material. Within the scheme of things the prophylactic use of fungicides correctly integrated into the production system can substantially decrease crop losses and improve quality and health of those that survive.

ALPINES AND HERBACEOUS PLANTS FROM SEED PRODUCED IN LOW COST FILM PLASTIC STRUCTURES

J. G. FARTHING[1]

Lee Valley Experimental Horticulture Station, Ware Road, Hoddesdon, Herts

Herbaceous and alpine subjects can be produced in fully ventilated low cost film plastic structures and will fit into the schedule of the traditional bedding plant producer. The material can be satisfactorily grown in these structures without heat although hardening off and control of growth by growth regulants may be necessary. The production of herbaceous and alpine subjects from seed has been part of the "Bedding Plant Programme" at Lee Valley EHS for the last four years. The objective set was to establish sowing schedules which would fit in with the traditional bedding plant season. Also to establish new subjects which may have not been grown by the traditional bedding plant producer.

Structures. The experiments were carried out in prototype 5 m side and end ventilated film plastic structures, all single clad with 150 micron UV inhibited EVA polyethylene. These structures are more fully described in the Station Leaflet "Low Cost Plastic Structures for Vegetables, Flowers, and Nursery Stock Production". An additional aid to seed germination and summer establishment has been the use of an internal thermal/shade screen which is fully described in Station Leaflet No 24. This screen can easily be replaced by a shade screen only.

A side "baffle" at floor level to approximately 20 cm as shown in Figure 1. This has helped in the reduction of the "edge effect" commonly found in single span side and end ventilated film plastic structures. The skirt successfully redirects the air flow above the plant material but does not adversely affect the ventilation capacity of the side ventilation. In addition, during winter, in periods of driving snow and rain, the outside rows of plants nearest the ventilation skirt were protected.

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[1]Deputy Director

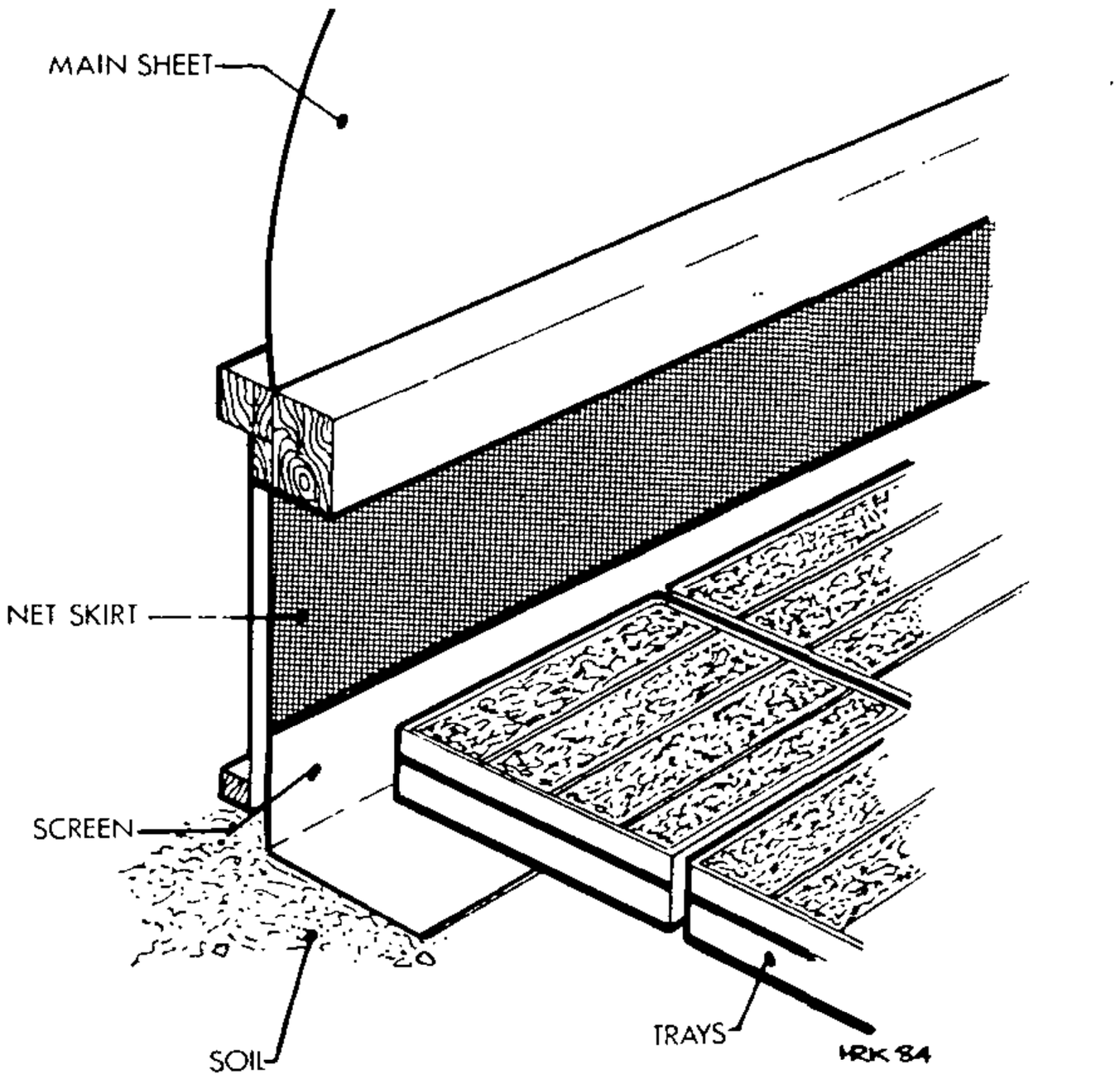

Figure 1. Side "baffle" screen from floor level to approximately 20 cm. to help reduce the "edge effect".

Compost. The compost used in the trials from 1981 to 1985 has been based on 75% medium grade peat, 25% coarse grit plus:

Fertilizer	grammes/ 10 litres	Fertilizer	grammes/ 10 litres
Ammonium nitrate	4	Ground limestone	24
Potassium nitrate	8	Magnesium limestone	24
Superphosphate (18%)	16	Fritted trace elements (WM 255)	4

This compost has given us good growth and compact plant material with the subjects in the trials. It also looks attractive as a compost for alpines with the larger particles of grit. The mix was altered for acid-requiring subjects where a lower pH was necessary, by reducing the lime content (omitting the ground limestone).

THE TRIALS

Direct seeding. This was examined but the variability of germination of herbaceous and alpine seed makes this method of production into the final container uneconomic.

Sowing of two seeds per station helped but still did not

give an acceptable plant stand and also created another operation (singling seedlings) later in the production cycle. The most successful of the subjects examined was hollyhock; delphiniums, though small-seeded and of variable germination, could be direct-seeded very easily into modules. Further work is necessary for improvement of seed germination in herbaceous and alpine subjects before the production by direct seeding of these plants can be considered a viable proposition. Direct seeding of small modules at present offers the best chance in this production system.

In the early trials, sowing schedules were established for production in fully ventilated side and end ventilated film tunnels. This is from setting out to point of sale and can be seen in Table 1.

Table 1. Sowing schedule for spring sales.

Species	Date sown	Species	Date sown
Alyssum montanum	8 Sept	lavender	11 Aug
A. saxatilis	18 Aug	*Leontopodium alpinum*	11 Aug
Aquilegia	17 July	lupin	25 Aug
Armeria	11 Aug	lupin	28 July (direct)
Aubrieta	23 Sept	Pansy	11 Sept
calliopsis	21 July	Polyanthus	2 July
canterbury bell	27 July	Polyanthus	21 July
chives	15 Sept (direct)	*Primula auricula*	2 July
Delphinium	28 July	pyrethrum	2 Sept
Erigeron	21 July	*Saxifraga* mossy types	17 July
Geum	4 Aug	*Sedum*, mixed species	4 Aug
hollyhock	30 July (direct)	sweet william	21 July

Schedules. Several methods of production in the film plastic structures were examined:

1. Full ventilation from pricking out to sale.
2. Modified ventilation (not ventilated in extreme weather conditions, i.e. driving snow/rain and sub-zero conditions.)
3. Outside-grown—without protection.
4. Sown in January within a heated structure at a minimum temperature of 10°C until sale.

The results from these trials indicated Method 1 gave us the most acceptable plant material. Methods 2 and 4 gave plants which were softer and required more hardening-off prior to sale. In some cases there was also a need for growth regulants. The habit of the plants was changed, which was not a desirable feature. It was only in the case of primulas that an

advance in flowering (10 days) was achieved in the modified ventilation tunnel (Method 2).

The crop grown without protection (Method 3) produced substantially later plants. Heavy winter rainfall leached plant nutrients very quickly from the compost. With this method especially, it was essential to liquid feed very early and it is even doubtful then whether a controlled release fertilizer would eliminate the necessity to liquid feed early in the spring prior to sale.

The major labour problems with the production of herbaceous plants under film plastic structures was cleaning the crop of foliage which had died down over the winter period. This is a very labour intensive operation. Late sowing and growing in a heated tunnel (Method 4) produced very soft plant material which needed growth regulant application and considerably longer weaning periods. These growth regulant treatments with Alar at 5000 ppm and chlormequat (Cycocel) at 3000 ppm had in some cases the effect of altering plant habit, e.g. in the case of *Alyssum saxatilis*. This appeared as a change in leaf shape from lanceolate to globose. With most subjects the application of Alar made the foliage a darker green and also compacted the plants. With chlormequat the typical marginal leaf chlorosis was to be seen. The severity of this chlorosis can be seen in Table 2:

Table 2. Leaf chlorosis from application of Cycocel.

Moderate	Severe	Slight
fennel	*Delphinium*	*Geum*
pyrethrum	*Aubrieta*	*Alyssum montanum*
Dianthus		*Erigeron*
Alyssum saxatilis		canterbury bell

Thus with the heated crop it was concluded plants could be produced from a January sowing but this would necessitate growth regulant treatment and additional movement for weaning off. These operations would increase the production costs and would not be compatible with the traditional bedding system and would also compete for labour.

Markets. The establishment of a market is a very important factor in the production system of both alpine and herbaceous plants. It is essential that a market be established before the crop is grown. There is, however, a safety factor in the production system for herbaceous plants that the traditional bedding plant crop does not have. One has the ability to pot on from the 15-cell packs to larger containers, for example, 1 litre poly bags or 1 litre square pots in order to produce a plant for the late summer or autumn sales. These could be sold in

flower which may encourage impulse buying in the garden centre. The cost of the extra labour for potting, the container, and the compost is fairly minimal. Again the market is limited and an outlet should be established for the product.

Alpine trials. A trial examining the effect of capillary watering on sand beds compared with traditional watering by hand indicated problems could occur with overwatering of alpines on sand beds. Considerable rooting through also caused problems at marketing. The rooting through was cured with the use of gloquat at the standard rate and did not cause any phytotoxicity on the subjects that we were growing. The species we examined were:

*Anenome pulsatilla**
*Aubrieta deltoidea [A. leichtlinii]**
Saxifraga umbrosa
'Elliot's Variety'
Cerastium 'Yoyo'
Alyssum saxatilis
Arabis 'Snow Drop'
Saxifraga, mossy hybrids
Aster alpinus 'Dunkle Schone'*
*Dianthus alpinum**
*Leontopodium alpinum**
Arenaria montana
Lychnis alpina
Gentiana septemfida

* The most promising subjects

The examination of other species of gentian has not revealed any suitable type which flower uniformly, quickly, and profusely enough in a small pot or pan. This subject must have great potential for impulse sales in the May period in garden centres.

Other uses. An extension of the bedding plant producers' season using herbaceous and alpine subjects in hanging baskets and pots was examined and attractive arrangements were obtained for a spring display by mixing the plants with small bulbs.

It is necessary to educate the public to accept this new line and perhaps another outlet will have been created.