

# Grassing on fertilisers?

Pamela Biss says 150 years of hay samples could tell us why some plants are losing genetic diversity.

The park grass experiment at Rothamsted Research, an agricultural research station in Hertfordshire, is 150 years old in 2006. For a century and a half, the same type and amounts of fertiliser have been applied to strips of meadow, making a 'patchwork quilt' of soil types, where different meadow flowers bloom.

A fertiliser inventor, John Bennet Lawes, started the experiment in 1856. He wanted to prove that his 'super-phosphate' improved hay yield. But he kept the experiment going because he was arguing with a German chemist over whether plants got nitrogen from soil or air. Largely because of his results, and a similar wheat field experiment, farmers started adding nitrogen and phosphates to crops.

Each year, researchers have stored samples of hay from the park grass experiment. That's very useful, because roughly 150 years ago we started increasing our use of fossil fuels and chemical fertilisers. Using the stored hay, we can peer into the past to see the effects.

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Sweet vernal grass (*Anthoxanthum odoratum*), the grass that gives hay its distinctive new-mown smell, grows on many of the experimental plots. By looking at DNA inside the plant's chloroplasts (the photosynthetic machinery), I've found that in the 1870s, sweet vernal grass on all the plots was genetically very diverse. Today, this diversity survives on a plot that has never had fertiliser and another that doesn't get nitrogen (though it does get other fertilisers). But the sweet vernal grass on a plot that gets nitrogen as sulphate of ammonia has only half the genetic diversity it had in the 1870s. This is worrying, because when species lose genetic diversity, they are more likely to go extinct. Sweet vernal grass isn't going to disappear any time soon, but if other plants show similar effects we ought to be concerned.

This is a preliminary study, and we can't really say definitely what's happening without comparing lots of plots. Adding nitrogen could be damaging genetic diversity the same way it reduces species diversity (the number of different species present), by letting the plants most able to take up nitrogen out-compete others. But there's another more likely explanation. The sulphate of ammonia makes the soil more acid. It is now pH 3.9, whereas the other two plots have a normal soil pH. On the acidified plot, the grass dies whenever there is bad weather—a dry summer or a late frost in the spring. This could be a bottleneck, killing most of the plants so the population comes back from just a few survivors. Or the acid soil could be a



Pamela at work in the laboratory.



The park grass experiment at Rothamsted.

'selection pressure' that gradually encourages plants most adapted to acidity. In our next experiments we'll find out more. Let's hope it doesn't take another 150 years!

## Want to know more?

You can read more about the park grass experiment at:  
[www.rothamsted.bbsrc.ac.uk/Research/ParkGrass.html](http://www.rothamsted.bbsrc.ac.uk/Research/ParkGrass.html)

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