POTTING MIXTURES and FERTILIZATION PRACTICES for CONTAINER GROWN ORNAMENTAL PLANTS

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Potting Mixtures and Fertilization Practices for Container Grown Ornamental Plants

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IN RECENT YEARS the ornamental horticulture industry has changed from the established procedure of growing plants in soil, digging, and burlapping to growing plants in soils or artificial soil media in containers. This change became necessary as a result of high labor costs and requirements for continuous marketing.

Growing plants in containers in substituted soil media depends on a root zone environment favorable for root penetration, moisture retention, and adequate but balanced nutrient supply.

Because of restricted root zone in a container, excellent management and supervision are necessary to maintain a favorable moisture and nutrient balance.

One of the first mixtures used for growing plants in containers consisted of equal parts sandy clay and German peat moss. The plant root media today consists of many combinations of various materials with highly variable physical and chemical characteristics. The materials used furnish inadequate nutrients for the plant, and practically all of the materials necessary to maintain an adequate pH and fertility level must be added.

The objective of these tests was to grow different ornamental plants in various potting media in containers under different ferti-

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lization practices to determine the more desirable potting mixtures and the amounts of fertilizers, lime, and micronutrients for production to marketable size. Results of this study will serve as a basis for future research with fertilization of ornamental plants.

PROCEDURE

Twelve different potting mixtures were used in these tests with different combinations of German peat moss, sandy clay, Bet-R-Growth (processed sugar cane bagasse), Perlite, charcoal, pine bark, and Sorbolite clay chips.[2]

Combinations of potting mixtures in these tests were as follows (equal parts of each unless otherwise stated):

Mixture A – Peat moss, Perlite, and sandy clay
Mixture B – Bet-R-Growth, Perlite, and sandy clay
Mixture C – Peat moss, bark, and sandy clay
Mixture D – Peat moss, charcoal, and sandy clay
Mixture E – Peat moss, clay chips, and sandy clay
Mixture F – Bet-R-Growth (3 parts), clay chips, and sandy clay
Mixture G – Peat moss (3 parts), sandy clay
Mixture H – Bet-R-Growth (3 parts), sandy clay, Perlite
Mixture I – Bet-R-Growth (3 parts), and sandy clay
Mixture J – Bet-R-Growth (3 parts), and Perlite
Mixture K – Stump ash, peat moss, sandy clay
Mixture L – Perlite, peat moss, pine bark, sandy clay

Fertilizer, lime, and micronutrients were uniformly added to the potting media in an 8-gallon capacity concrete mixer. After mixing, rooted cuttings, seedlings, or young liners were potted in No. 6 LeRio azalea cans (capacity 0.2 cu. ft.) or No. 10 food cans (capacity 0.5 cu. ft.) and maintained in greenhouses. Additional fertilizer according to treatment was added at 2- to 4-week intervals. At maturity plants were observed for differences in color, shape and size, and then harvested to obtain weight and in some cases height differences.

The following ornamental plants were grown in one or more of the potting mixtures:

Japanese Photinia (*Photinia glabra*)
Silver King Evergreen Euonymus (*Euonymus japonicus*)
Harlands Box (*Boxus Harlandi*)
Dwarf Capejasmine (*Gardenia jasminoides radicans*)

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[2] The use of certain trade-name materials does not constitute endorsement by the Ala. Agr. Exp. Sta.

Goldspot Evergreen Euonymus (*Euonymus japonicus*)
Pride of Mobile Indica Azalea (*Rhododendron indicum*)
Japan Cleyera (*Cleyera japonica*)
Japanese Aucuba (*Aucuba japonica*)
Fatshedra (*Fatshedra lizei*)
Jungle flame Ixora (*Ixora coccinea*)
Speckled "Gold Dust" Leaf Croton (*Codiaeum variegatum*)
(*Philodendron oxycardium variegatum*)

Both physical and chemical determinations were made on the different potting ingredients to determine pH, soluble salts index, base exchange, dry and wet weights per cubic foot and air- and moisture-holding capacity.

All treatments were replicated four times with 3 to 5 plants per treatment.

TABLE 1. FERTILITY TREATMENTS

Treat. No.	Add to potting mixture: Dolomite[1]	Add to potting mixture: Super-posphate	Source of N	Micro-nutrients	Added as topdress[2]
	Lb./cu. yd.	*Lb./cu. yd.*	*Lb./cu. yd.*	*Lb./cu. yd.*	*Half teaspoon per pot of each listed*
1	6	3	0	0	12-6-6
2	6	3	0	0	12-6-6 with micronutrients[3]
3	6	3	0	0	8-8-8 with micronutrients+CSM[4]
4	6	3	0	0	8-8-8 with micronutrients+CSM+ Dolomite[2]
5	6	3	0	0	8-8-8 with micronutrients
6	6	3	0	0	8-8-8
7	12	3	0	0	12-6-6 with micronutrients
8	6	6	0	0	12-6-6 with micronutrients
9	6	3	Uramite 5	0	12-6-6 with micronutrients
10	6	3	CSM 12.5	0	12-6-6 with micronutrients
11	6	3	0	1/16	12-6-6 with micronutrients
12	6	3	0	1/4	12-6-6 with micronutrients

[1] A fine grade dolomitic lime was used which had the following analysis: Ca 20.8%, Mg 9.9%, Fe 0.087%, Mn 0.008%, Zn 0.004%, Cu .004%, B .002%, Mo 0.004%.

[2] Biweekly applications except treatments 3 and 4.

[3] The following micronutrient mixture is included at the rate of 10 lb. per ton of fertilizer used as a topdress: Fertilizer Borate-46, 14% B, 220 lb.; Copper sulfate, 25% Cu., 439 lb.; Zinc sulfate, 35% Zn., 439 lb.; Nu-Iron, 30% Fe., 240 lb.; Manganese sulfate, 23% Mn., 440 lb.; Sodium Molybdate, 39% Mo., 22 lb., for a total of 2,000 lb.

[4] Topdressed at monthly intervals.

THIS FIGURE shows the response of Harlands Box to micronutrients. No. 1 can shows results of no micronutrients in potting mix or sidedress, No. 2 micronutrients in topdress, No. 11 micronutrients in potting mix (low rate), and No. 12 micronutrient in potting mix (high rate).

RESULTS AND DISCUSSION

Comparisons of properties of some of the potting ingredients used are given in Table 2. Some of these differences help to explain why results vary from one potting mixture to another. A mixture high in peat moss will require more lime than Bet-R-Growth or Perlite; a mixture high in Perlite will require more frequent watering than a mixture high in peat moss or Bet-R-

TABLE 2. CHEMICAL AND PHYSICAL PROPERTIES OF VARIOUS POTTING INGREDIENTS

Materials	pH	Soluble salts index	Cation ex-change ca-pacity	Wt. per cu. ft.		Extraction 2,000 lb. pressure		Heat treated
				Dry	Wet	Air % vol.	Water lb. avail. per cu. ft.	
Desired range	5.5-6.5	1.0-2.0	12-20	depends on use		25-35		
Bet-R-Growth	5.9	1.5	21.2	10.5	39.8	33.4	19.5	Yes
German peat moss	3.1	0.52	30.0	5.2	40.5	31.9	24.7	No
Pine bark	3.8	0.24	29.8	14.8	35.5	37.9	5.2	No
Perlite	7.3	0.00	0.9	14.2	26.2	48.8	2.2	Yes
Norfolk sandy loam	5.4	0.16	5.1	77.2	99.7	3.1	9.0	No
Sandy clay	5.1	0.28	7.9	93.6	113.4	4.8	14.4	No
Stump ash	7.0	0.12	2.7	41.2	70.5	10.2	9.9	Yes
Sorbolite clay chips	4.1	0.10	25.0	36.6	75.6	15.7	8.0	Yes

Growth. A sterile mixture may cause less problems from disease than a non-sterile one.

The data in Table 2 indicate that no single material is completely satisfactory as a growing medium. The following facts about each material are important considerations.

Bet-R-Growth has favorable pH, adequate soluble salts, cation exchange capacity, aeration, and available moisture for plant growth. It is too light for top heavy plants. Its physical characteristics vary with the particle size.

German peat moss has a low pH, and the highest cation exchange capacity and moisture-holding capacity of any material used. The low pH necessitates the addition of larger quantities of lime. The high cation exchange capacity is desirable in most cases. The pH and salt level of peat moss vary with the source.

Pine bark has excellent aeration and is a good additive for the materials that hold more water, such as peat moss, Bet-R-Growth, poorly aerated soil, and sandy clay. Both pH and physical properties vary with source, age, and particle size of the finished product. The pH of samples from different sources varied from 3.8 to 6.2. There is some danger in using pine bark unless it has been sterilized because it may carry the root rot fungus *Phytophthora cinnamoni* that causes little leaf disease of pines.

Perlite is light, improves aeration because of its large particle size and honeycomb structure, and holds considerable water, very little of which is available to the plant. Under low moisture levels, the water present may not be available to the plant. It has a high pH produced by sodium that may be misleading and can result in calcium deficiency. Some sources of Perlite have an excessively high pH (8.5).

Norfolk sandy loam is too heavy when used alone and has insufficient aeration and water-holding capacity for container production. When used at one-fourth by volume with either peat moss or Bet-R-Growth, it adds sufficient weight without reducing aeration. If greater quantities are used, some Perlite, pine bark, or clay chips would be needed to maintain sufficient aeration.

Sandy clay has many of the qualities of Norfolk sandy loam except that it holds about 50 per cent more available water. This quality results in waterlogging because of its poor aeration if it is used alone; therefore, sandy clay is used in the same proportions as Norfolk sandy loam with aeration material. It has less disease organisms and nematodes since it is generally a subsoil material.

Stump ash has a relatively high pH, low nutrient level, acceptable aeration, and sufficient weight. When combined with peat moss or Bet-R-Growth, the moisture- and nutrient-holding capacities are increased sufficiently to make a desirable potting mixture.

Sorbolite clay chips have a pH and available soil moisture level too low for use alone. Their main value is to increase aeration of the mixture and to add weight. The pH of other clay chips varies from 5.5 to 8.5.

Results show very little differences in plant growth with the combination of potting mixtures (see potting mixture composition) when adequate amounts of dolomite, fertilizer, micronutrients, and water are used. Water-holding capacity, cost, availability of materials, and freedom from plant pests and weeds should be an important consideration in selecting potting mixtures.

Since all of these potting mixtures serve primarily as a medium for root growth and not as a source of plant nutrition, additional nutrient elements required by the plant must be added either to the potting mixture or as a supplemental topdress as the plant increases in size. Prior to planting, adequate amounts of dolomite and superphosphate was added in the potting mixture. In 32 separate tests only 6 showed better growth from the higher rate of dolomite (12 pounds per cubic yard of potting mixture). The small rate of superphosphate, (3 pounds per cubic yard) in the potting mixture was adequate in 28 of the 32 tests.

When Uramite was added to the potting mixture, 8 out of 32 tests responded to this additional N. When cottonseed meal was added to the potting mixture 5 out of 32 tests responded to this additional source.

When responses from Uramite were compared with those from cottonseed meal as a source of N in the potting mixture, Uramite was superior to CSM in only 2 of 32 test cases and CSM was superior to Uramite in only one case. In all other comparisons there were no differences.

Response to a micronutrient mixture of B, Cu, Zn, Fe, Mn, and Mo was variable from no response to considerable increases in rate of growth and desirable green color. These differences are due mainly because of variations in plant requirements and impurities in components of the potting mixtures, fertilizer, lime sources, and water. Although all tests did not respond to added micronutrient sources, a micronutrient source should be added either in the potting mixture or topdressing or divided between the two. Results from these tests show that in 8 of 32 tests micronutrients applied in the potting mixture or topdressing produced better plants. Ornamentals most responsive to micronutrients were Box, Euonymus, Fatshedra, and Azalea.

These results would not necessarily be the same as those expected on container-grown plants receiving no shade and no protection from rainfall where both leaching rate and water requirement level of the plants would be greater. Under outdoor conditions, the loss of N, K, Mg, and certain micronutrients would have occurred at a faster rate. Perhaps a greater response from micronutrients and from the additional nitrogen added to the potting mixture would have been demonstrated under outdoor conditions.

Ornamentals, as most other plants, vary in their requirements for fertilizer, lime and micronutrients. These requirements may also vary when grown in potting mixtures of different chemical and physical properties. The listed plants when grown in potting mixtures indicated were found to respond to different rates of dolomite, superphosphate, additional slowly available nitrogen, and micronutrients. All of the following responses were significant.

Plants responding to the larger rates of dolomite as compared with lower rate are: (1) box in peat moss, bark, and sandy clay; (2) photinia in Bet-R.-Growth, Perlite and sandy clay; euonymus in peat moss, Perlite and sandy clay; and in peat moss, charcoal and sandy clay; (3) fatshedra in peat moss, clay chip, and sandy clay; in Bet-R-Growth, clay chips and sandy clay; and in Bet-R-Growth and sandy clay; (4) philodendron in peat moss, Perlite, and sandy clay; and (5) croton in peat moss, bark, and sandy clay.

Plants responding to larger rate of superphosphate as compared with smaller rate are: (1) euonymus in peat moss, Perlite and sandy clay; (2) box in peat moss, Perlite, and sandy clay; and in peat moss, bark and sandy clay; and (3) croton in peat moss, bark, and sandy clay.

Plants responding to source of slowly available nitrogen from CSM or Uramite are: (1) euonymus in peat moss, Perlite, and sandy clay; and in peat moss, charcoal, and sandy clay; (2) box in peat moss, Perlite and sandy clay; and in peat moss, bark, and sandy clay; (3) fatshedra in Perlite, peat moss, pine bark, and sandy clay; (4) croton in peat moss, bark, and sandy clay; and (5) photinia in peat moss, Perlite, and sandy clay.

Plants in various potting mixtures showing a response to micronutrients in topdressing or potting mixture are: (1) euonymus in Bet-R-Growth, Perlite, and sandy clay; (2) box in peat moss, Perlite, and sandy clay; and in peat moss, bark, and sandy clay; (3) photinia in Bet-R-Growth, Perlite, and sandy clay; (4) fatshedra in Bet-R-Growth (3 parts) and Perlite, and in Bet-R-Growth sandy clay and Perlite; (5) azalea in peat moss, charcoal and sandy clay; and (6) croton in peat moss, bark, and sandy clay.

SUMMARY

The ornamental horticulture industry has changed from growing plants in soil to growing plants in containers of artificial soil media. Care must be taken to maintain desirable aeration, moisture conditions and balanced nutrient supply.

Excellent plants have been grown with many combinations of potting material. In selecting the combinations of materials for a potting mixture, both physical and chemical properties should be considered.

Ornamental plants differ in their physical and nutritional requirements. No one potting mixture was best for all plants. Plants differ in their response to major and micronutrients. Good container grown plants can be produced when the proper medium, adequate amounts of dolomite, fertilizer, micronutrients, and water are used. Excessive amounts of all should be avoided.