SOME EXPERIENCES WITH SLOW-RELEASE FERTILIZERS IN CONTAINER-GROWN PLANTS

VOLKER BEHRENS

Institut für Obstbau und Baumschule, Hannover University
Hannover, West-Germany

Many of our container-grown ornamental shrubs are produced within 15 months from the cutting up to saleable size. Therefore these mass-produced plants are rather cheap and production costs have to be kept at a minimum. One of the main cost factors is a repeated feeding by hand. It is impossible to give all the fertilizer the plant needs during the growing season because of the high salt concentration on the one side and the leaching of nutrients on the other. And liquid fertilizers raise problems too, especially in very wet years. To avoid these problems the fertilizer industry offers various slow-release fertilizers. They are based on two different principles; one is to condense urea with different aldehydes (Ureaform, Crotudor, Isodur); the other is to coat a soluble fertilizer with a material that releases the nutrients slowly.

But up till now only few investigations are published on questions like the following: in which amount should these fertilizers be given to grow containerized plants? Which method is preferable, application on the container or mixing into the potting medium? Is it possible to give the entire quantity at the beginning of cultivation or would two applications be more advantageous? And how do the different fertilizer brands act; are they similar in performance with regard to their effect on the plants?

So to gain more information on these questions two factorial experiments were carried out at the Institut für Obstbau and Baumschule of Hannover University in 1978 and 1979.

MATERIALS AND METHODS

Plant material. As a test-plant *Pyracantha coccinea* 'Orange Charmer' was chosen, since it is an important plant in German nurseries, is vigorously growing, and reacts well to nutrition. It is typical of plants that are usually propagated in summer (late June/July), potted with a little fertilizer in small pots in autumn or early spring, kept under frost protection, and then potted on in the middle of May when frosts are no longer to be expected.

Fertilizers. Five different slow-release fertilizers were chosen, three of them were developed for nurseries, two are lawn-fertilizers (see Table 1).

Container and potting-medium: The plants were potted in

Table 1. Tested fertilizers and their characteristics.

Brand Name	Ratio of Nutrients N:P:K:Mg	Declared Duration	Nitrogen in form of:
Plantosan 4 D (rough granular)	20:10:15:6 + trace elements	10 weeks	85% slow-release, no information about the form by the producer, probably mostly urea form; 15% fastworking
Osmocote	16:10:13 no trace elements	8 to 10 months	resin-coated soluble fertilizer
Triabon (rough granular)	18:8:12:4 + trace elements	10 weeks	75% Crotudor, 25% fastworking
Mannadur Super (lawn-fertilizer)	20:5:8:2 + some trace elements	more than 4 months	50% ureaform, 23% urea, 15% nitrate, 12% ammonium
Rasen Floranid (lawn-fertilizer)	20:5:8:2 + some trace elements	many weeks	70% Isodur, 30% fastworking

pure peat-moss mixed with calcium carbonate (3 g per liter), in 5 liter black plastic bags.

A special trace-element fertilizer was added to the fertilizers which do not contain trace-elements. The containers were placed under an overhead irrigation system.

Treatments and design: Two randomized factorial experiments were carried out in 1978 and one in 1979, with 4 blocks and 5 plants each per plot.

1) Each of the 5 fertilizers was given at an amount of 0.9 and 0.6g nitrogen per liter substrate, either on the container or in the medium (only 1978).
2) The 5 fertilizers were applied in three different ways of application each — in the medium, on the container and a corresponding split application. The amounts were 0.9g N/l (1978) and 0.7g N/l (1979).

At the end of the vegetation period (1978) and at the end of August (1979) the height of growth was recorded, since that is usually the most important criterion for selling pyracantha.

RESULTS

No definite difference — much less a significant difference — was found in height of growth between the amounts of 0.6 and 0.9g N/l, whether given on the container or mixed in the potting-medium. All fertilizers reacted in the same way, there was no significant interaction and, therefore, the means over all fertilizers could be computed and compared (Table 2).

No significant differences could be found between the methods of application in 1978, due to a high variation within the treatments — large differences among the replicates.

Differences among the fertilizers are significant in some cases. Rasen Floranid caused an inferior growth compared with all the others, Triabon was not as good as Plantosan and Man-

Table 2. Effect of 0.6 and 0.9g nitrogen per liter potting-medium on the height growth of *Pyracantha coccinea* 'Orange Charmer'.

Method of Application	Amount (g nitrogen per liter)	Height Growth (cm)+
In the medium	0.6	97.0 n.s.
	0.9	93.5
In the container	0.6	97.0
	0.9	96.5

\+ means of 5 analogous reacting fertilizers
n.s. no significant differences ($\alpha = 0.05$)

nadur Super. Because of the high variation no significant interaction was found and the means over all the methods of application could be computed and compared (Table 3).

Table 3. Influence of different slow-release fertilizers and the method of application on the height of growth (cm) of *Pyracantha coccinea* 'Orange Charmer' (1978).

	Method of application			
Fertilizer	in the medium	in the container	in 2 applications	means
Plantosan	108.0+	102.0	103.0	104.0 a
Mannadur	96.5	100.5	108.5	101.5 a
Osmocote	93.5	96.5	98.5	96.0 ab
Triabon	91.0	97.5	88.5	92.0 b
Rasen Floranid	80.0	86.5	71.0	79.0 c

\+ no significant differences within the fertilizers ($\alpha = 0.05$)
a no significant differences between data with the same letter ($\alpha = 0.05$)

In 1979 the data could not be computed by a factorial analysis of variance, because the treatment "Mannadur in the container" was not comparable, due to irregular growing conditions. The data of each fertilizer and each method of application were analyzed separately.

No significant differences could be proved among the fertilizers, whether they were given in the medium or in the container or in the split application. Differences among the methods of application could only be proved to be significant with Osmocote. Feeding Osmocote in the container is not as good as the two other methods (Table 4).

Table 4. Influence of different slow-release fertilizers and the method of application on the height of growth (cm) of *Pyracantha coccinea* 'Orange Charmer' (August 1979).

	Method of application		
Fertilizer	in the medium	in the container	in 2 applications
Plantosan	102.0+	99.0	104.5
Mannadur	98.5	—	103.5
Osmocote	108.0 a	99.0 b	110.5 a
Triabon	98.5	103.0	105.5

\+ no significant differences within methods of application ($\alpha = 0.05$)
a no significant differences between data with the same letter ($\alpha = 0.05$)

DISCUSSION

The results of these trials were obtained under the climatic

conditions of Hannover, West Germany, and they do not necessarily apply in another situation, but nevertheless they can give some useful indications for plants which are similar to pyracantha in growth and cultivation.

The amount of 0.6g nitrogen per liter given as a slow-release fertilizer (e.g. 3g Plantosan per liter) seems to be sufficient for the whole growing season. This result was supported by accompanying salt concentration measurements. These concentrations were on a sufficient level. A higher amount did not increase the growth in height and did not prolong the period of time in which the plants are sufficiently supplied; it only increased the costs and the risk of salt damage. Therefore in 1979 an amount of 0.7g N per liter was chosen.

Lawn-fertilizers, which are usually much cheaper, might be successful container fertilizers too — like Mandadur Super — or might be of no value for container-grown plants — like Rasen Floranid. The latter caused a growth depression and even necrotic leaves due to temporarily high salt concentration levels. Therefore the fertilizer was not tested again in 1979.

In 1978 the main growing season up to the end of July was rather cold and rainy. Probably that was the reason for the diminished growth of the Osmocote and Triabon treatments in comparison to Plantosan and Mannadur and to the 1979 results. It could be possible that the leaching of nutrients is more severe with fertilizers which have fast dissolving granules, like Triabon. There were no clear and provable differences among the fertilizers within the individual methods of application up to the end of August in 1979. Since the plants had not stopped growing then, changes might be possible, especially with Osmocote. The same applies to the methods of application. There were no differences to be found, excepting Osmocote which should not be given in the container, but there seems to be a tendency that a split application might be of some advantage in comparison to the other methods. This tendency can be seen by the Mannadur treatment in 1978, too.

Probably there are no definite differences among growth in height of plants fed with Plantosan, Mannadur and Triabon. Osmocote might have an advantage.