

Creating an Orchid Meadow Using Seed

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In 2003 we started to convert a small (0.15ha) grass paddock by our house (near Blairgowrie in eastern Scotland) into a wildflower meadow. For several years before that it had been used to graze sheep (Fig. 1), and even further back it had been part of a field in an arable-grass rotation. Now, in 2022, it is full of wildflowers (Fig. 2), including 14 species of orchid, all of which have been grown from seed broadcast 'on the breeze'.

Creating and managing a meadow with orchids grown from seed is a long-term project. Many species will not flower until four years after spreading their seed, and some species will take longer. It is well worth planning ahead when starting a wildflower meadow with orchids and keeping a diary. To enable any plant introductions to be distinguished from natural spread it is essential to inform your local Botanical Society of Britain and Ireland (BSBI) vice-county plant recorder. The records collected by the recorders enable the BSBI to map the distributions of all plants in the British Isles (<https://database.bsbi.org/maps>).

Most orchid species found in meadows have specific ecological requirements, potentially limiting their distributions. They favour infertile soils and competition from grasses and other meadow plants needs to be minimised. Their flowers and seed capsules need to be protected from herbivores. If the site is to be grazed, this should be restricted to the autumn and winter – it is a question of getting a balance between minimising competition from other plants and minimising damage to the orchids by grazing and trampling. It is also important to avoid introducing orchid diseases. We have been troubled by *Dactylorhiza* 'Black Death' (Trudgill 2015, Scrase 2022) a lethal and highly infective fungal disease that will kill all species of *Dactylorhiza*. Our infection came from an infected plant introduced into the neighbouring garden. Hopefully, an effective fungicide has now been identified (Temple 2022).

Figure 1. Jean feeding calves in the early 1990s. The grass paddock that is to become the wildflower meadow is through the gate and to the right of the fence stretching into the distance. The field that once it was a part of is to the left of the fence.

Figure 2. Our wildflower meadow, looking north in the spring of 2020.

Photos by Dave Trudgill





Starting to create an orchid meadow

There are many different potential starting points when seeking to create a wildflower meadow. These range from a small lawn to several hectares of agricultural land. Our meadow is c. 0.15 ha and our first step in 2003 was to dig a pond using a large, tracked excavator (Fig. 3). We then sprayed the whole area with the herbicide glyphosate (Roundup) to kill all the grasses and herbs and provide a clean base. About three months later we repeated this to kill any perennial weeds that subsequently emerged. Unless your site is already a wildflower meadow, a clean start has several advantages. These include the ability to initially determine the species of most of the plants present and, where desirable, to make physical modifications to the site.

It is useful to ‘know’ your soil and any physical peculiarities of the site. Over time, grassland can become progressively more acid, so soil pH (acidity) should be checked. All that is needed is a simple, cheap meter used to check the pH of fish tanks. Many species of orchids are calcicoles and prefer, or even require, soils with a pH >7.0. Adding lime to the soil should be considered for many sites. We have subsequently added large amounts (sometimes > 5.0 kg/m²) of agricultural lime, dolomitic limestone and limestone chippings to several areas in our meadow.

Wildflower seed mixtures.

We initially sowed our meadow with a wildflower seed mixture from a local producer (Scotia Seeds) that contained several grass species and sixteen species of herbs, all of local provenance. We also included seed from four seed-heads of Lesser Butterfly-orchid (*Platanthera bifolia*) and planted two birch and one willow tree in the south west corner. There were no legumes in our seed mixture as one of our long-term aims was to decrease soil fertility. We tried to avoid vigorous species that might become too dominant such as Ox-eye Daisy (*Leucanthemum vulgare*). Smaller, less competitive species that do well in our meadow include Cowslips (*Primula veris*) and Yellow Rattle (*Rhinanthus minor*), a hemiparasite of grasses. Since then we have spread seed of several other wildflowers to increase the biodiversity. We are now trying to grow Bird’s-foot Trefoil (*Lotus corniculatus*) in the margins of our meadow to provide a food source for the larvae of Six-spot Burnet Moth (*Zygaena filipendulae*), a pollinator of some orchid species, particularly Pyramidal Orchid (*Anacamptis pyramidalis*).

Our seed mixture was incorporated by a light hand raking. It is, we suspect, desirable to minimise any subsequent disturbance of the soil because this may damage the

Figure 3. The pond after it was dug and then after filling. The surrounding land had been sprayed with glyphosate (RoundUp).

Photos by Dave Trudgill

hyphal networks of the mycorrhizal fungal on which the orchid seed rely for their germination. We obviously did something right because four years later we discovered a few plants of Lesser Butterfly-orchid.

Creating diversity

Creating a diverse habitat is important when trying to grow many different species of orchids. The digging of an unlined pond, fed with water from the adjacent Lunan Burn, was particularly valuable as the Lunan Burn has a pH sometimes as high as 8.0. Consequently, the ground bordering the pond never dries out and is slightly alkaline, making it suitable for several species of orchids with a preference for damp, alkaline soils. Seven of our fourteen orchid species grow exclusively, or mostly around the pond. These are, in order of flowering, Green-winged Orchid (*Anacamptis morio*), Early-purple Orchid (*Orchis mascula*), Heath Spotted-orchid (*Dactylorhiza maculata*), Early Marsh-orchid (*Dactylorhiza incarnata* var. *incarnata*), Southern Marsh-orchid (*Dactylorhiza praetermissa*), Greater Butterfly-orchid (*Platanthera chlorantha*), and Marsh Helleborine (*Epipactis palustris*).



The ‘Pussy Willow’ (*Salix* sp. Fig. 5) and two Birch Trees (*Betula utilis* and *B. pendula*) that we planted in the south-west corner of the meadow created conditions that favour several species, particularly Common Twayblade (*Neottia ovata*), and Broad-leaved Helleborine (*Epipactis helleborine*). The latter only grows under these trees. We think this is because the mycorrhizal fungi associated with the Helleborine roots have a close association with, and pass nutrients from the roots of the neighbouring trees to the developing orchids (Trudgill 2019). It is also the only place where White Helleborine (*Cephalanthera damasonium*) has established

Figure 4. One of nine White Helleborines (*Cephalanthera damasonium*) under the *Betula utilis* flowering in our meadow for the first time in 2022.

Figure 5. The ‘Pussy Willow’ in late spring. The blue arrow is pointing at a group of Early-purple Orchids (the pink spot), the only place under the trees where they grow.

Figure 6. Modifying an area by removing the turf and about 10cm of top soil and replacing with a mixture of agricultural lime, sub soil and leaf-mould.

Photos by Dave Trudgill (Figs. 5 & 6) & Graham Wood (Fig. 4)



in our meadow. We spread a small amount of seeds in March 2016 and it flowered for the first time in 2022 (Fig. 4). This was a surprise because we did not see any sign of it prior to its flowering. Also, we thought it highly unlikely it would grow so far north as, except for an outlying population in Lincolnshire, it is totally confined to the south of England. It may be relevant that it is growing in an area where, in the summer of 2015, we had removed 5 to 10cm of the turf and top soil and replaced it with, and lightly incorporated a mixture of agricultural limestone, sub-soil and leaf-mould (Fig. 6). A few plants of Early-purple, Early Marsh-orchid, Greater Butterfly-orchid, and Marsh Helleborine (otherwise found only along the edge of the pond) also grow under these trees, perhaps because they are shaded and the transpiration demand is decreased.

The majority of our meadow could be best described as ‘open grassland’. The orchids that grow here appear to be less specific regarding their habitat requirements as they also grow around the pond and under the trees. They include Common Spotted-orchid (*Dactylorhiza fuchsii*), Northern Marsh-orchid (*Dactylorhiza purpurella*) and Pyramidal Orchid (*Anacamptis pyramidalis*). These three species are widespread and numerous in our meadow, with many hundreds flowering each summer. Lesser Butterfly-orchid also grows well across much of the meadow with more than 60 plants flowering each year, some every summer since 2007. However, there is no overlap between the areas where Lesser Butterfly-orchids and Greater Butterfly-orchids grow. Several plants of Heath Fragrant-orchid (*Gymnadenia borealis*), a fifteenth species, appeared in 2012 in an arc across the middle of the meadow but, just before they flowered for the first time, some ‘numpty’ applied the herbicide glyphosate to several small patches to kill a creeping vetch and, in the process, unintentionally killed all the Fragrant-orchids.

Introducing orchids as seed or plants

We always introduced our orchids as seed that we spread across the meadow (Fig. 7). There is no time-limit on when to spread orchid seed – we are still doing so 20 years after we first established our meadow. Typically we try to use the seed from at least four seed heads. We have never introduced orchids as plants (it is illegal to dig-up wild plants without the land owner’s permission). Although some people have been successful in transplanting orchids, we have had relatively poor survival rates when we have moved plants from the paths to other parts of the meadow, despite taking a ball of soil 12 to 15cm in diameter. Instead, we now move such plants into pots



Figure 7. Spreading seed in the autumn by opening seed capsules whilst moving up-wind.

Figure 8. Seed of Lesser-butterfly-orchid (*Platanthera bifolia*).

Photos by Dave Trudgill

where they can be readily watered and suffer less competition. We have used these pot-plants as a source of further seed and for experiments involving *Dactylorhiza* ‘Black Death’ and vernalization requirements. We also have grown micropropagated plants of Green-winged Orchid to maturity in pots and used the seed from them to establish it in our meadow. We have failed to establish Dark-red Helleborine (*Epipactis atrorubens*) and Bee Orchid (*Ophrys apifera*) in our meadow, but one plant of Bee Orchid has appeared in the edge of a gravel drive and, in 2022, another appeared in our small glasshouse, the seed for both coming from a plant in a pot.

Introducing seed has several advantages compared with introducing plants. Seed is usually free, it does not carry diseases and it can be obtained in relatively huge numbers. Seed is also much more likely to ‘find’ the parts of the meadow with suitable biotic and abiotic conditions and the appropriate mycorrhizal fungi for its germination and subsequent development and growth. Any plants that grow from seed and survive to flowering must, almost by definition, be in the ‘right’ place where they, and their progeny, are likely to prosper.

We usually distribute orchid seed in the autumn after the meadow has been mown. Previously, we spread the seed by carefully and progressively opening the capsules in a light breeze whilst we moved from side to side across the whole of the meadow (Fig. 7). Now we gently mix the seed with a much larger volume of dry, fine organic material such as sieved leaf-mould. Orchid seed is tiny and lacks food reserves (the endosperm) – hence the need for the involvement of a mycorrhizal fungus to supply the embryo with nutrients. Also, it lacks a hard outer shell (testa) and is easily damaged (Fig. 8), so it must be handled gently and protected from crushing when being sent through the post (Bill Temple, pers. comm.).

Guidelines for obtaining seed.

These include seeking the land owner’s permission, only taking seed from British populations of known provenance (preferably local populations) and from populations where the loss of seed is unlikely to have an adverse impact. It is not illegal to collect seed, except that of rare species that are totally protected (Schedule 8, Wildlife Countryside Act 1981) and from SSSIs and areas such as Nature Reserves that have additional legal protection.

Management

The importance of appropriate management cannot be overstated. Its main aims are 1) to decrease competition for the orchids from the other plants in the meadow, 2) to prevent successional changes to scrub and then woodland, 3) to protect the orchid plants from harm, and 4) to maximise orchid longevity and seed production. To achieve these objectives we mow our meadow each year, starting in mid-August as the orchid capsules mature. We do this using a light-weight, self-propelled mower

with a cutter bar at the front. We dry the mowings to produce a crop of hay. This is often followed three or four weeks later by a further mowing using a ride-on mower. The hay and all other mowings are removed to try to decrease soil fertility. We do not now use herbicides (after accidentally killing all the Heath Fragrant-orchid) and we avoid the use of heavy machines or live-stock that will compact the soil and damage the orchid plants. Our meadow is fenced and rabbit-netted on three sides to protect the orchids from herbivore damage (except for Voles that occasionally take the seed-heads). The fourth side is bordered by the Lunan Burn and now Beavers are becoming a problem.

Decreasing soil fertility can be a slow process in ex agricultural land that has a history of inorganic fertiliser inputs – there is still a substantial crop of hay in our meadow (Fig. 10), despite not adding any fertilizer since 2001 and having removed a crop of hay every year for the last 18 years. In November 2021 we took soil samples (each made up of 50 cores) from either side of the fence (see Fig. 1) that separates our meadow from the adjacent field (of which it was a part prior to 1993). A third sample was taken from across the central area of our meadow. These samples were professionally processed to determine levels of extractable soil nutrients. The amount of readily extractable phosphate (P) in the soil from our meadow had not decreased (Table 1) compared with that in the sample from the adjacent field (that had continued to be conventionally fertilized). Levels of extractable potassium (K) and magnesium (Mg) had decreased, and calcium (Ca) and the pH were slightly lower than in the field. Nitrogen levels were not determined, but rates of deposition from the atmosphere are probably close to 10kg/ha (Tomlinson *et al.* 2021). It was noticeable during soil sampling that the soil in the adjacent field was very compacted compared with that in our meadow.

	pH	P	K	Mg	Ca
Field	6.2	9.9	88	272	1700
Meadow - fence line	5.9	12.0	66	197	1600
Meadow - centre	5.9	10.6	45	168	1400

Table 1. Extractable* soil nutrients (mg/l) in November 2021 for a combined sample of 50 cores taken from just inside the fence line of the adjacent field, the opposite side of the fence within our meadow and the central part of our meadow.

*Reflects the amounts available to the growing plants, not the total in the soil much of which, especially for P, is not immediately available.

Value of creating an orchid meadow

Our orchid meadow has had an impact at several levels. At one level it could be regarded as an experiment. We have demonstrated that southerly distributed species such as White Helleborine, Southern Marsh-orchid (current natural northern distribution limit c. 30 km north of Newcastle-upon-Tyne), and Green-winged Orchid (northerly limit in Ayrshire – see <https://database.bsbi.org/maps>) are able to grow, from seed, much further north in our meadow near Blairgowrie. Our meadow has also provided new insights into the development of orchids. We know, for example that Broad-leaved Helleborine (BLH) can develop from seed to large, mature plants in just three years (Trudgill 2019), whereas White Helleborine took six years. We know this because we know when the seed was first spread. And we know that BLH has a preference for growing near trees because this is the only place where it grows although the seed was initially spread across the whole of the meadow. Also, the development of the BLH to a plant large enough to flower appears to have been entirely below ground.



Our meadow has also increased our knowledge about species longevity e.g. some plants of Lesser Butterfly-orchid in our meadow have flowered every year since 2007 (Trudgill 2016) and, during that time have increased (apparently) vegetatively (Fig. 11). The localised distribution of some species but not others is also of interest. Early-purple Orchid grows in only two small areas, one to the north of the pond and the other under the Willow Tree where several plants are crammed together in an area only the size of a tea-plate (Fig. 9). Pyramidal orchid has increased greatly so that in 2022 we counted more than 700 plants. But, again, it tends to be aggregated – where there is one plant there are nearly always others close by.



Figure 9. Three mature *Orchis mascula* growing in one small area under the Willow Tree (also see Fig. 5).

Figure 10. Starting to take a hay crop off part of our meadow in late August 2019.

Figure 11. A plant of *Platanthera bifolia* that has flowered every year since 2007 and appears to have increased vegetatively.

Photos by Dave Trudgill

Our meadow has also been a productive source of seed, much of which we have supplied to others with an interest in growing orchids in their meadows. We know of two meadows in Scotland with LBO grown from seed supplied by us. In 2021 we supplied to the HOS seed bank c.35g of seed of BLH and c.15g of seed of Common Spotted-orchid and in 2022 we supplied ten HOS members with a mixture containing seed from several orchid species for spreading across their own meadows. However, whilst orchids may produce large numbers of seeds, even where conditions are suitable it also usually requires a large number to establish each plant. Experience suggests that, in our meadow, one new plant per seed head would be a good return. Furthermore, there is one area in our meadow that, since we started, has never produced an orchid plant despite having received many 1000's of seeds of several species.

Final thoughts

Wildflower meadows are a delight that can provide interest and colour throughout much of the year. It is important, therefore, to include herbs and trees with other desirable features. Each spring there is a succession of plants flowering, starting with Wood Anemone (*Anemone nemorosa*), Snake's Head Fritillary (*Fritillaria meleagris*), Cuckoo Flower/Lady's Smock (*Cardamine pratensis*) and thousands of Cowslips. This is finished in late summer with Devil's-bit Scabious (*Succisa pratensis*). In the spring the Pussy Willow in our meadow hums with the sound of hundreds of bees collecting pollen and nectar. In early spring the pond is alive with frogs and toads and, later in the year, with damselflies and dragonflies. It also attracts visitors such as herons and, occasionally, otters. Orchids are a bonus, but one that provides year-round interest. In the winter and early spring we are busy finding and marking the leaf rosettes of Green-winged Orchid, Pyramidal Orchid, and Early-purple Orchid. The spring and summer finds us looking for problems (e.g. plants with *Dactylorhiza* 'Black-death': Scrace 2022; Temple 2022; Trudgill 2015) and for the first appearance of any new species. There is great rejoicing in the Trudgill household when we find that yet another new species has established in our meadow. Many people visit our meadow and it is a pleasure to show them around. In the late summer there is seed to be collected and mowing to be done.

The success we have had growing orchids from seed in our meadow is, we suggest, important with regard to future orchid conservation. In Britain, the numbers of sites where orchids occur is decreasing for most species (Trudgill, 2022a,b,c; Trudgill 2023). Our meadow demonstrates that, with appropriate interventions, this decline could be reversed. We suspect that, provided they are appropriately managed, sites suitable for orchids are relatively wide-spread (e.g. the banks of many roads and motorways) but orchids are absent because they have not received sufficient seed. Colonization by rare species is especially unlikely as the probability of a site being colonised decreases rapidly with increasing distance from a source of seed (Trudgill

2015). In our meadow, only Common Twayblade has arrived unaided and this was initially a single, small non-flowering plant first found in 2015, more than 10 years after the meadow had been established. Only Northern Marsh-orchid and Common Spotted-orchid have spread from our meadow, mainly into our garden but a few plants have appeared in grassy areas within 300m of the meadow. Consequently, to make best use of suitable sites generally requires the introduction of orchid seeds, as we have done. The HOS has already made a start in providing seed for such purposes, but more needs to be done.

Footnote

A video that shows our orchid meadow and its management can be accessed through <https://youtu.be/Gqq6C-GQ4aU> or search YouTube for 'Newmill – Creating and managing an orchid meadow'.

Acknowledgments

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