STUDIES IN TRANSPLANTING SUMMER SQUASH

by

Tom B. Lindquist

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Approved by:
[signature]
Major Professor

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Introduction

Zucchini squash (Cucurbita pepo L.) is a high value, marketable vegetable where earliness can result in significant dollar returns in local markets for commercial growers. Transplanting certain crops will give greater total and early yields than a crop that has been seeded directly. Growers usually direct-seed zucchini because mechanized transplanting is a more difficult, time consuming, and expensive process than direct seeding.

Few studies have been conducted with transplanting summer squash. Squash is a fast growing crop which can be grown to transplant size in two to three weeks. By using small transplant containers, greenhouse space can be utilized more effectively. Greenhouse space is expensive since there is a fixed cost per unit area of bench space. A reduced cost per plant can be realized when a grower can increase the plants per unit area.

Less expensive plants will lower production costs, which means higher profits for growers. Transplanting zucchini may enable the grower to get an earlier harvest and a potentially higher yield because of the longer growing season.

Literature Review

According to previous research at Iowa's Muscatine Field Station, transplanting melon seedlings as opposed to field seeding increased early yields appreciably, and the higher value of these early melons more than compensated for the extra cost involved (17). Norton (16) also reported increased early melon yield in response to transplanting as compared with field seeding.

Many growers express concern for transplants when they are placed in the field. The plants may look wilted the first few days, but this slow-down or stoppage of the top growth is the initial effect of transplanting. The duration of the initial effect is directly related to the duration and amount of reduction in water supply (14).

Containers for broccoli and cauliflower transplant production are chosen according to the effect the container has on earliness, uniform maturity and yield. However, the lack of compelling evidence indicating the superiority of one container over another requires that a choice be guided by the degree of inherent economic risk. Since the cost of small transplants is lower than that of large, their advantage would be to lower establishment cost. Potential problems exist under certain field situations with small transplants which may override these economic aspects and affect their suitability. The utility of small transplants is dependent on soil texture and seedbed condition. With sandy soils, the interface or contact made between field soil and transplant media at transplanting usually tends to be continuous. This close contact reduces the risk of transplant desiccation. On heavy soils, small root systems of plants grown in small containers might not make firm contact with soil because of clods and large air spaces. The increased risk of transplant desiccation, death, and stand reduction may be alleviated by using transplants with larger root systems, which may sustain the transplants longer. Choice of container type, therefore, should be directed first by field seedbed condition and second by transplant cost (7).

Research suggests that improved plant production and development are affected most significantly by container size rather than composition (10). Vandemark and Splittstoesser (22) concluded that a reduction in growth of vegetable transplants was due to limited amounts of nutrients and soil volume available for root and plant growth.

For broccoli and cauliflower, the number of leaves per plant, leaf dry weight per plant, leaf area per plant and plant height generally increased with increasing container volume and width and decreasing plant density. Increasing the container's depth linearly increased plant height, but did not affect other variables. Although these plants were the same age at sampling, increasing the container size decreased plant competition and enhanced plant growth. It was important to ascertain whether the larger (and more expensive) transplants increase earliness, uniformity and yield (7).

A number of cultural practices are known to affect tomato transplant quality and subsequent fruit yield in the field. Fruit yield increased as space per plant during seedling growth in the greenhouse increased (4, 10, 15, 20).

Plants grown in large containers or root cells had more leaves, grew faster after transplanting (15, 20), and produced more early yields than plants from small containers (10, 19, 24). Tomato transplants grown in large cells produced more early yields than those from small cells, but generally did not produce more total yields (23).

The size and shape of the containers used for transplants places a limit on the rooting volume both in terms of horizontal spread and depth of penetration. The size of the container controls the amount of soil available to the root system, which may influence the root development as well as the above ground parts (3).

Container size and rooting volume also influences the nutrient and water supply available to the plant, and growth will be affected if this supply is limited in some way, or in excess. It is for this reason that we must regulate these inputs according to the container size and the existent rooting volume (5).

It is apparent from all parameters measured that soil volumes have a direct influence on plant growth and quality with reductions as volumes decrease (12).

Research has been conducted in an attempt to extend the postharvest life of bedding plants. The use of hydrophilic gels has been used to increase survival, improve handling, conserve water, promote growth, and reduce maintenance of various crops, specifically for use in bedding plant and nursery industries (18). These gel substances are capable of absorbing hundreds of thousands of times their dry weight in water for six months to a year (6). They have been found to expand to thirty times their size, increasing aeration - a key factor in plant growth (18, 6).

Gehring and Lewis (9) found that hours to wilting of certain bedding plants can be increased and moisture stress reduced by incorporation of hydrophilic gels in the growing medium. This proves more economical than increases in container size. These hydrophilic polymers act as rechargeable reservoirs, holding many times their dry weight in water, most of which is held at -0.1 to -2.0 atm.

During transplanting, usually only a small portion of the roots are retained, making the role of new root formation important for field survival. Very little harmful effect from transplanting results when the root system is retained and adequate moisture is available to the plants. The root-to-top ratio, speed of root placement, and the relative suberization or periderm layer development in vegetable roots effects ease of transplanting (11).

By studying only the early stages of plant development or by studying plants with small root systems, the restriction of the unlimited horizontal and vertical root development may partially be overcome (1). Most research workers believe that root length per unit soil volume is one of the best parameters for calculations of water uptake by plant roots (8). The effect of container size and shape on growth is dependent upon the plant species and their intended use. Most growers recognize the advantages of producing plants in larger containers with large soil volumes. However, the trend is toward growing plants in smaller containers. Smaller containers result in a lower unit cost with a higher return to the grower per square foot of greenhouse space (2).

Container volume, width, and depth and density did not affect marketable yields of broccoli and cauliflower. Earliness, length of harvest season, and cull yields of broccoli and cauliflower generally were unaffected by container size. Small containers are economical and appropriate depending on seedbed conditions (7).

The scarcity and high cost of water for irrigation in some areas may also influence growers to use transplants, rather than direct fall seeding. Use of transplanting to establish vegetable crops will most likely increase. Although establishment cost using transplants compared to direct field seeding are higher, these cost are offset in many instances by earlier harvest, more uniformity, and higher production. Land cost, labor and other production inputs will undoubtedly continue to increase, which will require growers to maximize production from each acre (13).

Materials and Methods

The purpose of this study was to evaluate transplanting of zucchini squash considering several variables.

1) Study transplanting from containers of different styles of approximately the same surface area.

2) Study a peat:vermiculite potting mix with and without a hydrogel additive to grow squash transplants.

3) Study several sizes of peat pots with and without a gel additive in the potting mix and to evaluate removal of different parts of the pot on subsequent growth of squash plants.

4) Study the influence of several container sizes and styles on field transplants and yield.

5) Compare a hydrogel media additive on various plant growth parameters of summer squash.

6) Compare cost advantages of using smaller or refillable containers in squash transplant production.

The following containers were used in various aspects of this research.

Table 1. Containers used in studies with squash transplants.

Containers	Width (cm)	Height (cm)	Volume (cm^3)	Cost/ cell (¢)	Plants/m^2
Speedling·100A	2.5	7	26	1.9	823
150	3.8	6	46	2.6	528
200	5.1	7	78	5.2	295
Plastic (48)	(4x6)	5.5	100	0.5	295
Plastic (72)	3.8	5.5	40	0.4	443
5.1 cm peat (poly)	5.1	5.5	75	2.1	295
5.8 cm peat (single)	5.8	5.8	110	1.7	242

Research was conducted at Kansas State University greenhouse and field research facilities in Manhattan, Kansas. Zucchini (Cucurbita pepo L. c.v. 'Black Beauty') were grown in each study. Greenhouse temperatures were maintained at approximately 20°C. Plants were fertilized with each watering using a 20 N - 8.6 P - 16.6 K solution at 150 ppm N.

Study 1: Transplant containers.

The first study involved cell packs (48 cells per flat), peat pots (5.8 cm), and 200 Todd planter flats (5.1 cm). The Todd planter flats are referred to as Speedling flats, since they are used by Speedling, Inc., Sun City, Florida, in their commercial transplant production system. Jiffy Mix, a commercial peat:vermiculite potting mix, (Jiffy Products Company, West Chicago, IL) was used in all containers using a peat:vermiculite mix.

A randomized complete block experimental design with

3 replications was used. The containers were seeded, and when the seedlings were 12 days old, 2 plants per experimental unit were transplanted to .056 m^3 plastic tubs filled with a greenhouse soil-mix consisting of 1 part loam soil, 1 part peat and 1 part perlite (by volume), with six plants in each tub. Plants were measured at 0, 4, 8, 12 and 16 days after transplanting. The length of the above ground plant, top dry weight and root dry weight were measured.

Study 2: Potting mix + synthetic mix

A study was conducted using cell packs (48 cells per flat). Three treatments consisted of peat:vermiculite mix with and without a gel amendment, and a soil mix. The hydrophilic gel, Viterra II, is a granular, organic polymer (99.5 percent Active Ingredient potassium propenoate-propenamide copolymer) manufactured by Nepera Chemical Co. and was mixed in at 3.2 kg/m^3. The soil mix was a 1:1:1, soil-peat-vermiculite mix (by volume). The same sampling dates were used as above.

Study 3: Peat containers.

In this study, zucchini seeds were seeded into two sizes of peat pots (5.1 cm, 5.8 cm). A peat:vermiculite mix was used as the growing media. A randomized complete block experimental design with 3 replications was used.

The seedlings were allowed to grow 17 days after seeding before transplanting.

At transplanting, 5 plants were measured for the zero day above-ground length, top dry weight and root dry weight. Treatments were then divided into three groups; removing the bottom of the peat pot, removing the side, and leaving the pot intact. Removing one plant per treatment at 6 and 12 days was then completed, and measurements described above were taken.

Study 4: Peat containers - gel amendment

Zucchini seeds were seeded into two sizes of peat pots (5.1 cm, 5.8 cm). Hydrophilic gel was incorporated into the peat:vermiculite mix at 3.2 kg/m^3, and a control without gel was used. A randomized complete block experimental design with 3 replications was used. The same measurements described in Study 3 were performed.

Study 5: Container-Growth parameters

Zucchini seeds were planted in six different container sizes (2.5 cm, 3.8 cm and 5.1 cm Speedling; 48 and 72 cell packs, 5.8 cm peat). The containers were filled with a peat:vermiculite mix. A hydrophilic gel treatment, along with a control, was added to one-half of the pots using Viterra II at 3.2 kg/m^3. Seedlings were measured 20 days after seeding. Measurements included top length, root depth, top and root fresh weight, leaf area (using a LICOR Leaf Area Meter), top and root dry weight, total root length using the Tennant line-intersect method (21), and a rating of the coarseness of the root system. Root diameter (um) was also measured in one replication, with the measurement being taken 20 mm below the base of the plant at the media surface.

The line-intersect method involves measuring the total root system length. A 1-cm grid was placed in the bottom of a glass dish. Water was then added, and the root system placed in the water and teased apart. Counts were then made of the intercepts of the roots with the vertical and horizontal grid lines. Primary, secondary and tertiary roots were counted. Complete counts were converted to total length measurements using a modified formula inclusive of the grid unit: Root length (R) = 11/14 x Number of intercepts (N) x grid unit. A 1-cm-square grid was used based on the type of root system of zucchini squash. Intercept values were multiplied by 11/14 (0.7857) to estimate total root length (cm).

Study 6: Containers-Field Study

A field study was conducted at the Kansas State University Ashland Horticulture Research Farm. Various containers (2.5 cm, 3.8 cm and 5.1 cm Speedling; 48 and

72 cell packs; 5.8 cm peat) were used to determine if container size would influence early harvest and total yield of zucchini squash.

The containers were seeded in the greenhouse on May 13, 1987. A peat:vermiculite potting mix was used and temperature and fertilizer were as previously described with previous usage. Plants were transplanted June 1, 18 days after seeding, into a very fine sandy loam (Mollic Udifluvent coarse-silty, mixed calcareous messic). Plants were spaced 60 cm apart in the row, with 90 cm between rows. Ten plants per treatment were hand transplanted in each experimental unit, and a randomized complete block experimental design with 4 replications was used. Plants were watered at transplanting using a commercial starter fertilizer (3.6 g/l using .23 l/plant), and 1-cm irrigation water was provided immediately after planting. Male and female flowers were recorded on a per plant basis until the first fruit was harvested. Fruit number and weight were recorded at each harvest (according to USDA market standards). Irrigation and insecticides were applied as in commercial production practices, and harvest continued until August 11.

Results and Discussion

Study 1: Growth of squash transplants in 3 containers of approximate equal top dimensions are compared in Table 2. There was no significant differences initially or at 4-day increments through 16 days after transplanting in top length, top or root weight. The top/root ratio was larger for transplants at day 4, 8, or 12. An increase in top/root at day 16 may have been due to difficulty in removing total roots at day 16. It appears that squash can be grown in various types of containers with little differences in subsequent growth after transplanting at least in the ideal conditions of this greenhouse study.

Study 2: In comparing peat:vermiculite potting mix with and without a gel additive to a soil based potting mix, plants in the peat:vermiculite no gel treatment were shorter, but less top weight was measured in the soil-based mix and generally continued through the study as shown in Table 3. Although not significant in all growth parameters measured at each date, it was generally observed that the gel:peat:vermiculite mix developed slightly larger plants. Therefore, we would conclude that a gel:peat:vermiculite potting mix may be a preferred potting mix. This difference in growth may be due to improved nutrient availability or water availability through the growth period in the gel:peat:vermiculite treatment. These differences were perhaps not conclusive due to the small plant sample used and further research may be needed to examine these differences.

Study 3: In comparing removal of the sides, bottom, and top of the peat containers, there were no observed differences in growth 6 or 12 days after transplanting (Table 4). This would indicate that squash roots can adequately penetrate peat pots and grow despite the resistance or absence of the pot wall. It must be remembered, however, that this was done in the desirable conditions of a greenhouse study where the top lip of the pot was completely covered at transplanting. Under field conditions, care must be used to insure good transplanting technique.

Study 4: In observing some of the squash in 5.1 cm or 5.8 cm peat pots with and without a gel additive, there were no differences in growth recorded for either size peat pot or the gel additives (Table 5). There was no significant interaction. Thus, it appears that under these conditions a smaller (less expensive) pot with no media additives would be suitable for adequate growth.

Study 5: Transplant growth parameters are presented in Tables 6 and 7. Growth of squash transplants was examined at transplanting stage, (2-3 true leaf). In general, top length, root length, top fresh and dry weight, and root dry weight was greater in peat pots compared to other containers, plastic pots compared to speedling containers, and in 100A vs. 200 containers. There was, generally, few difference between 100A and 150 containers or in 48 vs. 72 containers for the same parameters. Root dry weight, however, was greater only for peat compared to other containers. There was no difference in the top fresh/dry wt ratio and differences only in the Speedling vs. plastic and 100A vs. 200 speedling containers in root fresh/dry weight ratio. In general these same comparisons resulted in similar results for leaf area and root length.

There was a significant difference in the morphology only when comparing plastic to Speedling cells where the plants in plastic pots had a more fibrous root system compared to the plants grown in peat containers. One measure of transplanting success may be related to root and top balance. The top/root ratio was greater for peat to other containers, and plastic to speedling. There was no difference in top/root ratio between 200 to 100 Speedling, 150 to 100 Speedling, or 48 to 72 plastic. No greater top/root ratio existed comparing gel to no gel media additive. Thus, it would appear in squash that there is a balance that does exist between the top and root which may result in similar results in transplanting to the field, which was exactly what we observed.

Adding hydrophilic gel to the potting mix produced plants that had a generally larger top and larger root fresh weight. The dry weight of the root was similar. The gel does form a layer of water on the surface of the root which becomes part of the root fresh weight measurement which may explain why root fresh weight and dry weight differences were observed. We did observe a slightly greater leaf area in gel plants as well as a slightly greater top to root ratio, although not significantly different at the 5% level. Thus, it would appear that plants grown in hydrophilic gel may have a slightly larger top to root system which may or may not cause problems in field transplanting.

Since several reports in the literature indicate a correlation between containers observed and other growth parameters (7, 15, 20), linear correlations between container volume and data parameters is shown in Table 8.

High correlations exist in volume-to-top length, root depth, top fresh weight, top dry weight, leaf area and total root length. Root fresh and dry weight, however, do not appear to be related to container volume. A problem with root measurements is that significant amounts of roots may have been lost in pruning root systems with the peat pots involved. Thus, this may be a problem in technique rather than an actual difference in root weight, however, root length as measured by the line-intercept method was not similarly reduced in the peat container.

Study 6: In the field study there were no differences recorded in blooms-per-plant or early yield-per-plant. Total harvest was not significantly different among the treatments. Thus it would appear that zucchini squash could successfully be transplanted to the field using smaller containers and using refillable containers. There is no significant advantage of using peat containers compared to the refillable containers.

Although the early yields were not significantly different, there was a trend for the peat pots to give a greater early yield. This needs to be further investigated using a larger field sample since there was considerable plant-to-plant variability in field production data.

Summary

When studying transplants of zucchini squash, few differences between plants grown in different containers tested were observed. The use of hydrophilic gels had some effect on plant size, but may not be enough to convince growers to utilize this material as an amendment for potting mixes.

Even though the larger, more expensive and space consuming containers sometimes had slightly greater plant heights and weights than the smaller containers, it would be up to the growers discretion on which container to use.

A larger container may provide a slightly larger plant, but the added expense of greenhouse space and container cost must be considered. The smaller containers take up less valuable space and provide the grower with a strong, healthy plant that may be slightly smaller but achieves the same growth and yields after transplanting as those plants from larger containers.

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Table 2. Height, top weight, root weight and top to root ratios of squash transplants in 3 containers 0-16 days after transplanting

Days After Transplanting (DAT)

Container	0		4		8		12		16	
	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)
Plastic (48)	.24	.05	.46	.08	.82	.15	1.28	.25	3.05	.42
Peat (5.8 cm)	.24	.06	.48	.10	.78	.14	1.51	.30	2.99	.32
Speedling (200)	.23	.05	.47	.11	.74	.16	1.20	.28	2.80	.43
	NS[z]	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio
Plastic (48	10.75	7.8	10.67	5.7	11.17	5.3	12.5	5.1	12.83	7.6
Peat (5.8 cm)	10.25	7.7	10.17	5.0	11.33	5.5	11.33	5.8	11.75	9.3
Speedling (200)	9.25	7.9	9.5	4.3	10.83	4.9	11.33	4.2	12.00	6.3
	NS	NS	NS	NS	NS	NS	NS	NS	NS	*[y] peat vs others

[z]NS = indicates no significant differences at the p = .05 probability level.

[y]* = indicates significant differences at the p = .05 probability level.

Table 3. Height, top weight, root weight and top to root ratios of squash transplants grown in 3 potting mixes 0-16 days after transplanting.

	Days After Transplanting (DAT)									
	0		4		8		12		16	
Mix	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)	Top Wt (g)	Root Wt (g)
Soil	.23	.08	.40	.15	.54	.14	.97	.29	1.90	.37
Gel	.29	.10	.48	.16	.78	.23	1.34	.44	3.06	.49
No Gel	.27	.05	.53	.08	.76	.13	1.27	.24	2.16	.31
	*[z]	NS[y]	*	NS	NS	NS	*	*	NS	NS
	s vs others		ng vs others				s vs others	g vs others		
	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio	Height (cm)	Top/Root ratio
Soil	9.79	2.9	9.42	2.7	10.33	3.8	10.08	3.3	11.83	5.1
Gel	9.67	2.9	10.33	3.0	9.50	3.4	11.17	3.3	11.83	6.2
No Gel	7.88	5.4	8.67	6.6	7.75	5.8	9.50	5.2	10.00	6.9
	*	*	NS	*	*	NS	NS	NS	*	NS
	ng vs others	ng vs others		ng vs others	ng vs others				ng vs others	

[z]* = indicates significant differences at the p = .05 probability level.

[y]NS = indicates no significant differences at the p = .05 probability level.

Table 4. Height, top weight and root weight of squash transplants 6-12 days after transplanting when removing the bottom or side of the peat container compared to not removing the container.

	Days After Transplanting (DAT)					
	6			12		
	Height (cm)	Top Wt. (g)	Root Wt. (g)	Height (cm)	Top Wt. (g)	Root Wt. (g)
Remove bottom	9.04	.90	.16	9.63	1.61	.31
Remove side	9.42	.80	.15	9.54	1.60	.31
Not removed	9.13	.73	.11	10.38	1.63	.29
	NS	NS	NS	NS	NS	NS

NS = not significantly different at the p = .05 probability level.

Table 5. Height, top weight, and root weight of squash transplants 0-12 days after transplanting, using two sizes of peat pots and a hydrophilic gel media additive.

	Days After Transplanting (DAT)								
	0			6			12		
	Height (cm)	Top Wt. (g)	Root Wt. (g)	Height (cm)	Top Wt. (g)	Root Wt. (g)	Height (cm)	Top Wt. (g)	Root Wt. (g)
Gel Additive									
Gel	8.80	.36	.08	9.33	.85	.16	9.64	1.75	.33
None	8.40	.36	.09	9.06	.77	.13	10.06	1.47	.28
	NS	NS	NS	NS	NS	NS	NS	NS	NS
Container									
5.1 cm Peat	8.20	.34	.05	9.36	.78	.15	9.64	1.68	.30
5.8 cm Peat	9.00	.38	.09	9.03	.84	.14	10.06	1.54	.31
	NS	NS	NS	NS	NS	NS	NS	NS	NS

[z]NS = not significantly different at the $p = .05$ probability level.

Table 6. Squash transplant shoot and root growth in several transplant containers with and without hydrophilic gel media additive.

Containers	Top Length (cm)	Root Depth (cm)	Weight: Top Fresh (g)	Root Fresh (g)	Top Dry (g)	Root Dry (g)	Top/Root ratio
100A	8.11	7.79	11.8	5.9	.74	.29	2.50
150	8.16	8.30	13.6	6.7	.84	.33	2.52
200	8.80	10.03	16.4	7.8	.97	.32	3.00
48	9.97	12.47	18.9	8.5	1.08	.32	3.35
72	10.19	11.28	17.8	8.7	1.02	.34	2.95
Peat	10.60	11.44	20.6	4.9	1.28	.20	6.36
Peat vs others	**	**	**	**	**	**	**
Spdl vs plastic	**	**	**	**	**	NS	**
100A vs 200	*	**	**	**	**	NS	NS
100A vs 150	NS	NS	*	NS	NS	NS	NS
48 vs 72	NS	*	NS	NS	NS	NS	NS
Gel	9.19	10.72	18.0	8.2	1.04	.298	3.48
No Gel	9.42	9.72	15.0	6.0	.94	.311	3.00
Significance[z]	NS	**	**	*	*	NS	NS

[z]Significance * = p.05, ** = p.01, or NS = not significant

Table 7. Squash transplant leaf area and root growth in several transplant containers with and without a hydrophilic gel media additive.

Container	Leaf Area (cm)	Total Root Length (cm)	Root Morphology[z]	Root Diameter (um)
100A	169	117.9	1.13	1650
150	199	117.1	1.25	1500
200	245	147.7	1.25	1600
48	270	190.9	1.75	1350
72	250	157.9	1.63	1250
Peat	288	168.9	1.25	1150
Peat vs others	**	*	NS	--
Spdl vs plastic	**	**	**	--
100A vs 200	**	*	NS	--
100A vs 150	*	NS	NS	--
48 vs 72	NS	**	NS	--
Gel	258	142.2	1.42	1300
No Gel	216	157.9	1.33	1553
Significance[y]	*	NS	NS	--

[z]Morphology based on a 1 = coarse to 3 = very fibrous scale

[y]Significance * = p.05, ** = p.01, or NS = not significant

Table 8. Relationship between transplant container volume and several growth parameters of squash transplants (volumes of containers from 26 cm^3 to 110 cm^3)

Growth parameter	Linear Regression equation	R^2 value	Significance[z]
Top length	y = -158.03 + 24.95 x	.69	*
Root depth	y = 86.01 + 15.67 x	.80	**
Top fresh wt	y = - 81.56 + 9.38 x	.92	**
Root fresh wt	y = 50.28 + 3.35 x	.02	NS
Top dry wt	y = -86.72 + 162.35 x	.88	**
Root dry wt	y = 147.02 - 239.12 x	.15	NS
Leaf area	y = - 95.25 + .715 x	.97	**
Total root length	y = -74.74 + .779 x	.79	**

[z]Significance p = .05(*) p^2.01(**) or not significant (NS)

Table 9. Bloom and yield of zucchini squash transplanted from several growing containers.

	Early Blooms[z] per plant	Total Blooms[y] per plant	Early Harvest[x] gm/plant	Total Harvest[w] gm/plant
Speedling 100A	13.75	22.25	368.52	1219.30
150	11.25	23.00	284.02	1224.92
200	12.75	20.51	259.41	1358.04
Plastic (48)	16.75	26.25	374.92	1224.35
Plastic (72)	13.00	21.50	414.28	1476.97
Peat (5.8 cm)	11.75	23.25	424.67	1350.89
	NS[v]	NS	NS	NS

[z]Includes male and female blooms from 15 to 22 days after transplanting (DAT).

[y]Includes male and female blooms from 15 to 32 DAT.

[x]Fruit harvested 36 to 52 DAT (first fruit harvested 32 DAT)

[w]Fruit harvested 36 to 71 DAT.

[v]NS = not significantly different at the $p = .05$ probability level.

Table 10. Weather Information for Manhattan, 1987.

	Rainfall, cm	Avg. monthly temp. °C
May	15.09	21
June	6.05	25
July	2.21	27
August	16.84	26

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STUDIES IN TRANSPLANTING SUMMER SQUASH

by

Tom B. Lindquist

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AN ABSTRACT OF A MASTER'S THESIS

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Zucchini (<u>Cucurbita</u> <u>pepo</u> L. c.v. 'Black Beauty') summer squash was seeded in several sizes and styles of containers for transplant production. Containers used were Todd planter flats (Speedling) 100A, 150, and 200; Jiffy 806 (48 cells per standard greenhouse flat); Jiffy 1206 (72 cells per flat); Jiffy 5.1 cm (poly) peat pots and Jiffy 5.8 cm single peat pots. Hydrogel treatments received 3.2 kg/m^3 of Viterra II.

No differences in height, top or root weight of subsequent plant growth 0-16 days after transplanting was recorded comparing Speedling 200, plastic 48, and 5.8 cm peat pots. Few differences were observed comparing similar plant growth comparing a soil mix(1:1:1 soil:peat:perlite by volume), and a peat:vermiculite mix with and without hydrogel additives for the same times for plants grown in 48 plastic cells. No difference in subsequent growth of plants was observed when the bottom or side of 5.8 cm peat pots was removed compared to not removing the pot. A gel additive to peat:vermiculite potting mix did not influence subsequent plant growth in either 5.1 or 5.8 cm peat pots.

In comparing 3 sizes of Speedling pots, 2 plastic pots, and a 5.8 cm peat pot, plants from peat pots were taller, heavier, and had greater leaf area and root length. Plastic pot plants were similarly larger and heavier than Speedling plants. There were, generally, few differences in sizes of 48 vs 72 plastic plants or in 150 vs 200 Speedling plants. A hydrogel additive to peat:vermiculite mix resulted in slightly larger and heavier plants with slightly greater leaf area.

Correlations of container volume was found to be linearly related to top and root depth, top fresh and dry weight, leaf area, and total root length. There was no relation with root fresh or dry weight.

When transplanting to the field there was no significant differences in early or total flowers or in early or total yield when 100, 150, and 200 Speedling, 48 & 72 plastic, and 5.8 cm peat pots were compared.

Squash can successfully be grown and field transplanted from a variety of styles and sizes of containers with little difference in subsequent plant growth or fruit yield.