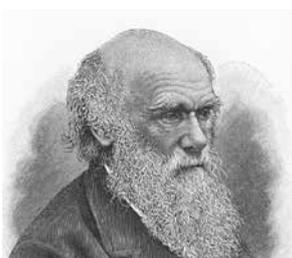


## WEED FILE:

# HERBICIDE RESISTANCE Part 1

### WHAT IS HERBICIDE RESISTANCE?

Herbicide 'resistance' is where plant species that were previously well controlled by a particular herbicide begin to develop a resistance to that active ingredient. It happens more often with certain types of selective herbicides that are used on the same paddock repeatedly, without alternating with other actives having a different mode of action. With long-term, one-product use like that, developed resistance to selective herbicides eventually becomes pretty close to inevitable. But it can also happen, and is happening in NZ, with non-selective herbicides, including the widely-used glyphosate.

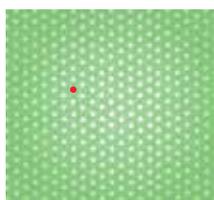


### HOW DOES RESISTANCE HAPPEN?

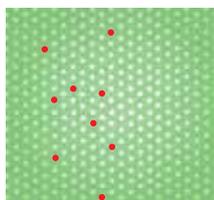
Herbicide resistance is not caused by some design weakness or fault in the herbicide. It's natural. In fact, it's inevitable, given how natural selection works. There will always emerge, in any living population of anything at all, a very tiny percentage of individuals that have some variation that none of the others have, purely as a genetic accident. And genetic accidents can reproduce. Just ask Charles Darwin.

### THREE GENERATIONS OF WEEDS

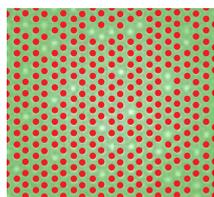
Imagine a paddock infested with 1000 specimens of a particular weed, and just one of them is – purely by genetic accident – resistant to herbicide 'X'. That's a mere 0.1% of the paddock's population of that weed, which doesn't seem too bad. So if you spray with herbicide 'X' you'll still kill 99.9% of those weeds, which of course appears to you to be the lot.



But plants produce many seeds each and a new generation grows every year. So in the second year your paddock might now have 30 weeds per 1000 that are resistant to herbicide 'X', which is 3% of the weed population. You'll now be getting a 97% kill, which still looks to be quite satisfactory and not noticeably different from last year.



Then in the third year, just at that very same rate of annual increase (i.e. about x 30), the number of resistant weeds leaps to something like 900 in a thousand. So your kill rate will suddenly be just 10%, which might as well be bummer all, as far as you're concerned.



### DIAGNOSIS

So what do you then conclude, looking at that paddock still full of weeds? You've sprayed it with herbicide 'X' for years, and you've always had great results; a total kill. But this year you've sprayed it with the same stuff, at the usual rate, and you've got hardly any effect at all. So it's inescapable ... it has to be a bad batch of herbicide! And now you, not unnaturally, want some answers.



### TAKEN BY SURPRISE

That's the lesson here. Herbicide resistance is not necessarily a gradual thing at all. Not something you're likely to notice slowly developing into a problem over many seasons. It's perfectly likely to take you from what appears to be a reasonably normal kill rate to no useful effect at all, in just a year.

The 3-year figures opposite ignore many variable factors and are, of course, simplified. In reality, it might just be one resistant weed in a million, or in ten million, that starts the process. But however remote and improbable is the likelihood of even a single random accidental genetic variant, if you allow enough time under the same conditions (in this case repeated exposure to the same herbicide), then the outcome is inevitable: resistance will eventually develop.

On the other hand, occasionally using herbicide 'A' instead of herbicide 'X' can break the chain and stamp out resistance before you ever notice it's there. Which is why the ideal answer is to rotate or alternate your herbicides; don't just use the same stuff year after year and expect the results to always be the same – that's not how nature works.

### OTHER THINGS WORTH KNOWING

- Some plant species are more prone to developing resistance than others.
- Some herbicides are more prone to 'being resisted' than others.
- The ideal alternative herbicides must have a quite different mode of action than that of the primary herbicide.
- There are different types of resistances. Some involve a single gene and can appear very quickly; others involve many genes and often become apparent very slowly.
- Herbicide resistance tends to first appear in isolated sites, but in some plant species that can change very quickly if it goes undetected.

*This Weed File continues in Part 2, covering how to recognise a possible case of herbicide resistance, the current spread of resistant species in NZ, and some practical advice about avoiding and dealing with developed herbicide resistance.*