RESULTS OF LIQUID FEEDING IN THE PRODUCTION OF BEDDING PLANTS

G.A. Boertje
Glasshouse Crops Research
and Experiment Station
Naaldwijk,
The Netherlands

Summary

Petunias and Tagetes are the most important bedding plants grown in Holland, with an annual output of 24 million plants or 40% of the total bedding plant trade. Many bedding plants are produced in soilblocks, but there is increasing interest in the production of bedding plants in multiple pot trays. The supermarkets in particular like to sell in units of for instance four plants. A multiple pot tray consists of 6 or 8 units with four pots per unit. The trays are filled with potting compost based on frozen black peat, peat moss, sand, dolomite lime and fertilisers.

An experiment was carried out to determine the optimum rate of liquid feeding during the growing period of six types of bedding plants in multiple pot trays. The experiment was started in February 1978 and completed three months later. The best results in Petunias, Salvias, Tagetes and Ageratum were obtained with ten liquid feed applications consisting of the water-soluble fertiliser 17 + 6 + 18 at a concentration of 1 to 1.5 g per l water. Impatiens and Dahlias gave a positive response to higher liquid feed applications. Osmocote 15 + 12 + 15 with an active release life of three to four months, applied to the potting compost at a rate of 2 kg per m3 before potting up, also gave satisfactory results in the case of Petunias.

Introduction

About 60 million bedding plants are produced in the Netherlands every year. Petunias and Tagetes are the most important crops with an annual output of about 12 million each. Salvias take third place with more than 5.5 million. About 3.5 million Pelargoniums and more than 3 million Begonias are also grown. Ageratum, Alyssum, Impatiens and Lobelia are also important crops with a total production of more than 10 million. Bedding plants are produced all over the Netherlands, but there is a significant concentration in the West of the country. There are about 1 200 nurseries involved in bedding plant production. About 40% of the bedding plants are sold via the auctions, about 35% are retailed direct to the public and the remaining 25% are supplied to merchants (van Rijssel, 1977).

Most of the bedding plants are grown in soilblocks, with the exception of Pelargoniums and Fuchsias. Depending on the species, the soilblocks used have a minimum width of 4 cm and a maximum width of 8 cm. In recent years there has been an increasing interest in the use of plastic multiple pot trays (sets) for the production of bedding plants. The auctions have recommended to their members standard multiple pot trays which fit into cardboard auction boxes. Two types of multiple pot trays are being used generally, trays with 24 pots and with 32 pots. The small pots (32 per tray) have a content of about 110 ml. The content of the large pots (24 per tray) is a little more than 160 ml. A 7 cm soil-block has a volume of about 320 ml which means that the plants grown in the 160 ml pots have only half the volume of compost available and half the nutrients. Because of the reduced compost volume, liquid feeding in the multiple pot trays is therefore of great importance.

The potting compost

The composition of the potting compost has a profound effect on the quality of the bedding plants. The recommended potting compost for use in the multiple pot trays consists of 60% frozen decomposed black sphagnum peat and 40% peat moss. Per m3 peat mixture, about 50 l sand, 7 kg dolomite lime and 1.5 kg compound fertiliser 'PG Mix' are added. 'PG Mix' contains 14% N, 16% P_2O_5 and 18% K_2O. The fertiliser also contains 0.12% Cu, 0.03% B, 0.2% Mo, 0.16% Mn, 0.04% Zn and 0.09% Fe (iron chelate DTPA). Bedding plant growers do not prepare their own potting compost, but they purchase it from potting compost manufacturers. Some growers consider that a potting compost consisting of 6 parts frozen black peat and 4 parts peat moss is too fluffy for soilblock making. In that case the compost manufacturers can cater for the grower's preferences by reducing the proportion of peat moss in the compost or by adding 10 to 15% peat with binding qualities.

Experimental design

The effects of liquid feeds during plant raising in multiple pot trays were studied in six bedding plants, viz. Petunia 'Grand Prix', Impatiens 'Minette', Dahlia 'Rigoletto', Salvia 'Pixie', Tagetes 'Harvest Moon' and Ageratum 'Wedgwood'. Ageratum and Tagetes were grown in multiple pot trays of 32 pots per tray (110 ml compost per plant). The other four species were potted in trays of 24 pots per tray (160 ml compost per plant). Starting from the fourth week after potting up, different concentrations of liquid feeds were applied via the overhead irrigation system, first at weekly intervals and later at intervals of five days. The fertiliser used was 'Kristalon Blue'. This fertiliser is water-soluble and contains 17% N, 6% P_2O_5 and 18% K_2O. Kristalon also contains some trace elements, viz. 0.025% B, 0.0005% Mo and 0.01% Cu. The experimental design is shown in Table 1. The fertiliser was disssolved in demineralised water which - as the Table shows - has a low conductivity. On average, 1 g Kristalon per l water increases the EC value by 1.4 points. The fertiliser solutions were applied to the crops via the overhead irrigation system and they were not washed off. This method was chosen in order to establish for each species at what concentration leaf scorch would occur.

Besides the liquid feed experiment, the slow release fertiliser 'Osmocote' 15 + 12 + 15 was tried in Petunia. Quantities of 2 and 4 kg fertiliser per m3 potting compost were compared. The fertiliser was mixed into the compost before potting up. At a later stage, a number of the multiple pot trays were given a top dressing of Osmocote equivalent to 2 and 4 kg per m3 compost.

Progress of the experiment

The multiple pot trays were filled with moist compost on 17 February 1978. The young plants were pricked off three days later. The day temperature was set at 19°C which was reduced gradually to 15°C. The Salvias were stopped at two pairs of leaves on 7 March. The first liquid feed was applied on 13 March. A quantity of 0.5 l liquid feed was given per multiple pot tray of 24 or 32 pots. The feeds were applied first at weekly intervals and later on at intervals of five days. The tenth and final application was given on 25 April. The sets were spaced out twice, on 22 March and 17 April. The Salvias were assessed on 22 May and the experiment with the other species was completed on 2 May.

In the Osmocote experiment the top dressing was applied to the Petunias on 3 April. The rates used were 8 or 16 g Osmocote per tray containing about 4 l potting compost.

Results

The most important results of this fertiliser experiment have been compiled in Tables which show for instance the degree of leaf scorch. At the end of the experimental period values were awarded for leaf colour and general plant quality. The weights of the aerial parts were also determined.

Leaf scorch

The data in Table 2 reflect the amount of leaf scorch sustained as a result of liquid feeding. The figure 0 indicates that no leaf scorch was found whilst figure X indicates leaf scorch. No leaf scorch was observed in Petunias, not even at the highest fertiliser concentrations. Tagetes and Ageratum developed severe to very severe leaf scorch at fertiliser rates of 3 and 4.5 g per l water. In the case of Tagetes there was some leaf scorch even at the 1 and 1.5 g rates. Dahlias and Salvias developed leaf scorch to some degree at 3 and 4.5 g fertiliser rates. Impatiens was not particularly susceptible and leaf scorch was found only at the 4.5 g rate.

Generally speaking, no leaf scorch is likely to occur if Kristalon blue or a comparable fertiliser is used for overhead liquid feeding, provided the EC value of the liquid feed is 2.0 or less. Tagetes is an exception.

Leaf colour

The colour of the foliage was assessed on 2 May, at the end of the experiment. Value 5 indicates a normal leaf colour, whilst lower figures indicate a lighter and higher figures a darker leaf colour. The relevant data are shown in Table 3. Where no liquid feeding was applied the leaf colour was much too light.

Liquid feed rates of 0.5 g fertiliser per l water resulted in a leaf colour which was lighter than normal. With the exception of Impatiens, the leaf colour was normal where feeding rates of 1.5 g were used. At rates of 3 g and even more so at 4.5 g fertiliser per l water, the leaf colour was rather dark. An interesting observation was that nutrient deficiency caused a patchy purplish blue leaf colour in Tagetes and Ageratum. The discoloration was clearly visible at the end of the experimental period, especially where no liquid feeds had been applied.

Quality

The factors taken into account in the assessment of plant quality included leaf colour, sturdiness, flower colour and plant size. The better the quality, the higher the number of points awarded. Figure 10 indicates very good quality and figure 5 or less indicates insufficient quality. The quality assessments are shown in Table 4.

Where no liquid feeds were applied, growth was severely retarded, resulting in quality assessments of 3.2 to 5.0 depending on the species. The quality of Impatiens and Dahlias in particular left much to be desired. Regular liquid feeding with 0.5 g fertiliser per l water gave a substantial improvement in growth compared with no liquid feeding. Liquid feeding with 1 g fertiliser per l water produced acceptable quality in Petunias and Salvias. On the whole, the best results were obtained with ten liquid feeds of 1.5 g 'Kristalon Blue' 17 + 6 + 18 per l water. Impatiens and Dahlias gave the best results with 3 g fertiliser per l water. The highest fertiliser concentration had a negative effect, particularly in Salvias and Ageratum.

Plant weight

At the end of the experiment, the plants were cut off and the aerial parts were weighed. The results are shown in Table 5. Liquid feeding of bedding plants in multiple pot trays appears to have a significant effect on the plant weight. Averaged over all the species, liquid feeding with 0.5 g fertiliser per l water resulted in an increase in the plant weight of 26% compared with the untreated control. Applications of 1 and 1.5 g fertiliser resulted in weight increases of 50 and 63% respectively.

Where liquid feeds of 3 and 4.5 g fertiliser per l water had been applied regularly, the plant weights were more than doubled compared with the untreated controls. A comparison of the plant weights with the quality assessments discussed earlier shows that there is hardly any correlation between high plant weights and high quality values. The reason for this is that the heavier plants are less sturdy with the result that they are liable to suffer during transport from the grower to the consumer. It is worth mentioning that bedding plant growers use growth regulators to obtain compact plants. These chemicals were not used in the experiment under discussion.

Osmocote

Table 6 contains the results relating to the use of the slow release fertiliser Osmocote 15 + 12 + 15 which has an active life of 3 to 4 months. Petunias were used in the experiment. A plant weight of 30 g was obtained where not top dressings were applied. Plant quality was only moderate and the leaf colour was too light. Liquid feeds of 1.5 g fertiliser per l water gave good results. As far as plant weights and quality assessments are concerned, comparable results were also obtained with the treatment in which 2 kg Osmocote was mixed into each m3 of potting compost before potting. A rate of 4 kg Osmocote produced a better leaf colour, but the plants were less sturdy and had to be awarded a lower quality figure. Top dressings of Osmocote applied to the crop at a later stage did not result in improved growth and quality. The use of Osmocote at a rate of 2 kg per m3 compost, and particularly at the 4 kg rate, gave temporary growth inhibition for a short period following potting. The moisture content of the pot balls should be increased in order to prevent these negative effects as much as possible. In view of these experiences, it is probably a good idea to reduce the rate of Osmocote to 1 or 1.5 kg per m3 potting compost, particularly for crops which are salt sensitive and tend to grow away slowly.

Conclusions

The investigation discussed in this paper leads to the conclusion that satisfactory results were obtained with liquid feeds of 1 to 1.5 g fertiliser 17 + 6 + 18 per l water applied to Petunias, Salvias, Tagetes and Ageratum grown in multiple pot trays. Higher fertiliser concentrations had a positive effect on the quality of Impatiens and especially Dahlias. The multiple pot trays were filled with a potting compost based on frozen black peat and peat moss. Per m3 potting compost, 50 l sand, 7 kg dolomite lime and 1.5 kg Pg mix (14 + 16 + 18 + trace elements) were added.

Osmocote applied at a rate of 2 kg per m3 potting compost gave good results in Petunias, provided the moisture content of the potting compost was increased for a short period after potting up.

References

Van Rijssel, E., Some structural aspects of the production and marketing of bedding plants. Agricultural Economics Institute, No. 4. 78 (1977) 36 pp.

Table 1 - Experimental design.

Treatment	Fertiliser 17 + 6 + 18 in g per l water	EC of the liquid feed expressed as mS per cm at 25°C
1	0	0.1
2	0.5	0.8
3	1.0	1.5
4	1.5	2.2
5	3.0	4.3
6	4.5	6.4

Table 2 - Leaf scorch following overhead irrigation with liquid feed at different concentrations. (0 = no leaf scorch, X = some leaf scorch and XXX = severe leaf scorch).

Treatment	Fertiliser 17 + 6 + 18 in g per l water					
Crop	0	0.5	1	1.5	3	4.5
Petunia	0	0	0	0	0	0
Impatiens	0	0	0	0	0	X
Dahlia	0	0	0	0	X	XX
Salvia	0	0	0	0	X	XX
Tagetes	0	0	X	X	XX	XXX
Ageratum	0	0	0	0	XX	XXX

Table 3 - Leaf colour assessments. (5= normal leaf colour. Lower figures indicate lighter leaf colour and higher figures darker leaf colour).

Treatment	Fertiliser 17 + 6 + 18 in g per l water					
Crop	0	0.5	1	1.5	3	4.5
Petunia	3.0	4.0	4.3	5.0	6.0	6.7
Impatiens	2.0	3.0	3.7	4.3	6.3	7.0
Dahlia	2.7	4.3	4.7	5.0	6.3	7.0
Salvia	3.3	4.0	5.0	5.0	5.7	6.0
Tagetes	3.0	4.0	5.0	5.0	6.0	7.0
Ageratum	3.0	4.0	5.0	5.0	7.0	7.0

Table 4 - Quality assessments. The higher figures indicate better quality.

Treatment	Fertiliser 17 + 6 + 18 in g per l water					
Crop	0	0.5	1	1.5	3	4.5
Petunia	4.7	6.0	8.0	8.3	7.8	6.2
Impatiens	3.2	4.5	5.7	6.5	8.2	6.8
Dahlia	3.5	5.2	6.3	6.8	8.0	8.0
Salvia	5.0	6.7	8.0	8.3	6.3	4.3
Tagetes	4.0	5.7	7.2	7.7	7.5	6.0
Ageratum	4.0	6.5	7.5	8.0	6.2	5.5

Table 5 - Weights of aerial plant parts in g per plant following irrigation with liquid feeds at different concentrations.

Treatment	Fertiliser 17 + 6 + 18 in g per l water					
Crop	0	0.5	1	1.5	3	4.5
Petunia	30.0	37.2	46.2	52.8	73.6	77.0
Impatiens	26.7	31.9	36.5	39.1	42.9	47.8
Dahlia	16.7	19.8	23.8	25.8	32.0	38.2
Salvia	11.2	17.6	20.0	22.6	26.0	25.2
Tagetes	14.3	19.0	20.8	21.4	30.4	26.7
Ageratum	14.4	16.8	23.1	22.9	27.6	30.7

Table 6 - Results of an experiment with Petunia comparing different quantities of Osmocote 15 + 12 + 15 (3 to 4 month's life).

Treatment	Plant weight in g per plant	Plant Quality	Leaf colour
No supplementary feeding	30.0	4.7	3.0
Ten liquid feeds of 1.5 g 17 + 6 + 18 per l water	52.8	8.3	5.0
2 kg Osmocote per m3 compost	57.2	8.0	4.3
4 kg Osmocote per m3 compost	66.4	7.7	5.0
2 kg Osmocote per m3 compost + top dressing of 2 kg Osmocote	58.3	8.0	4.7
4 kg Osmocote per m3 compost + top dressing of 4 kg Osmocote	63.8	7.3	6.0