Ten bulbs of *Galanthus* 'Green Ribbon'. They had been planted seven months earlier where previously all the snowdrops had died.

Can the benefits of using soil microbes be seen?

David Way

The changing range of commercial products currently on sale to gardeners includes not only natural living organisms in the form of nematodes, mites and flies for pest control, but soil microbes. They are microscopic so they are invisible to the naked eye, so we never see them. If you open a packet, what do you find inside? The commonest types look like a yellowish fibrous meal or greyish granules. They contain a range of species of mycorrhizal fungi and beneficial bacteria, increasingly referred to as AMFs and PGPRs (see *New Knowledge, New Language, The Hardy Plant* Vol. 38, No, 1, 2017 where there are also pictures of relevant products).

A wide range of claims are made regarding the use of microbes in gardens, and increasingly the media accept their use as routine, particularly on television gardening programmes. However, many gardeners are sceptical because it's often hard to identify convincing visual evidence of benefit.

I became interested in these products in 2014, a year after moving from Kent to Hertfordshire, and from alluvial soil over clay to clay with flints over chalk. As gardeners do, I had brought many treasured plants with me for the new garden, including 130 kinds of snowdrops, potted up in lattice baskets. Fortunately it was May and by then they were dormant, which gave my wife Anke time to design the new garden before replanting them in August. When I lifted quite a number of the lattice pots to reposition them, to my horror I discovered the bulbs were very severely diseased. There was no obvious solution, because no fungicides are legally available for the control of snowdrop diseases in gardens.

With nowhere else to turn, I began on a steep learning curve finding out about soil microbes. As my knowledge built up I began to experiment.

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A clump of *G. reginae-olgae* 'Tilebarn Jamie' bulbs, badly infected with the fungal pathogen Fusarium Basal Rot. The fungus prevents bulbs forming new roots at the end of dormancy, so they starve to death.

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Ten bulbs of *G. plicatus* 'Lambrook Greensleeves' photographed after the end of flowering. The vitality of this clump is striking. They had been planted seven months earlier in a hostile site of known pathogenicity.

After a limited start I decided it was all-or-nothing, so in early spring 2016 I coated the entire garden with a mixture of biochar and commercial mixtures of AMRs and PGPRs, then immediately coated this with a layer of shredded and composted conifer bark. This process was repeated in 2017.

By flowering time 2017 there were many signs of improvement right across the garden in terms of increased clump size and number of flowers. The magnitude of improvement increased still further by spring 2018 and the overall display was excellent. Outstanding were ten new cultivars, obtained in summer as dormant bulbs from a leading supplier. They were immediately potted using a prepared microbe-rich compost (JI Seed with added commercial AMRs and PGPRs) and stood in shade to develop expanding root systems before planting out in autumn. This process can be regarded as pre-planting inoculation.

Ten planting sites were spread across the garden, but two were specifically chosen as sites of known fungal infectivity, precise locations where all the snowdrops which had been planted there previously had died within one or two years.

In late April 2018, as they die back in annual senescence, I can report that all the snowdrop bulbs throughout the garden have grown with striking vigour and flowered well, including the two cultivars which had

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'Grumpy' is an iconic cultivar of *Galanthus elwesii*, instantly recognisable from the pattern of green markings on the inner segments. This specimen, photographed in February 2011 in my garden in Kent, always remained a small clump seldom producing more than two flowers.

'Grumpy' moved with us to our new garden in Hertfordshire in 2012. Its performance did not change until 2017, a year after treating the entire garden with soil microbes, when it grew profusely, produced 6 flowers, and at least doubled the number of bulbs in the clump, so that it needed to be lifted and divided.

The divisions were repotted in a microbe-rich compost. They have produced many flowers and grown extra vigorously. Seen here on 28/03/18, the leaves are 30mm wide, 50% wider than the published norm.

been planted in the locations of known infectivity. At last we can see the benefit of microbe use.

Bearing in mind that microbes were applied to the entire garden, it's reasonable to ask whether any other plants can be seen to have benefited. The answer at the moment is no. But that is not the same as saying that there is no benefit. Like most plant lovers' gardens, mine is planted with a wide range of herbaceous plants and some shrubs and trees. In the main the plants are single specimens or groups, selected because they are likely to prosper on my kind of soil. Microbes are likely to be beneficial, even if they just help supply water to their roots, a major function in AMR symbiotic associations. But although the plants in a typical garden like mine probably do benefit, it is unlikely to be seen quickly or clearly because valid comparisons cannot be made.

However, we also grow many *Helleborus*, and both *H. odorus* and *H. orientalis* can suffer severe disfigurement of the foliage from Black Spot diseases. Microbes could well be effective in controlling these diseases too. As in my garden, many other gardeners plant snowdrops with hellebores so overall soil treatment with microbes could have an expanded potential. From now onwards I shall need to take appropriate records.

David Way continues his lifelong interest in plants with experiments in his new garden.