For most gardeners, sowing seed directly into the ground is restricted either to the vegetable plot or to growing a few hardy annuals or biennials. Direct sowing, however, represents perhaps the most cost-effective way of raising large numbers of plants, and as such it has much wider potential as a technique for creating garden plantings. Over the last five years, the University of Sheffield has carried out a series of trials aimed at widening the application of direct seeding, focusing on flowering herbaceous vegetation, and the results have practical implications for all gardeners. Modeled on methods used to develop wildflower meadows with native species, the plant communities also include cultivated species from other temperate climates intended to increase and extend the season of display. The main advantage of the technique is financial—to fill a square metre (11sq ft) of garden with herbaceous perennial plants may cost around £20–25 at garden-centre prices. The cost of seed to cover the same area can be just 20–50p, making it feasible to create attractive plantings over large areas. Direct sowing can produce a spontaneous, naturalistic effect that is difficult to obtain by direct planting.

Once established, these herbaceous communities are remarkably robust; however, the early stages of establishment are crucial to long-term success. At the University of Sheffield our research highlighted two areas in particular where initial problems can lead to subsequent failure: grazing by slugs and snails, and competition from weeds.

Protecting seedlings from slugs

Slugs and snails are abundant in almost all gardens in the UK, and usually represent the greatest threat to establishing plants from seed. Seedlings are succulent and far more tempting to such molluscs than are adult plants of the same species. The different species and the number of slugs and snails found in a garden varies, and populations fluctuate over the year, often peaking in autumn. Essentially nocturnal, molluscs (and the damage they cause) will appear in greatest numbers near features such as weedy hedge bases, compost heaps, herbaceous vegetation and other areas that provide moist cover during the day. Though large slug species will forage up to 2–3m (6–10ft) from their habitual place of cover, the most damage to areas of seedling herbaceous plants usually occurs within 1–1.5m (3–5ft) of the margins.

Our research has tried to identify when slug grazing is most damaging to herbaceous seedlings. One set of trials examined the effect of temporarily removing slugs from sown vegetation for differing lengths of time using slug pellets containing metaldehyde (see margin note, left). They were scattered at densities of 100 per sq m (11sq ft), or one pellet every 10cm (4in) or so. This is a much lower density of pellets than often is applied, but it nevertheless proved effective.

First in, last out

Controlling slugs and weeds at the right time is crucial to ensure success with seedlings, as Nigel Dunnett and James Hitchmough found following trials growing mixed herbaceous plantings from seed.
The results showed that 30 percent more seedlings survived on the baited plots than on the plot without pellets. In addition, without slug control around half the surviving seedlings were moderately or severely damaged compared with only 4 percent of seedlings on continuously baited plots (figure A). Undamaged seedlings will grow better and establish more quickly.

Equally notable for gardeners, perhaps, was that a single application of pellets was nearly as effective as continuous baiting, provided the pellets were applied as the seedlings were emerging. Given the pattern of slug movement and feeding and their need for cover, controlling molluscs in a 30-cm (12-in) band around the sown area should prove just as effective as pelleting the whole area, since slugs only take up residence in seeded plots once the plants have grown large enough to give them adequate shelter.

Suppressing weed competition
Weeds cause two main problems in seed-raised plant communities. Initially, weed seedlings compete with the sown species for water, space, light and nutrients, and as most weeds are fast-growing, they can usually out-compete cultivated species. Secondly, unwanted species can be visually intrusive and can come to dominate the sown community unless controlled.

Thorough weed control prior to sowing is therefore essential. This can be achieved chemically (using a glyphosate-based herbicide), by physical removal, or through light exclusion (using mulches). However, there is an unexplained source of weeds that is much more difficult to deal with: the ‘soil seed bank’ (see margin note, right). Weed species have evolved to exploit open, disturbed ground, and digging and raking almost any area of ground produces a flush of weed seedlings from this seed bank. Since hoeing or hand-weeding large meadow-like sowings is not feasible, it is much better to stop weeds germinating in the first place.

Spreading a weed-free material such as sand, grit or subsoil over the surface of prepared seedbeds as a mulch and then sowing into that keeps the weed seeds buried in the soil underneath. Our trials have focused on inorganic mulches because the chemicals produced by the breakdown of organic mulches may reduce germination in many plant species. This can be desirable in mature plantings as it inhibits weed growth still further, but is self-defeating when raising herbaceous communities from seed.

Our trials have investigated the effects of mulching with different depths of ordinary builders’ sand on the germination of weed seeds. Sand is ideal as it is free-draining and allows rapid root penetration to the soil below, but is also heavy and light-excluding.

The number of germinating weeds was significantly reduced by 5 mm (9/32-in) of sand (figure B, left), and a 10-mm (3/8-in) layer proved even more effective. Although not prevented, weed germination decreased to manageable levels. Counting the number of wanted plants also revealed that sowing directly into the mulch slightly increased the number of seedlings that established (figure B, right) compared with the bare-ground plot. Either the mulch did not adversely affect germination, or the reduced weed competition offset any inhibitory effects of the sand.

The trials continue, but first results indicate that, with simple precautions at the earliest stages, robust communities of annuals or perennials can be achieved by direct sowing. There is a tenet in ecology of ‘first in, last out’. By intervening early on to control slugs and snails, and by stopping weeds getting a toehold, desirable plants get established and are in the forefront, paying dividends for years to come.

Nigel Dunnett is a lecturer in the Department of Landscape at the University of Sheffield, integrating horticulture, ecology and design.

James Hitchmough is Associate Professor in the Department of Landscape at the University of Sheffield.

Sand mulch trial
The trial on weed suppression began in September 2000, when a seed mix of annual species was sown into cultivated plots. Bare plots formed the control, while others were covered in a 5-mm (9/32-in) or 1-cm (3/8-in) layer of builders’ sand. In December the number of weeds, number of sown species and size of the sown species were measured.

Conclusions:
The sand mulch suppressed the weeds but did not inhibit germination of the seedlings (see figure B).

Soil seed bank
Topsoil contains a seed bank dominated by weed species that lie dormant until triggered into germination by favourable conditions, such as exposure to light. Each time soil is cultivated, a whole new ‘crop’ of weed seeds are brought to the surface. Seed banks are primarily associated with the top 10cm (4in) of the soil, and decline rapidly below this depth. Subsoil is generally free of weed seeds, and when well structured is a useful alternative to topsoil for some plantings.

A typical garden seed bank will contain more than 10,000 seeds per sq m (11 sq ft).

4 Seedlings on a bare ground plot in the mulching trial. Most of these are weeds like chickweed.

5 The same seed mix sown onto a sand mulch produces dramatically fewer weeds and the sown plants are larger.

6 A perennial meadow of North American prairie species, established by seeding, is still full of colour in September...