RAISING BEDDING PLANTS FROM SEED

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The term "bedding plant" at one time applied only to half-hardy plants planted outside once the danger of frost has passed. In the 1980's this term has a far wider meaning and can be divided into three groups:

Group 1. summer bedding. Group 2. autumn and winter bedding. Group 3. spring bedding.

The majority of bedding plants grown today are raised from seed. Each genus of plants produces different types of seed which require different germination conditions to obtain the maximum seed emergence from each lot.

The basic requirements for successful seed germination are:

1) Adequate moisture
2) Adequate heat
3) Adequate air
4) Adequate hygiene
5) Good seed

Adequate Moisture: Water the compost before sowing and allow time to drain and warm up. When sowing for our trials we use Fison's Levington compost and drench with the fungicides, Filex and Basilex, to give protection against damping-off diseases. Bedding plants fall into 4 categories for moisture requirements in the propagation stage.

1) Seed that germinates in dry to wet composts, e.g. marigold.
2) Seed that germinates in composts from an intermediate moisture level to a high moisture level, e.g. pansy, *Salvia*.
3) Seeds that require high moisture levels, e.g. *Lobelia*, *Begonia*.
4) Seeds that germinate well at low moisture levels but do not germinate at high moisture levels, e.g. *Verbena*.

The maintenance of adequate moisture levels whilst the seed is germinating can be difficult, especially for small seed. Covering the trays with polythene or glass and paper has been practised for many years but now misting or fogging is being used by large scale propagators and is giving excellent results.

Adequate heat: Singly this is the most important environmental factor in good seedling emergence. Most species of plants have an upper and a lower level at which seeds will not germinate. When the temperature rises above the upper limit, seed goes into a state of secondary dormancy which may or may not be broken; e.g. *Delphinium* seed becomes dormant

above 15.5°C. Dormancy is broken by subjecting the seed to 5°C for 3 weeks and then germinating at 15°C. An emergence of 70% is then possible. If seed was subjected to 5°C after sowing and then germinated at 15°C, an emergence stand of 80 to 85% is possible.

Adequate Air: Three points to bear in mind are:

1. Gaseous exchanges between the medium and air are reduced by depth. Depth of covering is not only critical for air exchanges but also for light requiring species.
2. Oxygen intake limited by water content of the compost medium.
3. Capping on the compost surface reduces gaseous exchanges.

We recommend all sowings to be covered with horticultural grade vermiculite. The material does not cap even when wet and it also allows sufficient light to those seeds that require light but need covering to obtain maximum seedling emergence, e.g. *Impatiens*.

Good hygiene: Clean propagation area, propagation house, growing structures and sensible use of chemicals to prevent disease will keep crop losses to a minimum.

Good seed: This is the most important factor in producing quality bedding plants. Most seed is produced abroad for reasons of environment and economics. Open pollinated cultivars are field-grown in California. Hybrid seed production is in Guatamala and Kenya. Primrose seed production is confined to Europe. Upon arrival here at Adderbury the seed is tested for moisture content and inspected to see what further processes are required to the seed batch before packing. Samples are taken from the batch for: 1) germination tests; 2) emergence tests; and 3) cultural and stock trials.

The seed is stored in a temperature and humidity controlled store. Some seed, such as sweet pea and lupins are stored in a temperature controlled room as fluctuating moisture levels are necessary to ensure the seed coat does not harden. All seed is packed by hand. Seed is sold by weight or by count and packed into crystal liners before being placed in foil packets which are then heat sealed to ensure that seed viability remain high for long periods. After packing, the seed remains in the warehouse until it is collected for despatch to the customer.

Germination tests are carried out on all incoming stock and stock held over from one year to the next. Flower seeds are not governed by EEC regulations for purity and emergence. Our standards of germination are based upon the N.S.T.O. and

its American counterpart. Batches of seed which fail to come up to standard are discarded and burned.

Germination tests are carried out in petri dishes which are placed in cabinets. These provide optimum conditions for germination. Germination is said to be complete once the radicle has emerged from the testa.

Emergence tests are carried out on all System Seed items. Seed is sown in Levington compost and germinated in a specially constructed germination room.

Cultural and stock trials are carried out each year in our own trial ground. Seed is raised in the glasshouse unit in a propagator of similar design to the Electricity Council's small propagator, or in a specially constructed germination room. Each batch is tested for quality, trueness-to-type, and compared with new cultivars on offer from plant breeders.

Production costs for growers of bedding plants are continually rising. Seed accounts for approximately 7% of the total production cost. Any saving in the annual seed bill, without affecting the quality of the plant produced and garden performance is always welcome. Construction of more sophisticated propagation areas will enable higher germination rates to be achieved, or purchasing seedlings and plants from a specialist propagator are ways which growers can achieve a reduction of production costs.

The pressure on seedsmen to supply better quality seed has resulted in many improvements in seed quality.

Alternaria, once the greatest disease problem of bedding plant growers is now a disease which is easily controlled. It is mainly seed-borne but treatment of the seed before packing with a warm water/alcohol soak is now standard practice with *Alternaria* susceptible species, e.g. *Lobelia*.

Improvements in the techniques of seed cleaning ensure that dust, dirt, and disease spores are at a minimum in a particular batch. Air column blowers are used to clean seed as small as *Begonia* (67,000 seeds per gram).

Clipping of marigold seed to remove the halm — where diseases can be carried over from one crop to the next — is one of the latest seed quality improvements now being seen by the bedding plant grower.

The biggest single improvement in providing better quality seed has been the introduction of System Seed. Cultivar selection starts in the trial grounds at Adderbury in the U.K., Holland, and Germany. System Seed cultivars are those in their own right and have been bred for European conditions. The seed crops produced must be of a high quality and, upon

testing the seed, the germination percentage, and emergence time must fall within a given specification. When the seed is received it is graded by either size, density, shape, weight, or colour.

A chemical treatment is then applied to the seed to enhance the vigour of emergence. The batch is then subjected to compost emergence tests to check the uniformity and vigour, after which, by use of a simple formula, we calculate the number of seeds to put into a packet to provide a predictable amount of uniform seedlings.

System Seed is used for plug production by our seedling and plant department. It saves time and money so growers can benefit by cutting their production costs, but still produce a quality bedding plant.

At present the number of plant genera, species, and cultivars is limited to:

Ageratum houstonianum 'Blue Champion'
Cineraria maritima 'Silver Dust'
C. 'Cindy'
Dianthus Princess Series
Geranium Century Series
Impatiens 'Accent'
marigold 'Perfection'
pansy 'Universal'
pansy 'Lyric' × *hybrida*
Petunia Express Series and Cloud Series
Salvia splendens 'Fury'
Verbena × *hybrida* 'Garden Party'
Zinnia 'Peter Pan'

but further developments are underway.

LARGE SCALE APPROACH TO CROP PROTECTION

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I look at the job of a grower as one of eliminating the variables of the environment. I see these variables as follows:

1) Moisture levels
2) Nutrient levels
3) Gaseous levels
4) Temperature levels
5) Pest and disease levels

Many of the so-called crop protection duties are a result of an imbalance of one or more of these variables, not just pest or disease factors. Crop protection is not, therefore, just the appli-