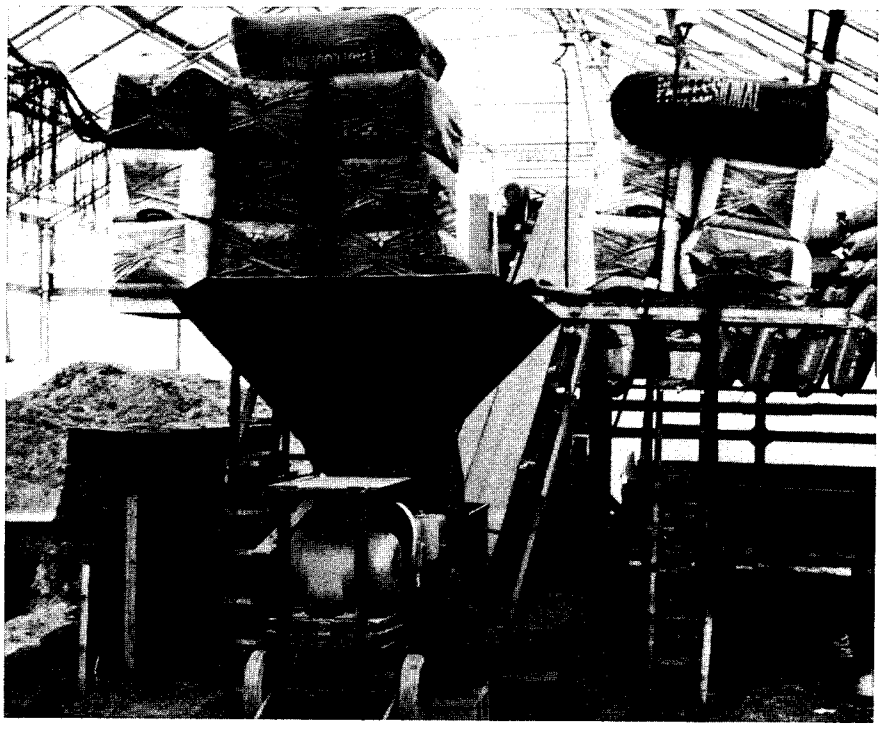
Cornell Peat-Lite Mixes for Commercial Plant Growing

James W. Boodley and Raymond Sheldrake, Jr.



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Media Cost

The Cornell peat-lite mixes have been in use for 20 years. The reasons for their development are as valid now as they were in the early 1960s. Good topsoil is increasingly difficult to obtain. The nutrient content, drainage characteristics, and disease organism, weed seed, and residual herbicide contents of topsoil are often difficult to determine. Unless topsoil is sterilized before it is used, poor crop growth may result.

Soilless media, sometimes called artificial soils, offer the plant grower several advantages. Two soilless media referred to as peat-lite mixes have been developed through research at Cornell. These media have sphagnum peat moss and horticultural vermiculite or perlite as their main components. The mixes are readily available and easy to handle and produce uniform plant growth from year to year. Sterilization of peat-lite mixes is usually not necessary if reasonable care is taken during preparation, storage, and use. Nutrients are added according to formula for controlled nutrition of crops from sowing seed to sale. The cost of peat-lite mixes compares favorably with that of properly prepared soil mixes. There are over 35 soilless mixes on the market with a Cornell peat-lite mix as their basis.

The versatility of the mixes, developed primarily as media for starting flower and vegetable transplants, has enabled growers to use them in other areas where controlled plant growth is desired. Many types of plants have performed well in the peat-lite mixes.

Components of Peat-Lite Mixes

Sphagnum Peat Moss

Medium to fine, horticultural-type, imported sphagnum peat moss is preferred to domestic peats. Domestic peat mosses frequently contain large quantities of nutrients or other materials in unknown amounts and are usually too decomposed to provide the desired structural and water drainage characteristics. When used directly from the bale, sphagnum peat moss is usually free of most disease organisms and weed seeds. Baled peat moss may need to be shredded if the bale is hard and dry. Growers should determine the expansion ratio for their peat. Because of different bale sizes and compression ratios used, there may be up to one-third difference in final volume between various brands.

Vermiculite

Vermiculite, a micaceous material that has been heated to approximately 1800° F, is sterile and has a bulk density of 6 to 8 pounds per cubic foot. The unique platelike structure of vermiculite enables it to hold and release large quantities of water and minerals for plant growth. Vermiculite has a relatively high cation exchange capacity, which results in good buffering characteristics to resist rapid changes in pH and permits the use of somewhat higher fertility levels without plant damage.

Vermiculite contains some potassium, magnesium, and a small amount of calcium. Additional calcium is needed to satisfy plant needs. Calcium is supplied in the form of limestone to bring the pH of the mixture to the proper range. Regular superphosphate also adds some calcium and sulfur as well as phosphorus.

Only horticultural-grade vermiculite should be used for plant growing since the less rigorous quality control used with construction grades may not exclude toxic contaminants.

Foreign sources of vermiculite should have their pH checked because some have excessive alkalinity.

Most of the domestic vermiculite ore comes from mines in Montana, South Carolina, and Virginia. Four sizes are available, ranging from the large pea size, number 1, to the finer grade, number 4. For horticultural purposes, sizes 2, 3, and 4 have been satisfactory.

Perlite

Perlite is a form of volcanic rock that has expanded during heating to 1800° F. It is sterile and has a pH of 7.0 to 7.5 and a bulk density of 6 to 9 pounds per cubic foot. Unlike vermiculite, perlite has no cation exchange capacity, or buffering capacity. (It contains sodium and aluminum in appreciable amounts; these can be extracted by growing plants.) Perlite does not decay or deteriorate except through physical destruction. It holds water on its irregular surface areas.

Preparation of Mixes

Thorough mixing of the components is important to success with the peat-lite mixes. Small quantities can be mixed efficiently in a home concrete mixer, but a large concrete mixer, such as a transit-mix truck or other large blender, is necessary for rapid uniform preparation of large quantities. When mechanical mixers are used, shredded peat moss can be uniformly distributed throughout the other components in 5 minutes or less. If mixed by hand with shovels, the components should be turned a sufficient number of times to ensure thorough mixing.

If the peat moss is very dry, 1 gallon of warm water for every 2 bushels of medium-grade moss will help to keep the dust down and will permit easier wetting and handling. By reducing the surface ten-

Plants grow well in all kinds of containers with the peat-lite mix.

sion of the water, wetting agents speed its movement and reduce the amount of water required to wet the peat-lite mix (table 2). They also aid in future wetting of the mixes during growth. Three ounces of nonionic wetting agent in 5 to 10 gallons of water facilitate the wetting of 1 cubic yard of the mix. Granular formulations are available. Use at label rates.

The basic peat-lite mixes differ slightly in composition. Peat-lite Mix A is a combination of 50 percent (by volume) sphagnum peat moss and 50 percent horticultural-grade vermiculite (2, 3, or 4). Mix B is composed of sphagnum peat moss and horticultural perlite in the same proportions. Both mixes have been successfully tested at Cornell and used by many plant growers throughout New York State. It is suggested that growers first use the mixes on a trial basis to become familiar with growth responses to this method of culture. Plant growers who have never used the mix should try the first formulation listed in table 1. Combinations for other purposes are also given in table 1.

Certain fertilizers can be added when a longer lasting effect is desired. The materials listed in table 3 should be used at the rates given.

The fertilizer should be added uniformly to the mix. If hand turning is done, spread the materials on a clean surface and sprinkle the limestone and fertilizer evenly over the pile. Turn with a large scoop. After all the ingredients have been added, the pile should be turned about 10 to 15 times to ensure thorough mixing. For mechanical mixers, a 2- to 3- minute agitation will give thorough mixing.

Always put the peat moss in the mixer first. This cushions the vermiculite/perlite and reduces breakdown. Never add large quantities of water during the mixing since this destroys structure.

Sanitation in Mixing

Although essentially free of insects, disease organisms, or weed seeds, mixtures can easily be contaminated with any of these in the course of mixing, storing, and handling. Growers should take every precaution to keep their peat-lite mix from coming into contact with unsterile soil or plant debris. All tools, containers, and mixing areas should be washed with a disinfestant or should be steam sterilized. A good disinfestant for floors, tools, or mixing equipment can be prepared by using 1 gallon of clorox in 9 gallons of water. As an extra precaution

Table 1. Components for preparing peat-lite mixes

To prepare this mix:	Incorporate these ingredients: *Sphagnum peat moss (cu yd)**	*Hort. vermiculite (cu yd)*	*Hort. perlite (cu yd)*	*Douglas fir bark, fine ground (cu yd)*	*Ground dolomitic limestone (lb)*	*Regular§ superphosphate (lb)*	*Calcium or potassium nitrate (lb)*	*Trace elements†*	*Iron sulfate (oz)*	*10-10-10 (lb)*	*Osmocote 14-14-14 (lb)*	*MagAmp 7-40-6 (lb)*	*Wetting agent‖ (fl oz)*
Mix A for seedlings/bedding plants	0.5	0.5			10	1.0–2.0	1						
Mix A — slow release fertilizer for potted plants (except poinsettias & lilies)	0.5	0.5			10	1.0–2.0	1 potassium nitrate				5 plus 5		
Mix A for poinsettias (liquid feed)	0.5	0.5			10	8	1						
Mix A for greenhouse tomatoes with liquid feed	0.5	0.5			10	2.5	1.5						
Mix A for greenhouse tomatoes (no liquid feed)	0.5	0.5			10	2.5	1.5				10	5	
Mix B — slow release fertilizer for potted plants (except poinsettias & lilies)	0.5		0.5		10	1.0–2.0	1.5 potassium nitrate				7.5 plus 7.5		
Mix C for lilies	0.5	0.25	0.25		12	none	1.5						
Foliage plant mix‡	0.5	0.25	0.25		8	2.0	1.0 potassium nitrate		0.75	2.5			
Epiphytic mix‡	0.33		0.33	0.33	7	4.0	1.0 potassium nitrate		0.50	2.5			

*1 cu yd = 27 cu ft. However, 15 – 20% shrinkage occurs in mixing; and for 1 full yd, use 2 additional bu of peat moss and 2 additional bu of perlite or vermiculite.

†Trace elements. Use 3 oz of FTE 503, *or* 4 oz of FTE 555, *or* 4 lb of ESMIGRAN, *or* 4 lb of PERK per cu yd of mix.

‡Developed by R. C. Mott, formerly of the L. H. Bailey Hortorium, Cornell University.

§If treble superphosphate is used, use at one-half the rate above and also add 2 lb of gypsum to supply sulphur.

‖Use wetting agents at label rates for product.

a mix can be steam sterilized before use provided an Osmocote-type fertilizer has not been incorporated.

Before reusing mixes, have a total soluble salt test made after sterilizing them.

Planting Procedure

Mixes made without long lasting fertilizers can be stored indefinately without developing phytotoxic conditions. If a mix is to be stored, add additional water and cover the pile with plastic to retain the moisture. Small quantities keep well in covered plastic garbage cans or large plastic bags.

Insecticides should not be added during mixing. Insecticides as recommended in *Cornell Recommendations for Commercial Floriculture Crops, Part II,* should be applied only after seeds are sown or seedlings transplanted.

At the time of use, the following procedure should be used.

1. Fill the containers to be planted.
2. Firm the mix, particularly the edges.
3. If the mix is dry, wet it thoroughly. Never seed or transplant into a dry mix.
4. After transplanting, water the plants.
5. Keep the containers moist until the plants are established and, then, water as needed. Avoid excessive applications of water during dark weather.

Table 2. Chemicals, source, and rates of use for various wetting agents

Chemical	*Source*	*Percent active*	*Rate/yard**
Aqua Gro	Aquatrols Corp. of America Box 385 Delair, NJ 08110	100%	3 oz
Aqua Gro granular			1–1½ lb
Surf Side	Montco Products Corp. P.O. Box 404 Ambler, PA 19002	100	3 oz
Surf Side granular			1–1½ lb
Tetronic 908	Wyandotte Chemical Co. Wyandotte, MI 48192	100	3 oz
Triton B-1956	Rohm & Haas Company Independence Mall W. Philadelphia, PA 19106	77	3 oz

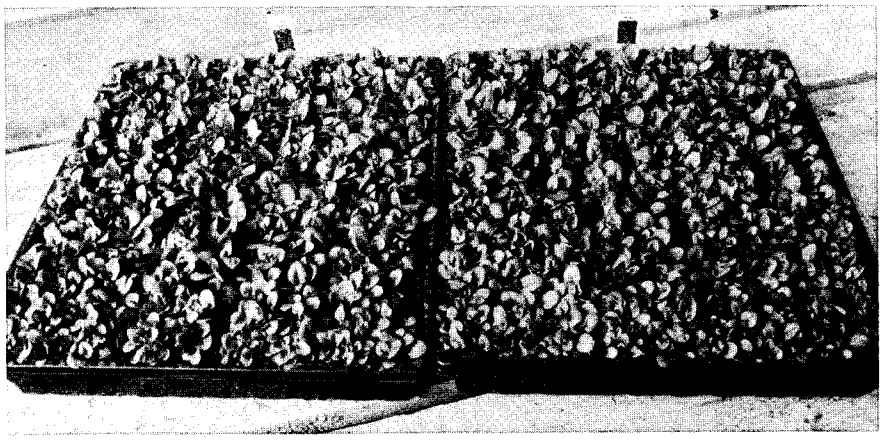
*The simplest way to add wetting agents is in the granular formulation. See text for method. If used as a liquid, dilute the 3 oz in 5 to 10 gal of water and add to the mix. To wet dry mixes after preparation, use a drench of 1 pt per 100 gal. This is equivalent to about 1 tsp per gal for small amounts.

Table 3. Long lasting forms of fertilizers (add only one)

Material	*For 1 cubic yard (lb)*	*For 2 bushels (oz)*
Osmocote (14–14–14 or 18–9–9)	5	3.8
Nitroform	2	1.5
Uramite	2	1.5
Bordens 38	2	1.5
Urea	1	0.75
MagAmp (7–40–6) (medium particle size)	5–10	7.5
Peters (14–7–7)	5	3.8
Scotts (23–7–7)	3	2.3

Table 4. Seed germination mix, amount for 1 bushel

Shredded sphagnum peat moss	0.5 bu
Horticultural vermiculite, #3 or 4	0.5 bu
Calcium nitrate	1 level tbsp
20% powdered superphosphate *or* Treble superphosphate	2 level tbsp 1 level tbsp
Ground limestone (not hydrated lime)	5 level tbsp



The mix has done an outstanding job of producing seedlings of all kinds.

Handling after Transplanting

The same temperature control, ventilation, and generally good growing conditions should be maintained for plants in peat-lite mixes as for soil-grown crops. Fertilization procedures can be handled differently.

When long lasting sources of nutrients are used for bedding plants, no further feeding is necessary after planting. Where potassium or calcium nitrate is used, feeding should begin 3 weeks after planting, but the period before feeding begins will depend largely on the frequency of watering. Plant appearance and soil tests are useful indicators of the need for fertilizers. No extra feeding will be needed for seedling flats. Plants such as mums, poinsettias, and greenhouse tomatoes should be fed immediately after potting or benching.

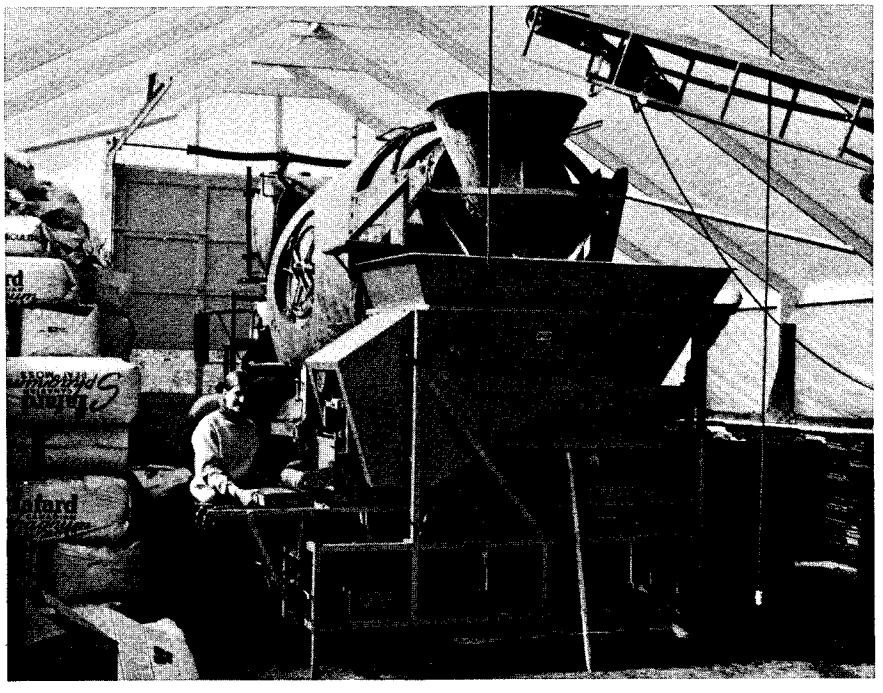
Fertilizers will leach from peat and perlite mixtures faster than from peat and vermiculite. Therefore, plants grown in Mix B may require more frequent applications or higher concentrations of fertilizer. To feed at every watering with a proportioner, follow the data given in table 5 for the necessary dilution amounts. This method is highly recommended. Bedding plants are successfully grown using 150 ppm nitrogen from a complete fertilizer at each irrigation.

Certain crops may require special fertilizer additions, but using preplant trace elements as recommended should adequately supply the majority of crops that are started in the mixes. Should iron chlorosis develop, it can be corrected by an application of chelated iron (6 – 10% Fe), at the rate of 0.5 teaspoonful per gallon of water, in a foliar spray. If the problem persists, repeat the application in 10 days.

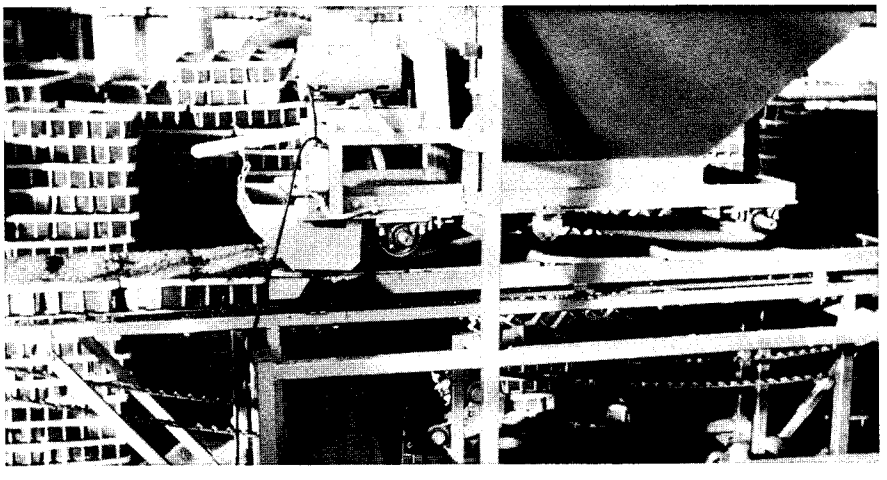
Table 5. Amounts of fertilizer to make stock solutions for dilution ratios 1:12 (HOZON), 1:100, and 1:200 to provide approximately 150 ppm actual nitrogen to the crop

Nitrogen content of fertilizer (%)	*Ounces per gallon of concentrate*		
	1:12 (HOZON)	*1:100*	*1:200*
12	2.1	17.0	34.0
13	1.9	15.6	31.2
14 (potassium nitrate)	1.8	14.5	29.0
15 (calcium nitrate)	1.7	13.5	27.0
17	1.5	11.9	23.8
18	1.4	11.2	22.4
19	1.3	10.6	21.2
20 (20–20–20)	1.2	10.1	20.2
21	1.2	9.7	19.4
22	1.0	9.2	18.4
23 (23–0–23)*	1.0	8.8	17.6
24	1.0	8.5	17.0
25 (25–10–10)	0.9	8.1	16.2
33.5 (ammonium nitrate)	0.8	6.1	12.2
44–46 (urea)	0.3	4.5	9.0

*Prepared by mixing equal parts by weight ammonium nitrate and potassium nitrate.



An automatic flat filler speeds the job of filling flats and paks.



Right: *Close-up of flat filler.*

Poinsettias flourish in the peat-lite mix.

Timing the Crops

When bedding plants are grown in peat-lite mixes, the timing schedule must be changed because the plants will reach a salable size in minimum time.

For most annual plants 5 weeks is the maximum amount of time needed between transplanting and sales when the crops are properly fertilized and grown at a minimum night temperature of 60° F. Maturity can be delayed somewhat by keeping the plants cooler than 60° F after they have become established.

Applications of growth retardants have helped to produce compact plants; however, plants in peat-lite mixes require stronger dosages or more frequent applications than are recommended for soil-grown plants to obtain the same effects. To gain experience, growers should first use the media for their final crops of the bedding plant season. ALAR or B-Nine SP used at 5,000 ppm (0.50%) once or twice as a spray has proved effective and safe on most bedding plants grown in the mix. Read the manufacturer's label for a list of plants on which the product can be safely used.

Potted Crops

In addition to bedding plant production, peat-lite mixes have been used successfully to produce potted chrysanthemums, geraniums, African violets, poinsettias, gloxinias, begonias, foliage plants, and orchids. In fact, all plants can be produced in peat-lite mixes.

Potted Bulbs for Easter

Both mixes have been successfully used in forcing tulips, hyacinths, and daffodils for Easter sales. The only fertilizer added for bulbs has been ground limestone at the recommended rate of 10 pounds per cubic yard because the bulb contains an adequate supply of other nutrients to complete growth. If the mix appears to be too lightweight, clean sand can be added. A mixture 1:1:1 by volume of peat moss, vermiculite, and sand will add enough weight to prevent the pots from tipping. (Even less sand may be needed. Sand weighs about 100 lb per cu ft.)

Through experimentation, a combination by volume of 2:1:1, peat moss, vermiculite, and perlite, has been found to produce the best growth in lilies being forced for Easter. Both calcium and dolomitic limestone were added at a rate of 5.5 pounds each per cubic yard of mix. Twenty-two ounces of ammonium nitrate were added also. A regular feeding program was started as soon as shoot tips emerged from the medium. It is recommended that lilies be grown in clay pots for greater stability or that a small amount of clean sand be added to the mix for greater weight.

Poinsettias

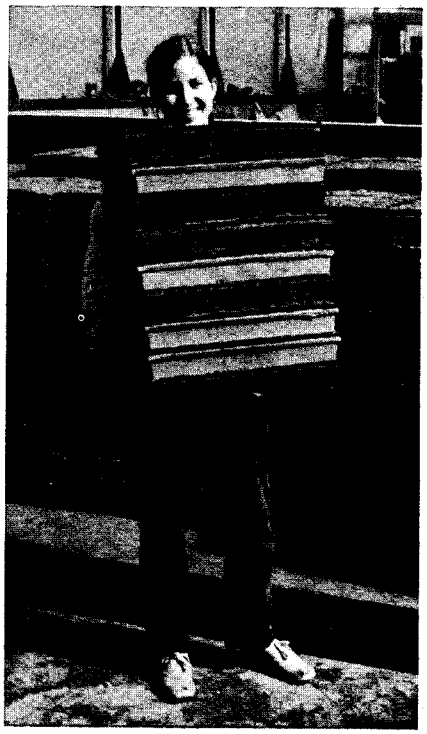
Poinsettias grow well in both mixes. If additional weight is desired, use 15 to 20 percent sand. The sand should be steam sterilized since it could be infested with root rot organisms. Use constant liquid feeding with 17 ounces of calcium nitrate and 10 ounces of potassium nitrate per 100 gallons of water (approximately 300 ppm N, 300 ppm K, and 250 ppm Ca).

Bench Crops

Trials with cut chrysanthemums, snapdragons, carnations, and roses have shown the mixes to be a good growing medium. Generally a 2 peat: 1 perlite: 1 vermiculite combination has been most satisfactory. Fertilizers are added according to table 1. The trace element mix must be added for crops to be grown longer than 3 months. Liquid feedings should be scheduled as they would be for soil-grown cut flower crops.

Greenhouse Tomatoes

Excellent crops of greenhouse tomatoes can be grown in peat-lite mixes. Use the mix recommended in table 1. It is essential to include trace elements. Tomatoes should be placed on a regular feeding schedule immediately after planting.[1]

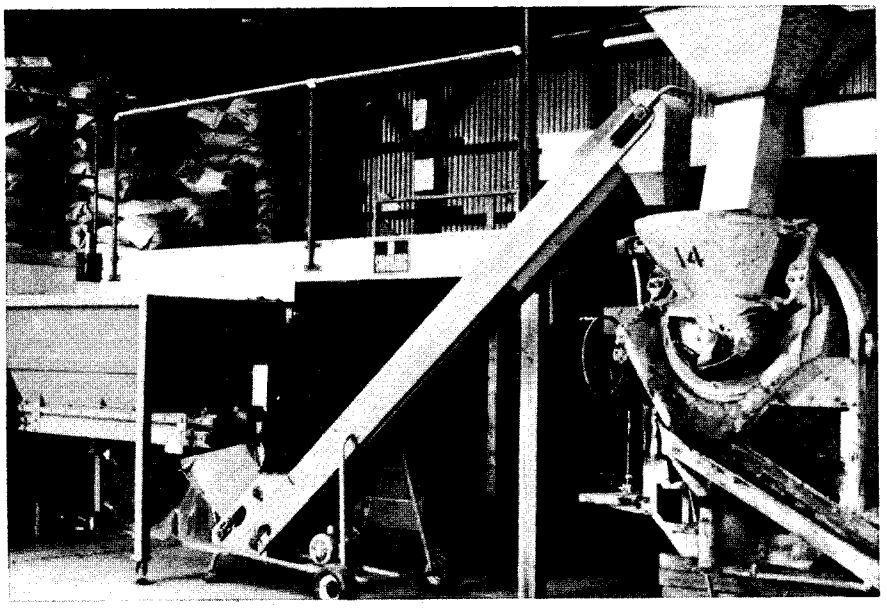


The light weight of peat-lite mixes makes them easy to handle by employees.

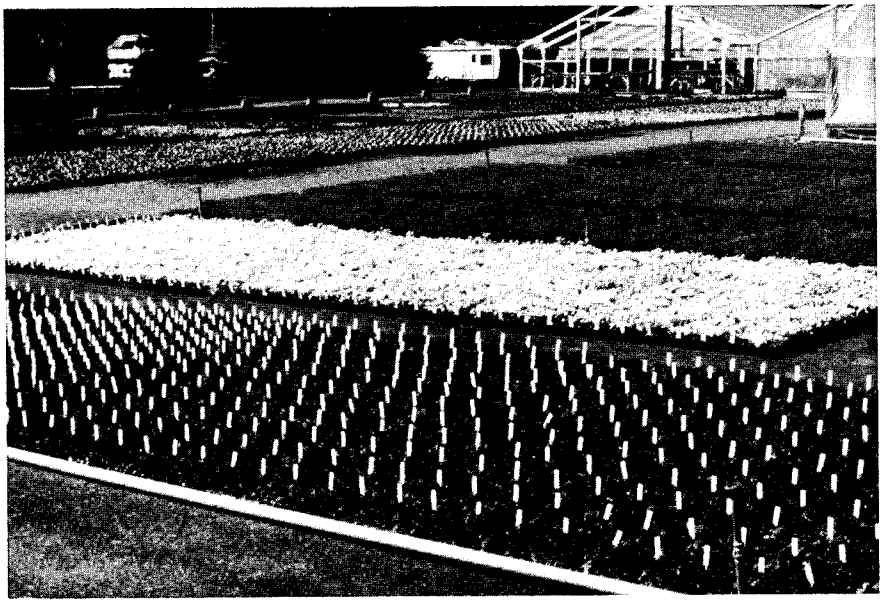
Table 6. Comparative costs of 1:1 by volume peat-lite combinations based on retail prices for single units of components

Medium	*Cost per cubic foot*	*Cost per bushel*	*Cost per cubic yard**
Peat moss†	$0.63	$0.79	$10.16
Vermiculite	1.33	1.67	21.68
Perlite	1.33	1.67	21.68

*One cu yd equals 27 cu ft or 22 bu. Because of 15 to 20% shrinkage in mixing, use 26 bu to obtain 1 full cu yd of mix.
†One 6-cu-ft compressed bale fluffed to 10 cu ft.



Standardized mixes are easily adapted to materials handling systems for efficient operation.



Peat-lite grown plants placed outside for hardening-off before sales.

Steaming and Storage

As discussed earlier, one of the prime advantages of the peat-lite mixes is that they do not require steaming. However, they can be steam sterilized if a specific condition demands. If the mix is to be steam sterilized, do not add slow-release fertilizer until after steaming.

The basic mixes can be stored indefinitely with no harmful effects. If the moisture is relatively low, they can be stored even if they contain slow-release fertilizers. However, since the release factor on some slow-release types is a function of moisture and temperature, storage is a questionable practice. Mixes containing Osmocote should not be stored longer than 7 to 10 days unless the storage temperature is 40° F or lower, or the mixture is very dry.

Media Cost

Cost comparisons were calculated on the basis of a single unit purchased at retail prices: a 6-cubic-foot compressed bale of peat moss cost $6.25, and a 6-cubic-foot bag of either vermiculite or perlite cost $8.00. Volume lot purchases of any of these materials could substantially reduce the cost. Table 6 shows the cost of various materials for different volume amounts. The cost per cubic yard is based on a 1:1 by volume mixture of peat moss and vermiculite (Mix A) or peat moss and perlite (Mix B). Use of other than a 1:1 by volume mix would change the cost per cubic yard.

Although the cost of fertilizer is not included, it is not a significant amount.

1. See Cornell Vegetable Crops Mimeo 49, "Production of Greenhouse Tomatoes in Ring and Trough Culture" by R. Sheldrake, Jr., and Stewart Dallyn.

No endorsement of any product mentioned herein is intended, nor is criticism of unnamed products implied.

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