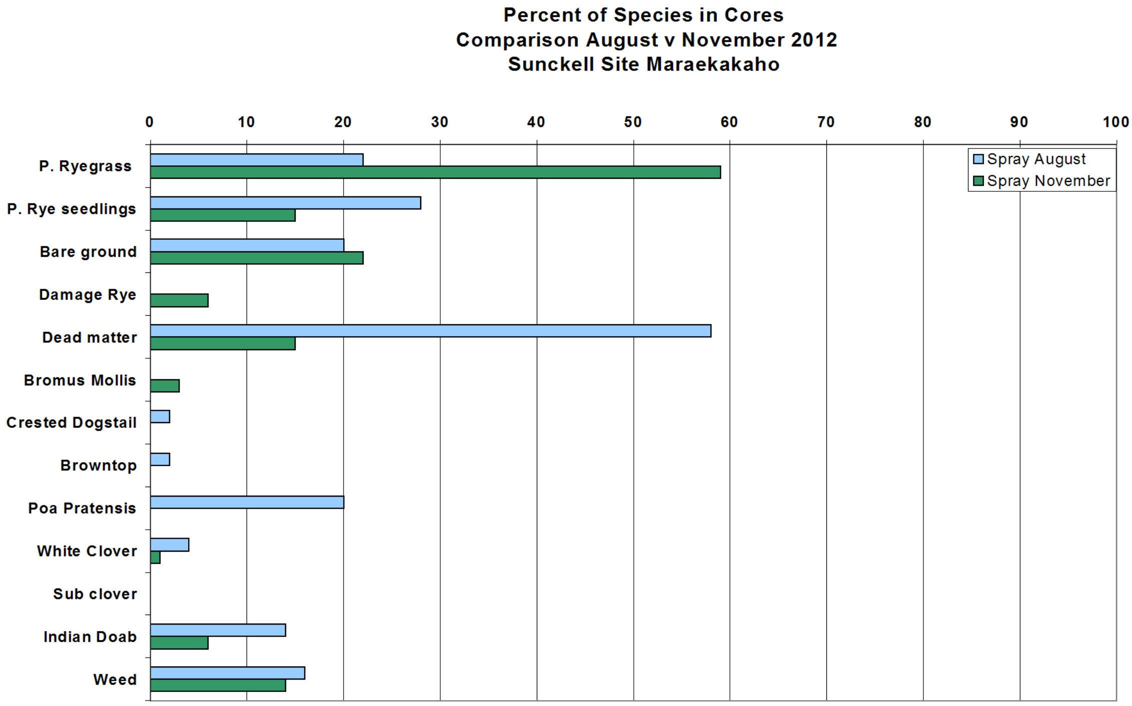
Below *left* and *right*, At Site 3, showing *Poa pratensis* and Perennial ryegrass.

Results from individual Sites

Site 1

A comparison between August and November sampling is shown in Figure 1**.**

Figure 1: Percent of species in cores at Site 1 sprayed areas in August and November.



The percentage of cores with rooted Perennial ryegrass in sprayed pasture has increased by 168% (22% to 59%) suggesting that recruitment did indeed occur through late winter and spring. Perennial ryegrass seedlings observed in August are now mostly robust plants up to 7cms in diameter (Perennial ryegrass seedlings in November are in fact juvenile plants). The Perennial ryegrass plants are large, ‘clump forming’ and elude the observer of the true bare ground component.

The bare ground component has increased marginally probably at the expense of less vigorous weed grasses that have died or been affected by the dry conditions. (Note in August *Poa pratensis* appeared to be set back by herbicide application). Percent of cores with bare ground, weeds, damaged Perennial ryegrass and dead matter were grouped and increased the non-productive area from 22% to 27%.

Recently weaned calves were grazing the paddock. The calves had preferentially grazed the previously sprayed area to a very even height (70 – 100mm) (**Plates 5a, 5b and 6**). Barley grass seed heads had been grazed off **(Plate 7)** The reason for this is unclear however the site may have had delayed heading relative to the pasture in the paddock or preference may be related to sugar content of the herbage. It was also observed close grazing of Perennial ryegrass had occurred in nitrogen 'fertility patches' in the unsprayed pasture.

With exception of plantain, weeds observed in cores were mostly seedlings, a few nodding thistle rosettes and docks. Docks appeared to be affected by herbicide. (**Plate 8**)

The difference between sprayed and unsprayed (foreground) pasture and the grazing effect is shown below.

Plate 5a (*left*) and b (*right*): Showing comparison between sprayed and unsprayed pasture and the preferential grazing effect.

Plate 6 **Plate 7**

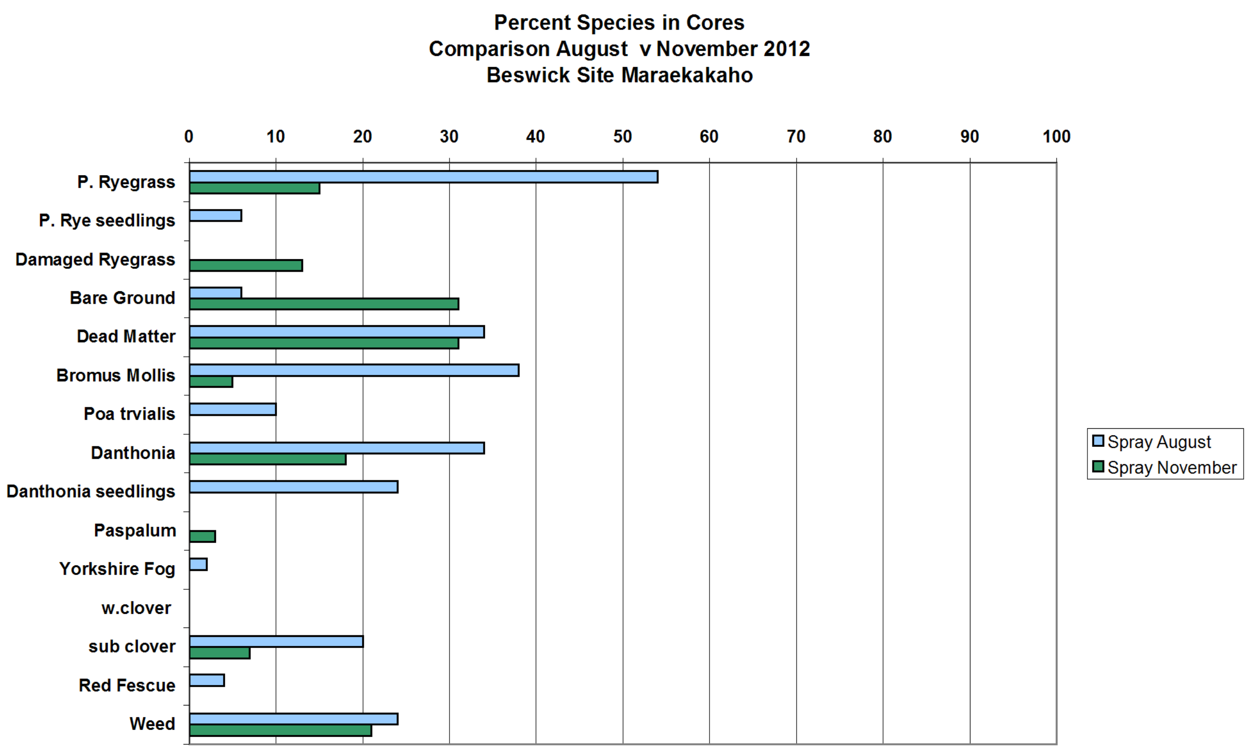
Plate 6: Showing close grazed pasture and the 'clumpy' appearance of the Perennial ryegrass plants and **Plate 7** showing close grazed Barley grass

Plate 8: Apparent herbicide damaged dock plant in 'sprayed' pasture

Site 2

A comparison between August and November sampling is shown in Figure 2.

Figure 2: Percent of species in cores at Site 1 sprayed areas in August and November.



The percentage of cores with rooted Perennial ryegrass in sprayed pasture decreased from August to November by 39% (54% to 15%). This represents an overall 72% loss in Perennial ryegrass since August.

The 13% presence of damaged Perennial ryegrass **(Table 1 and Plate 12)**, the weak *Danthonia spp.* and high dead matter associated with *Danthonia* suggests strongly that herbicide damage has been ongoing through spring. Presence of live *Danthonia spp.* in cores has reduced from 58% (Seedlings and live tillers) to 18%. Subterranean Clover was still affected by spraying and its presence had decreased since the August sampling.

Percent of cores with bare ground, weeds, damaged Perennial ryegrass and dead matter were grouped and increased the non-productive area from 31% in August to 53% in November.

The pasture in the sprayed area was in a very poor state **(Plate 9 and 10)**, is very open and mostly flat weeds, predominantly Catsear (*Hypochoeris radicata) and* intermittent stems of flowering *Bromus mollis* and Perennial ryegrass

In the sprayed area two colonies of Chilean needle grass (*Nassella neesiana*) were observed flowering **(Plate 10).**

No white clover (*Trifolium dubium*) was found in cores.

Plate 9: *Left,* sprayed pasture showing the open nature of the sward and flat weeds at Site 2. *Right* **Plate 10**: Reproductive Chilean needle grass in sprayed pasture at Site 2.

Cores placed in trays prior to analysis (**Plate 11**) indicate the typical appearance of the pasture prior to core destruction and analysis.

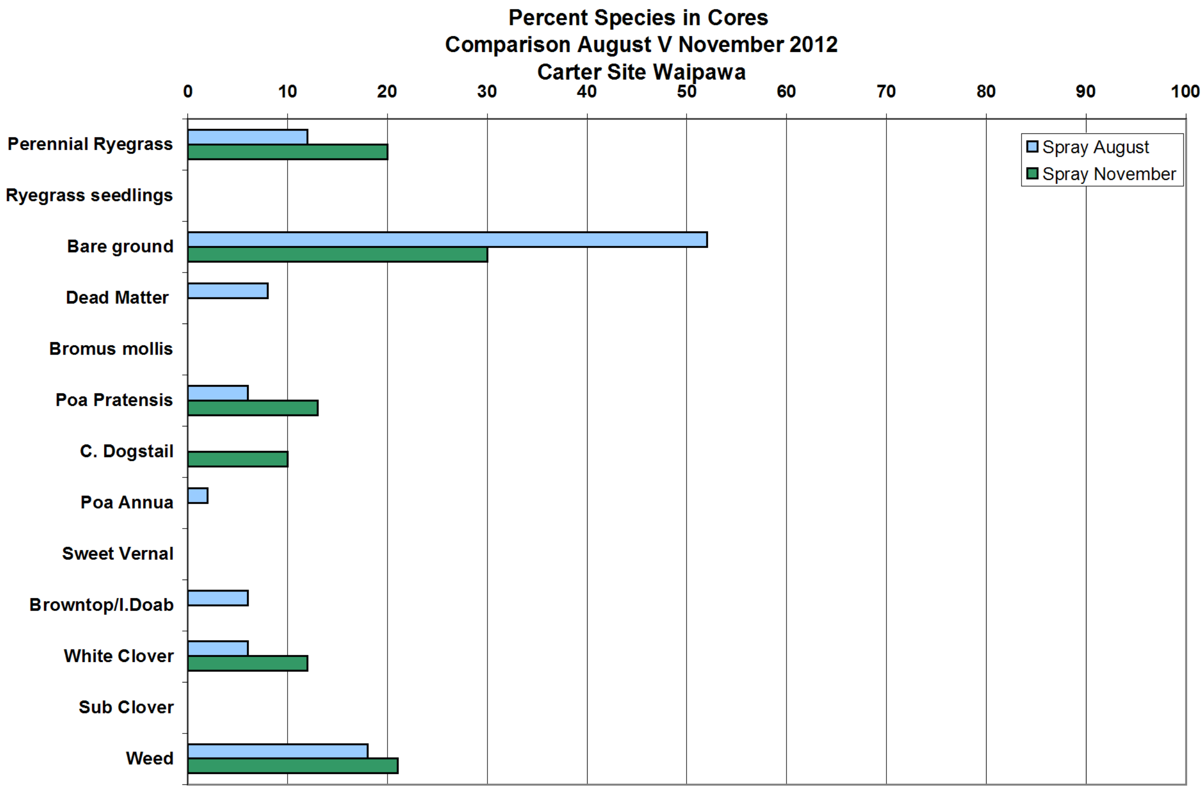
Plate 11: Site 2 (sprayed area). Cores prior to analysis; note the very poor pasture cover.

Plate 12 a and b: Damaged and dead Perennial ryegrass in cores.

Site 3

A comparison between August and November sampling is shown in Figure 3

Figure 3: Percent of species in cores at Site 1 sprayed areas in August and November.



The area of sprayed pasture adjacent to unsprayed pasture has improved considerably relative to the rest of the paddock **(Plate 13)** that remains very open **(Plate 15).** Pasture seeds had been sown (surface broadcast) on the sprayed area and though they had enabled some pasture recovery at the sampling site, it is not as successful further out in the paddock.

The percentage presence of cores with rooted Perennial ryegrass in sprayed pasture increased from August to November by 8% (12% to 20%). This represents a 66% increase in Perennial ryegrass at this site.

Additionally, there is a marginal increase in *Poa pratensis*, Crested Dogstail, white clover and the weed Plantain, that is a useful herb. This has had an effect on reducing the bare ground component from 52% in August to 30% in November.

Resident white clover and recently established white clover showed potential for good recovery.

Percent of cores with bare ground, weeds, damaged Perennial ryegrass and dead matter were grouped together; this increased the non-productive portion of cores from 31% in August to 53% in November.

Plate 13: Comparison between unsprayed and sprayed pasture (left) in November. Note the high incidence of Plantain.

Plate 14: *Left,* Typical sprayed pasture in sampling area. **Plate 15**: *right,* typical pasture in majority of the paddock.

Cores placed in trays prior to analysis (**Plate 16**) indicate the typical appearance of the pasture prior to core destruction and analysis.

Plate 16: Site 3 cores set out before analysis

It is considered that this site is generally the most extensively damaged site overall. Observations of adjacent sprayed banks (southerly aspect) and non-sprayed area are shown (**Plate 17)**

Plate 17: Adjacent paddocks sprayed with herbicide at Site 3.

Conclusions

- The writer suggests this report is read in conjunction with Report on 'The Effect of Herbicide Taskforce® on pasture species when applied to control Chilean needle grass in pasture' (September 2012)

- At Site 3 and Site 1 in November 2012, seven and six months respectively post herbicide application; there is an improvement of 8%

and 37% respectively in the presence of Perennial ryegrass in cores. This represents a 66% and 168% respectively increase in Perennial ryegrass cover since August. Recruitment at Site 1 is largely explained by seedling presence in August and clump expansion and at Site 3, by sowing of pasture seeds and clump expansion. At Site 3 'other pasture species' had an improved presence in cores.

- Residual activity of the herbicide appeared to be on-going with the greatest occurrence at Site 2. By November (four months post spraying), there was 39% less presence of Perennial ryegrass than in August and 57% less presence than the unsprayed sward in August. This represents a 79% loss in Perennial ryegrass over the four-month period. Moreover at this site, the presence of *Danthonia spp.* in cores that contributed to overall pasture productivity has reduced from 34% to 15% and representing an overall loss of 47% since August. In line with Taskforce® label information this is a likely expectation. Subterranean clover is affected similarly.

- The least occurrence of observed on going plant mortality is at Site 3 (seven months post spraying).

- The bare ground component increased at all sites but most significantly at Site 2 and marginally at Site 1. At Site 3 there is a reduction in bare ground mostly at the expense of weeds (plantain). Accordingly, for all sites the cores solely with weed or dead Perennial ryegrass were considered as 'non-productive' along with bare ground. These fractions were grouped together to determine the total % of cores with no presence of pasture. Sites 1-3 had 27%, 53% and 40% respectively presence of this 'core' group. This is a high proportion of the pasture to be non productive.

- At Site 1, calves grazing the paddock had selectively grazed the sprayed site suggesting herbicide treated pasture is more palatable. Similar grazing had occurred in Perennial ryegrass in urine fertility patches in the unsprayed pasture. Reason for this is unclear but may be related to the sugar content of the herbage. Barley grass in the sprayed area was grazed in a similar pattern removing seed heads; outside the sprayed areas Barley grass seed heads were prolific and not grazed.

- At Site 2 Chilean needle grass was found growing in the sprayed area and reported to HBRC Bio-Security – Plant Pests. Reason for these escapees' is unclear but is unlikely to be a herbicide resistance issue.

- It is clear from the August and November survey that pastures were compromised by the application of herbicide, perhaps beyond expectations suggested by the Taskforce® label data.

- It is appreciated the use of Taskforce® will require some initial long-term management plan for livestock farmers. For example, 100mm of rain needed to move herbicide into the soil, 3 months to act; the 120-day withholding period for grazing and a significant loss in pasture productivity primarily during winter and spring. On the positive side, this is an opportunity to plan new sowings of pasture in the autumn following Taskforce® application with the knowledge that herbicide use will be restricted for at least 5 years. Seed mixes that offer persistence and good pasture cover and are commensurate with rainfall and paddock aspect should be chosen to give high producing quality pasture. Care is advised when re-seeding not to disturb the soil unduly and expose Chilean needle grass seeds from the soil seed bank. To optimise establishment broadcast-sowing techniques should be avoided.

References

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