

Approaches to Herbicide Selection at Palmstead Nurseries®

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INTRODUCTION

When I started work at Palmstead Nurseries, I was amazed at the amount of time spent hand weeding. The only herbicide used on the crop was Ronstar 2G TRS® (oxadiazon) after potting. As a result, oxadiazon-resistant weeds such as chickweed and pearlwort flourished out of control and we were fighting a losing battle.

Most of the herbicides available for nursery stock are developed for agricultural crops use because of the size of the potential market over which the agrochemical companies have to spread their development and registration costs. Horticulture has very few specific products for weed control. As a result, we have to use agricultural herbicides to achieve a good level of weed control on the nursery. With no recommendations in place for our specific crops, they have to be used at growers own risk in terms of phytotoxicity.

In the U.K., growers are fortunate that the Horticultural Development Council (HDC) has directed industry levy funds to commission ADAS (formerly Agricultural Development and Advisory Service) to conduct trials on herbicides for nursery stock (see paper by Atwood in this volume) resulting in the very useful publication *Practical weed control for nursery stock*. Unfortunately, it is impossible for those trials to cover all combinations of crops and weeds encountered on U.K. nurseries and at Palmstead Nurseries we felt the need to conduct a few of our own trials to help us select herbicides for their performance against our own weed spectrum and safety on our crops.

SELECTING HERBICIDES

The starting point was to review published results of trials that had already been carried out, including nursery industry guides such as HDC's *Practical weed control for nursery stock*, HDC project reports, and herbicide product labels.

I used the information to begin to build up a data set covering:

- Which products controlled the weeds encountered on our site
- Which products were safe on which plants
- What time of year were treatments most effective and safest to the crop
- Which products offered any post-emergence activity
- Persistence of the products
- Cost of the treatments

I also began to develop a computerised recording system that was easy to search.

As I sourced the information, I set up two Excel spreadsheets. The first would be a list of the herbicides used and the weeds they control. This list can be filtered by herbicide or weed to be controlled (see sample in Fig. 1).

The second spreadsheet is for crop tolerance (see sample in Fig. 2). This has an A–Z listing of the plants grown on the nursery, down the left column, and the herbicides along the top row. With this spreadsheet lists can be filtered by plant or plant group (e.g., grasses, conifers, herbaceous); or herbicides can be listed according to the crops they are safe to use on.

Filter Groups	PLANT GENUS	Aramo	Artist	Avit	Bulisan S	Devinol	Diuron	Flexidor	Gallix	Grazon 90	Keib	Lenaal	Lihuron	Propachlor	Renslar 2G	Simazine	Stomp
H	<i>Aubrieta</i>																
S	<i>Aucuba</i>			T	T			T							T		
S	<i>Azalea</i>			T		T	M	T							T		
S	<i>Azara</i>																
B	<i>Bambusa</i>																
S	<i>Berberis</i>		S	T	T	T	M	T	M		T	T	S	T	M	T	M
H	<i>Bergenia</i>			T				T				S		T	T		
T	<i>Betula</i>							T							T		
CL	<i>Billardiera</i>																
S	<i>Brachyglottis</i>			M	T	T	T	S	T	S		T	M	S	T	T	S
H	<i>Brunnera</i>																
S	<i>Buddleja</i>			S	S	T	M	S			T	T			T		T
S	<i>Buxus</i>			T	T	T	T	S	M		T	T	T		T	T	
G	<i>Calamagrostis</i>	S		T	S	T					T	M		T			T
S	<i>Callicarpa</i>			T				T							T		
S	<i>Callistemon</i>																
S	<i>Calluna</i>																
C	<i>Calocedrus</i>																
S	<i>Camellia</i>			T		T	M	T							T		
S	<i>Campanula</i>			T				M				M		T	T		
CL	<i>Campsis</i>							T									
T	<i>Caragana</i>							T									
G	<i>Carex 'Buchananii'</i>	T		T		M	T				T	S		T			T
G	<i>Carex 'Comans Bronze'</i>			S		M	T				M	M		T			T
G	<i>Carex elata aurea</i>	M		M		M	T				T	M		T			T
G	<i>Carex 'Evergold'</i>	T		S		T	T		T	S		T	M	S	T	T	M
S	Susceptible (do not spray)																
M	Moderately unsusceptible																
T	Tolerant (Safe to treat)																

Filter groups
C Conifer
CL Climber
G Grass
H Herbaceous
S Shrub
T Tree

Figure 2. Sample of crop tolerance database.

The third record we can access is our pesticide spray records (see sample in Fig. 3). It is a legal requirement to keep these records for a period of 3 years but just keeping them on paper is fairly useless in terms of their potential as a management tool so we now also keep them on our database. The benefit is enormous. For example, if we notice any suspected herbicide damage, we can very easily look at the history of treatments applied to that crop. We can also tell who applied the product and the rate applied, weather conditions, etc. If we suspect a certain herbicide to have caused damage on a certain crop, we can then trial it further and highlight it on the spreadsheet as either safe or not safe to use on that crop.

We use this spray record for pest and disease control as well. Having the target pest or disease included (the “target” column on the right), means we can use the

File Edit View Data Goto Modules Tools Window Help

Production Order

Special: Search

Status: Cancelled

Chemical Item No.: 21514

Applications: 1

Warehouse: CHEMSTOR

Time(s):

No.: 1257 Primary

Order Date: 25.06.2010

Treatment Date: 25.06.2010

User: Lee Woodcock

Origin: Manual

Sales Order: _____

Customer: _____

Distribution Rule: _____

Items Spray Record Summary

#	Treated Item No.	Item Description	Form	Size	Spread	Warehouse	On Hand	Comments	Target 1
1	6039	Euonymus japonicus	2 litre	Not Ready	---	TJ12	1,439		Tortrix Moth Caterpillar
2	12536	Prunus laurocerasus 'Rotundifolia'	3 litre	40-60 cm	---	LA01	446		Tortrix Moth Caterpillar
3	12534	Prunus laurocerasus 'Rotundifolia'	3 litre	Not Ready	---	LA02	2,956		Tortrix Moth Caterpillar
4	12534	Prunus laurocerasus 'Rotundifolia'	3 litre	Not Ready	---	LA03	3,348		Tortrix Moth Caterpillar
5	12534	Prunus laurocerasus 'Rotundifolia'	3 litre	Not Ready	---	LA04	3,348		Tortrix Moth Caterpillar
6	12534	Prunus laurocerasus 'Rotundifolia'	3 litre	Not Ready	---	LA05	3,348		Tortrix Moth Caterpillar
7	12534	Prunus laurocerasus 'Rotundifolia'	3 litre	Not Ready	---	LA06	3,348		Tortrix Moth Caterpillar
8	12545	Prunus laurocerasus 'Rotundifolia'	25 litre	Not Ready	---	LA10	150		Tortrix Moth Caterpillar
9	12545	Prunus laurocerasus 'Rotundifolia'	25 litre	Not Ready	---	LA11	390		Tortrix Moth Caterpillar
10	22973	Choisya ternata	5 litre	40-60 cm	---	GLA12	214		Tortrix Moth Caterpillar
11	27496	Choisya ternata Sundance	5 litre	Not Ready	---	GLA12	80		Tortrix Moth Caterpillar
12	50615	Choisya ternata Sundance	5 litre	20-30 cm	---	GLB07	49		Tortrix Moth Caterpillar
13	27497	Choisya Aztec Pearlf	5 litre	Not Ready	---	GLB07	98		Tortrix Moth Caterpillar
14	28216	Choisya Aztec Pearlf	5 litre	20-30 cm	---	GLB07	20		Tortrix Moth Caterpillar
15	3637	Choisya ternata Sundance	2 litre	Not Ready	---	GLB09	1,460		Tortrix Moth Caterpillar
16	31337	Choisya ternata Sundance	2 litre	15-20 cm	---	GLB09	153		Tortrix Moth Caterpillar
17	3638	Choisya ternata Sundance	2 litre	20-30 cm	---	GLB09	537		Tortrix Moth Caterpillar

Remarks: _____

OK Cancel

System Messages Log (28)

Size: _____ 27.08.2010 13:40

SAP Business One 7.0

Figure 3. Sample of spray record database.

database to predict outbreaks of pests and diseases and so target control measures more effectively.

NURSERY TRIALS

The range of available crop protection products is constantly changing so we regularly undertake trials to ensure we understand the new products which are introduced and how they might fill gaps left by those which have been withdrawn. In the examples below, some of the products are no longer available but I have included the trials as examples of the trials system we have in place.

Herbicides for New Zealand Bittercress (*Cardamine corymbosa*). The objective of this trial in November 2005 was to find a herbicide to give both pre-emergence and post-emergence control of this weed in a range of container-grown plants. As liverwort was also present, we observed the performance of the products for potential control of liverwort too.

The chemicals used in the trial and rates of application applied were:

Herbicide	Rate
Axit (trifluralin)	100 kg·ha ⁻¹
Butisan S (metazachlor)	2.5 L·ha ⁻¹
Devrinol (napropamide)	9.0 L·ha ⁻¹
Diuron	0.8 L·ha ⁻¹
Flexidor 125 (isoxaben)	2.0 L·ha ⁻¹
Kerb Flo (propyzamide)	4.2 L·ha ⁻¹
Lenacil	2.0 L·ha ⁻¹
Ronstar 2G (oxadiazon)	200 kg·ha ⁻¹
Simazine	3.4 L·ha ⁻¹ (full rate)
Simazine	1.7 L·ha ⁻¹ (half rate)
Simazine	0.85 L·ha ⁻¹ (quarter rate)
Control (a batch of untreated plants included for comparison)	

The results are presented in Table 1. Only three of the herbicides trialled controlled New Zealand bittercress, the same ones also gave good control of liverwort. Of these, diuron was the most effective, giving good post-emergence and pre-emergence control of the bittercress and post-emergence control of liverwort. Simazine was quick to work and gave good control of bittercress and liverwort post-emergence, but less effective pre-emergence control. Lenacil was the least damaging of the three and gave good post-and pre-emergence control of the bittercress. Its post-emergence control of liverwort was good.

Our decision was that lenacil looked like the way to go for control of New Zealand bittercress. There was an issue with it being rapidly broken down by sunlight, therefore limiting its application to the winter months, as well as possible crop damage if applied in the spring onto soft growth.

Table 1. Control (none to excellent) of New Zealand bittercress and liverwort in nursery trials in 2005.

Herbicide product	N.Z. bittercress (Post emergence)	N.Z. bittercress (Pre-emergence)	Liverwort (Post emergence)	Liverwort (Pre-emergence)
Axit	None	None	None	None
Butisan S	None	None	None	None
Devrinol	None	None	None	None
Diuron	Excellent	Excellent	Excellent	None
Flexidor	None	None	None	None
Kerb Flo	None	None	None	None
Lenacil	Moderate	Moderate	Excellent	None
Ronstar 2g	None	None	None	None
Simazine (full rate)	Excellent	Moderate	Excellent	Excellent
Simazine (half rate)	Moderate	Moderate	Moderate	Moderate
Simazine (quarter rate)	Little	Little	Little	Little

Herbicides for Spring Application. The purpose of this trial in May 2006 was to establish the crop safety — or otherwise — for a range of herbicides applied during spring, when weed growth is active but the crops are producing tender growth likely to be susceptible to herbicide damage.

The herbicides trialled and rates of application used were:

Herbicide	Rate (L·ha ⁻¹)
Flexidor 125 (isoxaben)	2.0
Diurex 50 SC (diuron)	0.8
Simazine	3.4
Lenacil	2.0
Goltix (metamitron)	5.0
Linuron	2.5
Butisan S (metazachlor)	2.5
Kerb flo (propyzamide)	4.2

The trial was divided into two experiments, in the first the herbicide was washed off the foliage immediately after application; in the second the plants were left unwashed.

The results in terms of crop safety are presented in Table 2.

SUGGESTED STRATEGY FOR HERBICIDE SELECTION AND WEED CONTROL

- Look at the specific weed to be controlled and select the appropriate herbicides for the job.
- Look at the crops and the weed problems and select herbicide(s) based on crop tolerance.
- Look at how environmental conditions affect the application of the selected herbicide(s), e.g., are they broken down by light or heat. Do they need to be irrigated in?
- Time applications correctly for maximum effect and minimum damage.
- Look at the application method, this will depend on the crop canopy cover, water volume, etc.
- Choose a programme which is long lasting.
- Develop a two-tier strategy, for example use liquids in the dormant periods and granules to follow on to reduce crop damage.
- Keep surrounding non-crop areas and standing down areas clean with the use of residual, contact, and translocated herbicides.
- Hand weed frequently, a little and often, to prevent any weeds that may be present from setting seed. This often involves a very quick crop walk, pulling out the odd weed here and there.

Table 2. Crop safety of spring-applied herbicides from results of on-nursery trial in 2006.

	Flexidor		Diuron		Simazine (Half Rate)		Lenacil		Goltix		Linuron		Butisan S	
	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
<i>Athyrium filix-femina</i>	5	3	5	5	4	4	5	5	3	5	5	5	4	5
<i>Berberis 'Amstelveen'</i>	1	1	5	1	1	5	2	1	4	2.5	5	5	1	2
<i>Berberis 'Rose Glow'</i>	1	1	3	2	1	5	1	1	4	2.5	5	5	1	2
<i>Brachyglottis 'Sunshine'</i>	1	1	4	4	5	5	3	1	5	5	4	5	1	1
<i>Buxus sempervirens</i>	1	1	1	2	1	1	1	1	3	3	1	1	1	1
<i>Escallonia 'Apple Blossom'</i>	1	1	3	1	1	5	1	1	1	1	5	5	1	2
<i>Eurotymus 'Emerald N' Gold'</i>	1	1	1	1	1.5	2	1	1	3	5	1	4	1	1
<i>Hemerocallis 'Stella D'Oro'</i>	1	2	2	1	2	3	1.5	1	2	2.5	1.5	4	3	2
<i>Hosta 'Fire & Ice'</i>	1	1	3	4	4	4	1	1	1	1	5	5	2	2
<i>Iris 'Perrys Pride'</i>	3	1	3	3	2.5	4	2	1	2	2.5	2.5	4	1	1
<i>Lavandula 'Helmsdale'</i>	1	2	2	2	5	5	1	1	5	3	1	5	1	2
<i>Nepeta 'Walkers Low'</i>	4	3	1	1	2	2	1	1	3	2.5	1	4	1	3
<i>Sarcococca ruscifolia</i>	1	1	2	1	1	3	1	1	2	2	2	2	2.5	1
<i>Viburnum tinus</i>	1	1	1	1	1	1	1	1	2	2	1	3	1	2

Key

- Dead 5
- Extreme damage 4
- Unacceptable damage 3
- Slight damage (acceptable) 2
- No signs of damage 1