Single Stem Chrysanthemums In Peat Pots And Peat And Perlite Mixtures

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The use of peat pots in the production of chrysanthemums is not new. Many growers have found that peat pots can be used to hold chrysanthemums for a period of three or four weeks before they need be planted to the production bed. This practice results in a gain in time between crops since a nurse bed may be used for the holding area while the crop in flower is being cut off.

A slight modification in the foregoing program can result in an additional saving of time and labor. Used in conjunction with a known growing media, the system becomes almost foolproof for the production of highly desirable, single stem chrysanthemums for the retail grower. Four crops a year are a distinct possibility with this method of production.

Two crops of single stem chrysanthemums using the procedure described have been grown in the Cornell Floriculture greenhouses. A third crop is presently in production. The results obtained with the first two crops are presented.

Crop Number One

Rooted cuttings of the standard chrysanthemum varieties Whirlwind, Giant Betsy Ross, Yellow Betsy Ross and Golden Favourite were planted April 26, 1960, one cutting per pot in 3-inch square peat pots. A steam sterilized mixture of 9 parts soil, 6 parts german sphagnum peat moss, 4 parts horticultural perlite and 2 parts coarse sand, amended with 20 per cent superphosphate at the rate of 5 pounds to 40 bushels was used. The potted plants were placed on a nurse bed (figure 1) in a 60° night 70° F day temperature greenhouse. The plants were maintained under long day conditions from April 26 to May 15 by means of incandescent light. A minimum of 15 foot candles intensity was given from 10 pm to 2 am. The plants were watered as needed.

The potted plants were benched to the various treatments May 14, 1960. Treatment B-11 consisted of a one peat moss, one perlite by volume mixture that had been amended with 20 per cent superphosphate and 20 per cent ground limestone each used at the standard rate of 5 pounds to 40 bushels of mix. In this treatment the potted plants were placed on the mixture as shown in figure 2. Only slight pressure was used to ensure firm contact of the base of the pots with the peat-perlite mixture.

Treatment B-12 was similar to B-11 except the pots were plunged to the rim as in the normal practice followed with peat pots.

To avoid trace element deficiences a trace element mixture was applied to both treatments B-11 and B-12 prior to planting.

Figure 1. Nurse bed where peat potted chrysanthemums are held for three weeks. Pots are butted in two rows with a one-inch space left between each two rows.

Figure 2. The method of planting peat potted chrysanthemums on a peat-perlite mixture. The pots are firmly pressed down so that there is good contact between the bottom of the pot and the media. Roots have just begun to penetrate the pot wall.

Treatment B-13 was used as the control. A mixture of 3 parts soil 2 parts peat and 1 perlite was used as the media. Superphosphate only was added at the standard rate of application as previously described. The potted mums planted to this bench were plunged in a similar manner as treatment B-12.

All of the plants were grown single stem. A 5 by 6 inch plant spacing was used. The benches were planted equally with 49 plants of each of the four varieties per bench.

The benches were fertilized every Monday and Thurs-

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day with a solution that applied 98 parts per million nitrogen and 312 parts per million potassium at each application. This was obtained by using 19.3 grams of potassium nitrate, 5.0 grams of amonium sulphate and 10 grams of potassium sulfate for each bench. Each bench contains 45 square feet of growing area. Fertilization was started May 16, 1960, and continued until all flowers showed color. When necessary additional applications of water were made as needed. Twice a week watering/fertilization applications were sufficient to keep the benches moist until June 8 at which time more frequent watering was required. Regular tap water was used for the additional waterings.

RESULTS

The data recorded were: number of days from potting to visible buds, first color, first cut, and days of cropping; average stem length in inches, fresh weight in ounces and flower diameter in inches. To avoid any differences due to the extra light received because of location in the bench, flowers in the outside rows on each bench were excluded from the data recorded.

The most significant data presented in Table 1 are those contained in the column "days at cropping." These show that regardless of variety, the potted plants placed on the surface of the peat-perlite mixture in treatment B-11 cropped in much less time than those plunged in the soil in treatment B-13. There was a range of three to seven days from cropping of the plants in B-11 compared to 11 to 16 days for those in B-13. This benefit of being able to clear a bench of flowers rapidly would be desirable. The days at cropping for treatment B-12 range from 4 to 11 days depending on variety.

The data for average stem length, fresh weight and flower diameter are presented in Table 2. No great difference existed between treatments for any one variety. There were varietal differences in all three factors measured. Figures 3 and 4 allow visual comparisons to be made of the stem length and flower diameter. Although it was hoped that representative flowers were chosen for photographic purposes this was not true in all instances. Since the photographs of stem length may be misleading the reader is referred to the averages presented in Table 2 for a true comparison.

During the last few weeks of growth the plants in treatment B-11 and B-12 developed some marginal leaf burn of the basal leaves. This was attributed to the addition of the trace element mixture that had been applied. Other potted crops grown in peat and perlite mixtures showed similar effects from the addition of the same trace element material.

Crop Number Two

Encouraged with the results obtained with the first crop a second crop was grown to see what the effect of a different period of the year would have on this method of production. The Indianapolis varieties bronze pink, yellow and improved white, number three were chosen for study.

The rooted cuttings were potted August 5, 1960 in 3-inch square peat pots that had a one-half inch hole punched in the bottom. A potting mixture similar to that of the first crop was used. Superphosphate was added at the rate of 5 pounds to 40 bushels of mix. The cuttings were placed on a nurse bed similar to the first crop in a 60° F day and 70° F night temperature greenhouse. To ensure long days incandescent light of 15 foot candle intensity was used from 10 pm to 2 am daily, from August 5 to August 26. The plants were fertilized at each watering, beginning with the initial watering with a 20-5-30 analysis, completely soluble fertilizer at the rate of one-half pound to 100 gallons of water.

Prior to planting in the final location the production benches were thoroughly leached. Superphosphate at the rate of 2½ pounds and calcium limestone at the rate of 5 pounds to 100 square feet of area were incorporated into the peat and perlite mixtures in benches B-11 and B-12. The soil bench, B-13 received superphosphate and lime-

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Table 1. Number of days from potting to visible buds, first color, first cut and days of cropping of four varieties of chrysanthemums grown in peat and perlite mixtures. Crop number one. Potted April 26, 1960. Benched May 14, 1960.

Variety	Treatment[a]	Number Units	Days to Visible Buds	Days to First Color	Days to First Cut	Days to Last Cut	Days at cropping
Whirlwind	B-11	35	39	59	84	87	3
	B-12	34	39	59	84	95	11
	B-13	34	39	60	84	95	11
Giant Betsy Ross	B-11	35	39	66	84	91	7
	B-12	36	39	70	84	95	11
	B-13	34	39	74	89	105	16
Yellow Betsy Ross	B-11	35	39	66	92	95	3
	B-12	35	39	66	91	95	4
	B-13	38	39	75	91	105	14
Golden Favourite	B-11	34	39	62	91	95	4
	B-12	36	39	64	87	95	8
	B-13	35	39	69	91	105	14

[a] B-11—Pots placed on peat and perlite
B-12—Pots plunged in peat and perlite
B-13—Pots plunged in soil mixture

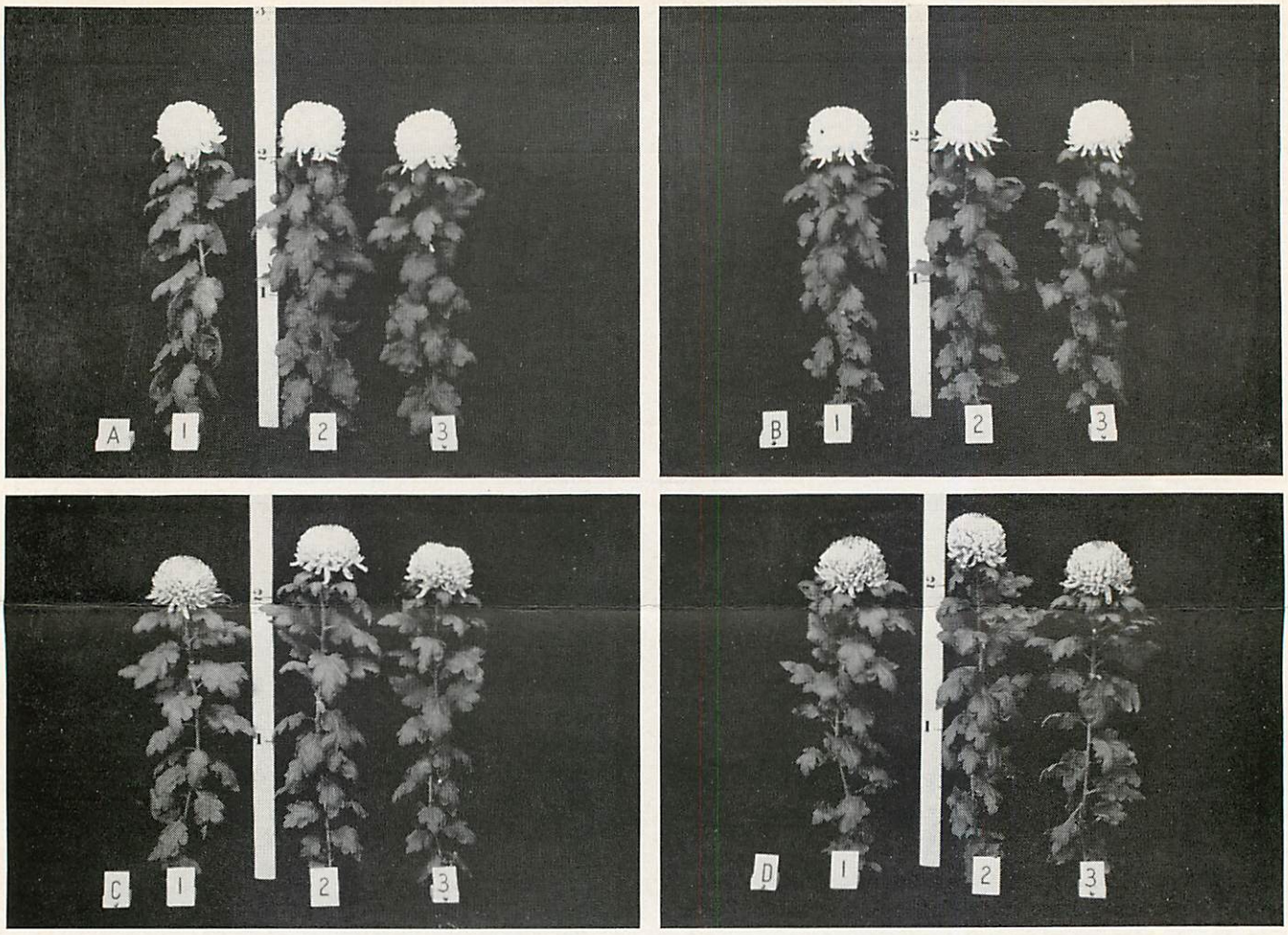

Figure 3. Single stem chrysanthemums grown in various soil mixtures. A—Whirlwind, B—Giant Betsy Ross, C—Yellow Betsy Ross, D—Golden Favourite. Treatments: 1. Three-inch peat pots placed on a 1 peat-1 perlite mixture. 2. Peat pots plunged into a 1-peat-1 perlite mixture. 3 Peat pots plunged into a 3 soil, 2 peat and 1 perlite mixture. Crop number one. Photographed July 22, 1960.

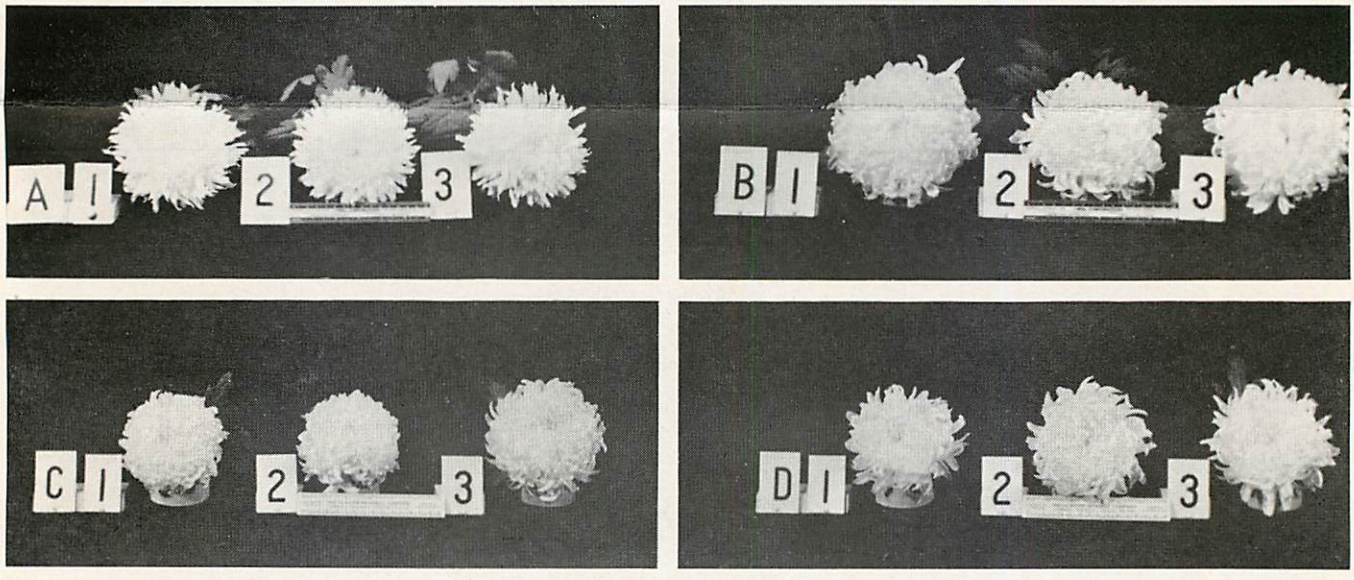

Figure 4. Flower heads for comparison of size. A—Whirlwind, B—Giant Betsy Ross, C—Yellow Betsy Ross, D—Golden Favourite. Treatments: 1. Three-inch peat pots placed on a 1 peat-1 perlite mixture. 2. Peat pots plunged into a 1 peat-1 perlite mixture. 3. Peat pots plunged into a 3 soil, 2 peat and 1 perlite mixture. Crop number one. Photographed July 22, 1960.

Table 2. Average stem length, fresh weight and flower diameter of four varieties of Chrysanthemums grown in peat and perlite mixtures. Crop number one.

Variety	Treatment[a]	Number Units	Stem Length (in.)	Fresh Weight (oz.)	Flower Diameter (in.)
Whirlwind	B-11	35	30.4	3.7	5.3
	B-12	34	29.7	3.6	5.1
	B-13	34	29.9	4.0	5.4
Giant Betsy Ross	B-11	35	34.1	3.7	5.6
	B-12	36	35.3	3.9	5.4
	B-13	34	36.5	4.3	5.5
Yellow Betsy Ross	B-11	35	30.8	3.4	4.5
	B-12	35	31.2	3.2	4.3
	B-13	38	32.0	3.9	4.6
Golden Favourite	B-11	34	25.8	3.2	4.8
	B-12	36	25.6	3.1	4.8
	B-13	35	25.9	3.2	4.9

[a] B-11—Pots placed on peat and perlite
B-12—Pots plunged in peat and perlite
B-13—Pots plunged in soil mixture

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stone at the rate of 2½ pounds each to 100 square feet of soil. All benches were steam sterilized after the additions of superphosphate and limestone.

The plants were benched August 24 as follows: B-11, pots placed on top of the peat and perlite as in crop number 1, figure 2; B-12 pots plunged in the peat and perlite; B-13, pots placed on top of the soil mixture.

The data recorded were the same as for crop number one. The figures for the various factors presented in Table 3 show that there were no great differences among treatments or among varieties. The early cropping advantage of placing the pots on top of the peat and perlite mixtures did not show up in the second study.

The figures for average stem length presented in Table 4 show that all four varieties of Indianapolis were of uniform height. The major difference in the average fresh weight occurred with Indianapolis bronze in treatment B-12. The flowers produced in this treatment were 4/10 of an ounce heavier than those from treatment B-11 and 3/10 of an ounce heavier than those from treatment B-13.

The effect of the treatments on flower diameter size was inconsistent. For example from treatment B-11,Indianapolis bronze; the average flower diameter was 4.1 inches. Treatment B-11, Indianapolis pink resulted in an average flower diameter of 4.7 inches. These figures also represent the smallest and largest flowers produced among all varieties and all treatments.

Visual comparisons of stem length and flower size may be made from the illustrations presented as figures 5 and 6.

The effect of fertilizing at each watering resulted in heavy stems, a dark green color of the foliage and closely spaced leaves that developed fully right up to the flower.

There was no marginal burn of the foliage as was described for the first crop produced. This further substantiated the fact that the trace element mixture was probably

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Table 3. Number of days from potting to visible buds, first color, first cut and days of cropping of four varieties of chrysanthemums grown in peat and perlite mixtures. Crop number two. Potted August 5, 1960. Benched August 24, 1960.

Variety	Treatment[a]	Number Units	Days to Visible Buds	Days to First Color	Days to First Cut	Days to Last Cut	Days at Cropping
Indianapolis Yellow	B-11	33	38	57	82	89	7
	B-12	36	38	58	82	89	7
	B-13	35	38	57	82	89	7
Improved Indianapolis No. 3	B-11	35	38	60	82	89	7
	B-12	33	38	61	82	89	7
	B-13	35	39	60	82	89	7
Indianapolis Pink	B-11	33	38	57	82	89	7
	B-12	35	38	57	82	89	7
	B-13	36	39	57	82	89	7
Indianapolis Bronze	B-11	35	38	60	82	89	7
	B-12	31	38	61	82	89	7
	B-13	36	39	61	84	89	5

[a] B-11—Pots placed on peat and perlite
B-12—Pots plunged in peat and perlite
B-13—Pots plunged in soil mixture

Figure 5. Single stem chrysanthemums grown in various soil mixtures. A—Indianapolis yellow, B—Indianapolis improved No. 3, C—Indianapolis pink, D—Indianapolis bronze. Treatments: 1. Three-inch peat pots placed on a 1 peat-1 perlite mixture. 2. Peat pots plunged into a 1 peat-1 perlite mixture. 3. Peat pots placed on a 3 soil, 2 peat and 1 perlite mixture. Crop number two. Photographed, October 25, 1960.

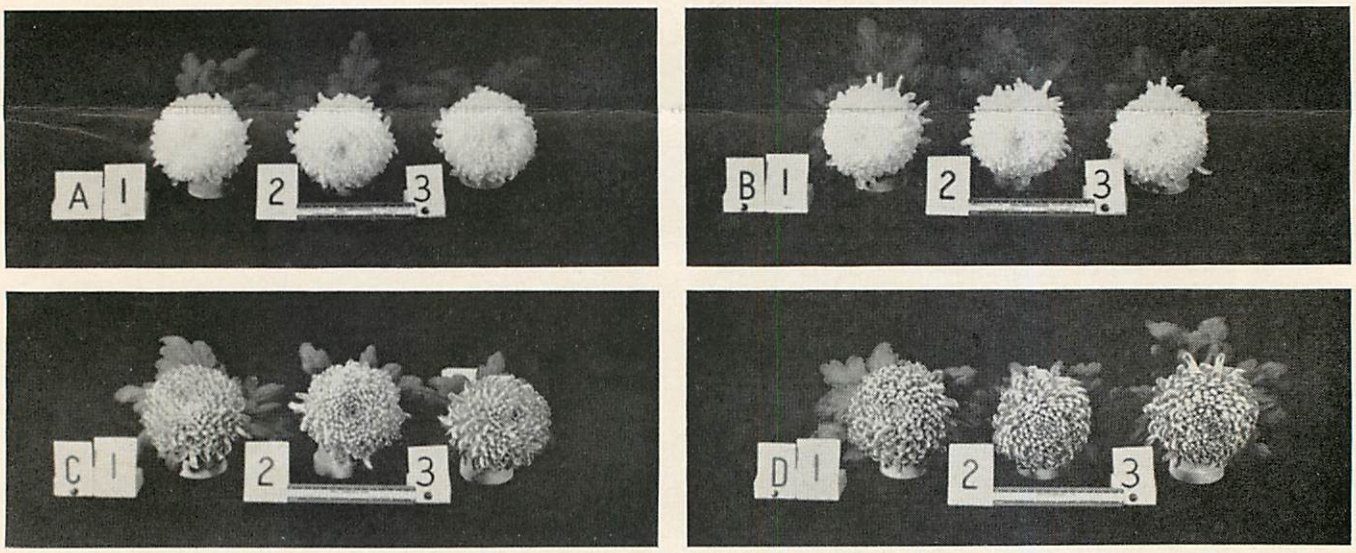

Figure 6. Flower heads for comparison of size. A—Indianapolis yellow, B—Indianapolis improved No. 3, C—Indianapolis pink, D—Indianapolis bronze. Treatments: 1. Three-inch peat pots placed on a 1 peat-1 perlite mixture. 2. Peat pots plunged into a 1 peat-1 perlite mixture. 3. Peat pots placed on a 3 soil, 2 peat and 1 perlite mixture. Crop number two. Photographed, October 25, 1960.

Table 4. Average stem length, fresh weight and flower diameter of four varieties of Chrysanthemums grown in peat and perlite mixtures. Crop number two.

Variety	Treatment[a]	Number Units	Stem Length (in.)	Fresh Weight (oz.)	Flower Diameter (in.)
Indianapolis Yellow	B-11	33	27.4	3.0	4.2
	B-12	36	29.3	3.1	4.4
	B-13	35	28.9	3.2	4.6
Improved Indianapolis No. 3	B-11	35	28.8	2.9	4.7
	B-12	33	28.8	2.9	4.6
	B-13	35	29.2	2.7	4.6
Indianapolis Pink	B-11	33	27.8	3.0	4.7
	B-12	35	29.4	2.9	4.6
	B-13	36	29.2	2.9	4.5
Indianapolis Bronze	B-11	35	28.0	2.6	4.1
	B-12	31	29.3	3.0	4.5
	B-13	36	28.4	2.7	4.4

[a] B-11—Pots placed on peat and perlite
B-12—Pots plunged in peat and perlite
B-13—Pots plunged in soil mixture

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to blame since no trace elements were added.

Although the flower quality was excellent the stem length was shorter than that usually obtained when Indianapolis varieties are grown single stem. Part of this may be attributed to the reduced long day period. The plants received only three weeks of long days rather than the recommended four weeks. It is also felt that the frequency of fertilization used on the second crop may have been more than needed. This luxury consumption could result in reduced terminal growth even though the soluble salt content of the soil does not become toxic. This factor is being tested on the third crop of chrysanthemums now being grown.

Advantages of the Cultural Program

In addition to the fact that four crops of chrysanthemums can be produced in one year there are several distinct advantages when this type of a cultural program is used.

Regardless of the growing media used there is a tremendous saving in time of planting when the pots are merely set on the media surface instead of being plunged. The time required to plant in this manner was one-third that required when the plants were plunged. This represents a substantial saving in labor.

By placing the pots on the surface of the media there is improved air circulation around the base of the plants. This has the tendency to reduce the chances for foliar diseases to occur by decreasing humidity among the plants.

Using this method of growing the root ball develops in the upper area of the soil where maximum air exchange takes place. Most growers have the tendency to plant chrysanthemum cuttings deeper than is needed. In a six inch soil depth this places the effective root system one to one-half inches below the soil surface. If the drainage of the bench is poor another inch or inch and one-half of growing depth is lost because of super saturated conditions and poor aeration. This leaves only three or four inches of a desirable soil environment in which the plant can grow.

There is also greater ease in cleaning the bench when the crop is finished. The peat pots do not disintegrate under this short schedule growing operation and can be easily lifted from the bench. It is not recommended that they be incorporated into the bench since this will change the proportions of the media. Besides, the beneficial effects of the root system are still obtained since the root ball freely breaks away when the peat pot is lifted.

The use of peat and perlite as the growing media has even further benefits in addition to those listed above. Maximum aeration is obtained with such a mixture. There is never a soluble salt problem since the mixture flushes so freely and quickly. If the salt level should build up because of poor watering practices a heavy leaching will immediately solve the problem.

A pretreatment of the initial mixture is needed. Superphosphate and limestone should be added to supply phosphorus and get the pH in the proper range. The recommended rates of five pounds each to 100 square feet of bench area are satisfactory. Once the pH is in the proper range it remains fairly stable and only small amounts of limestone are needed for subsequent plantings.

This media lends itself to a rapid work schedule at the time of replanting. The bench may be cleaned off one day; the necessary fertilizers are added and the bench steam sterilized the next day. Because of the looseness and openness of such a mixture steam sterilization is done more rapidly than when soil is used even if the mixture is wet. Planting of the bench can follow as soon as the mixture cools. Even though the mixture appears too moist for planting this has no effect on the potted plants since they are already growing in their own environment. Root penetration of the media does not substantially start for at least two or three days following the planting.

Disadvantages

There are some disadvantages with this method of growing, but none of these are insurmountable. The grower must have a nursery area available to carry the plants for two and one-half or three weeks. This is the

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major disadvantage and may present a problem to small establishments.

Since root penetration of the pot is absolutely essential it is suggested that the bottom of the pot be given an X-cut at the time of benching or a drain hole be punched in the bottom of the pot at the time of potting. This will offset any possibility of a manufacturers change in formulation restricting root penetration.

Watering the first week the pots are planted on the bench must be done carefully so that pots are not disturbed. This is necessary to avoid breaking the roots that have started penetrating the media.

Two sets of support wires are needed. Occasionally some of the pots break down slightly, this results in a reduction of support of the stem.

Under this advanced schedule shorter stems than normal may be produced. This is not undesirable for the retail grower since he frequently has little use for 36 inch or longer material. Thirty inch stems are easily produced and these are satisfactory for most design work.

TENTATIVE SCHEDULE

The following is a tentative schedule for producing four crops a year. This is for single stem culture only of standard chrysanthemums.

Crop number 1

Pot April 26—on nurse bed, under lights
Bench May 14—Start short days at time of benching
In flower July 22-29
July 30-31—clean bench—steam sterilize

Crop number 2

Pot July 11, on nurse bed
Bench—August 1
Start short days—August 8
In flower October 24-30
October 30-31—clean bench—steam sterilize

Crop number 3

Pot—October 10, on nurse bed—under lights
Bench—November 1—under lights
Start short days—November 21
In flower February 8-13
February 14-15 — clean bench, add fertilizer—steam sterilize

Crop number 4

Pot January 26—under lights
Bench February 16—under lights
Start short days—February 23
In flower May 10

Weather conditions will have an effect on the final flowering date of each crop. This may necessitate a shifting of the dates presented. The maximum time on the nursery bed is three weeks. This may be extended to four weeks during the poor growing periods of the year. If this is done it will be necessary to recalculate dates for the planting-lighting schedule

Adequate fertilization is required for this method of chrysanthemum culture. Excellent results were obtained with the use of 98 ppm nitrogen and 312 ppm potassium supplied in the irrigation water every Monday and Thurs-

day. These levels can be achieved by using the following materials and amounts in 100 gallons of water: potassium nitrate, 6¾ ounces; ammonium sulphate 1¾ ounces; potassium sulfate, 3½ ounces. Phosphorus is supplied through the addition of 20 per cent superphosphate at the rate of five pounds to 100 square feet of area.

When watering, there should be sufficient water applied so that some leaching occurs.

Summary

Excellent quality, single stem chrysanthemums were grown with the use of a nurse bed, peat pots and peat and perlite mixtures as a sub media. Single cuttings planted in a standard soil mix were placed on nurse beds for two and one half weeks. Regular cultural practices of lighting, watering and fertilizing were used. The potted plants were benched by firmly setting the peat pots on top of the media in the production benches.

Data on timing, fresh weight, stem length and flower size are presented.

The advantages of this method of growing are: ease of planting and clearing a bench; excellent growth and flower quality for retail growers particularly and the possibility of four crops per bench a year.

A tentative cultural schedule is outlined.

REFERENCES

Asen, Sam and C. E. Wildon 1953. Nutritional requirements of greenhouse chrysanthemum growing in peat and sand. Michigan State College Agriculture Experiment Station Quarterly Bulletin 36 (1): 24-29.

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Chrysanthemum cuttings. Yoder Brothers, Inc., Barberton, Ohio
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