Container Size During Propagation and Transplant Date Influence Growth of Two *Ilex* Species

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Stem cuttings of *Ilex cornuta* 'Dwarf Burford' and *Ilex* 'Nellie R. Stevens' were direct stuck into four different container sizes and transplanted 10 and 20 weeks later into trade-gallon containers. Shoot growth and root distribution were influenced by container size and time of transplanting. Plants propagated in small container sizes (cell packs and rose pots) when transplanted at 10 weeks had similar root growth outside a quart-container volume compared to plants propagated in large size containers (quarts and trade gallons). Plants propagated in cell packs and rose pots and transplanted into trade gallons 20 weeks after sticking had lower shoot numbers and dry weights compared to plants propagated in quart containers and transplanted at either 10 or 20 weeks. Plants propagated in quart pots were similar in size regardless of transplant date and were the largest plants in the study.

INTRODUCTION

No nursery standards in the southeastern United States specify how long rooted cuttings should be held before transplanting into larger containers. Most information on the effect of transplant time on plant growth is based on work with tree species (Keever et al., 1991). Early transplanting of most tree species resulted in greater shoot and root growth (Harris et al., 1971). Whitcomb et al. (1977) and Appleton and Whitcomb (1983) reported early transplanting dates enhanced shoot growth of several species with the exception of *Pistacia chinensis* and five pine species. Whitcomb (1984) suggested early transplanting is more beneficial for fast-growing species, but has negligible effect on slower-growing coniferous trees. Keever and Cobb (1989) also reported increased growth when cuttings were direct stuck into large containers.

Ilex 'Nellie R. Stevens' and *I. cornuta* 'Dwarf Burford', as with most *Ilex* species, are commonly propagated by direct sticking stem cuttings in small containers. After rooting occurs, plants are transplanted into larger container sizes. The time of transplanting after rooting varies from nursery to nursery. Limited information is available on the influence of container size during propagation and the influence of transplant date with *Ilex* species. The objective of this study was to evaluate the effect of four propagation container sizes and two transplant dates on the growth and development of *Ilex* 'Nellie R. Stevens' and *I. cornuta* 'Dwarf Burford' cuttings.

MATERIALS AND METHODS

Twelve-centimeter, dormant, terminal, single-stem cuttings of 'Nellie R. Stevens' and 'Dwarf Burford' were direct stuck into cell pack (31.4 cm^3), rose pot (220.5 cm^3), quart pot (1047.9 cm^3), and trade-gallon containers (2975.2 cm3) on 4 March 1991.

Cuttings were treated with captan 50WP (1.8 kg/378.5 l) and a 5-sec quick dip of 3,000 ppm KIBA (potassium salt of IBA) and inserted into the propagation medium to a depth of 3 cm.

The medium was a 6 pine bark : 1 sand (v/v) mixture amended with 3.0 kg/m^3 of dolomitic limestone and 0.9 kg/m^3 of Micromax. All container sizes were placed in a glasshouse under intermittent mist (6 sec/4 min). Greenhouse temperatures were maintained at 32/20°C max/min. All cuttings were removed from intermittent mist on 6 May 1991, and fertilized weekly with Peter's 20-10-20 at 250 mg/l. Half of all treatments were transplanted into trade-gallon containers on May 6, and the remaining plants transplanted on 22 July 1991, which was 10 and 20 weeks after sticking.

Plants were harvested on 20 September 1991, 30 weeks after sticking. Data collected included total root dry weight, segmented root dry weight, new shoot dry weight, and shoot number. Root mass was divided into four sectors that corresponded to the four initial container sizes (Fig. 1).

Treatments were organized in a randomized complete block design with four replications of 16 cuttings per experimental unit. Treatment means were separated using least significant difference and are presented as a mean of both species.

RESULTS AND DISCUSSION

Total root dry weight was similar for transplant date or propagation container size (data not shown); however, root distribution was influenced by both. Root dry weights in sector I were greatest for cell-pack and rose-pot liners transplanted 20 weeks after sticking (Fig. 2). These liners were pot bound when transplanted,

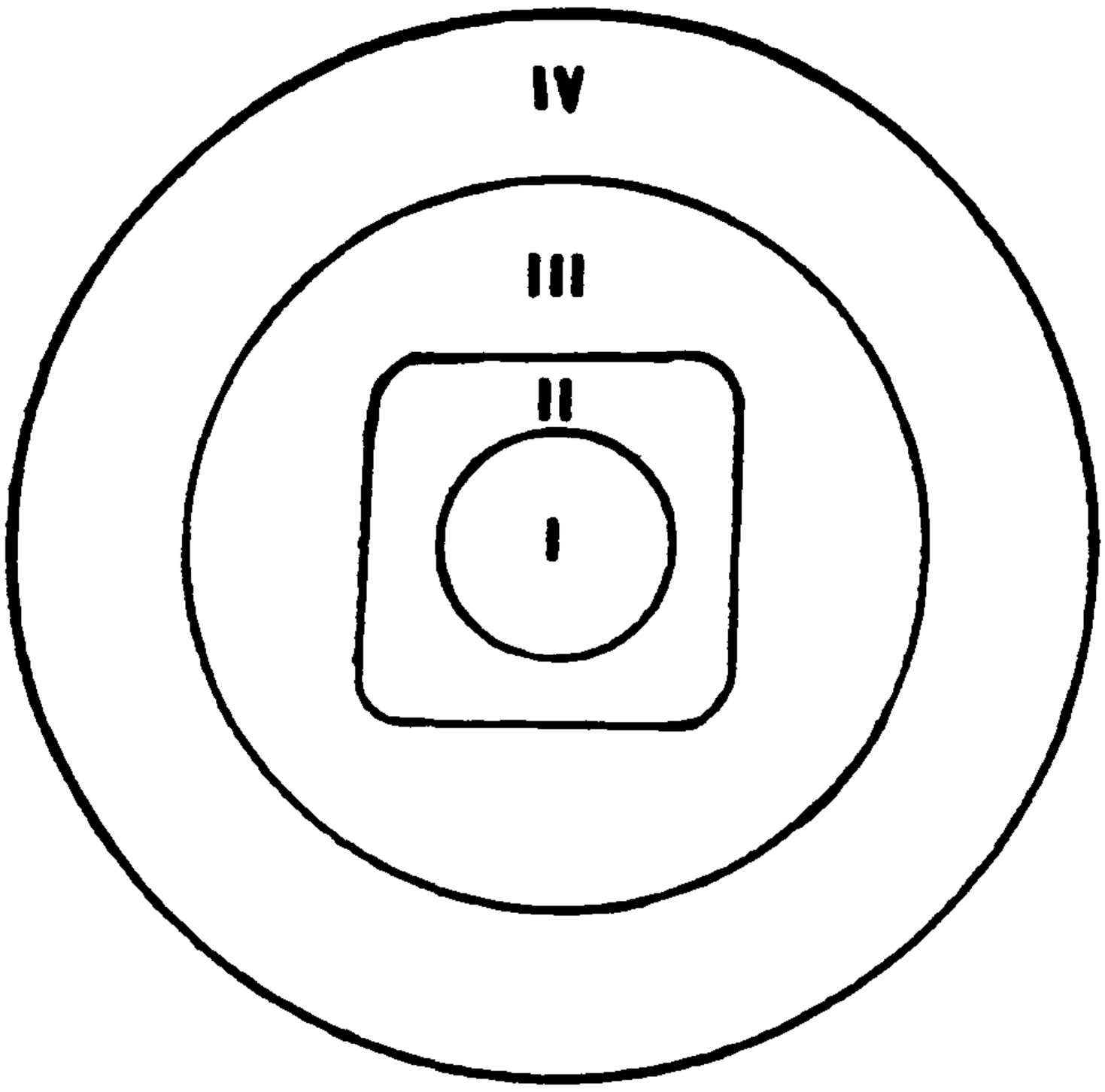

Figure 1. Root sectors used in evaluation of segmented root dry weight. Sector 1(cell pack) had a radius of 2 cm, sector II (rose pot) had a width of 6 cm, sector III (quart pot) had a radius of 6 cm, and sector IV (trade gallon) had a radius of 8.5 cm.

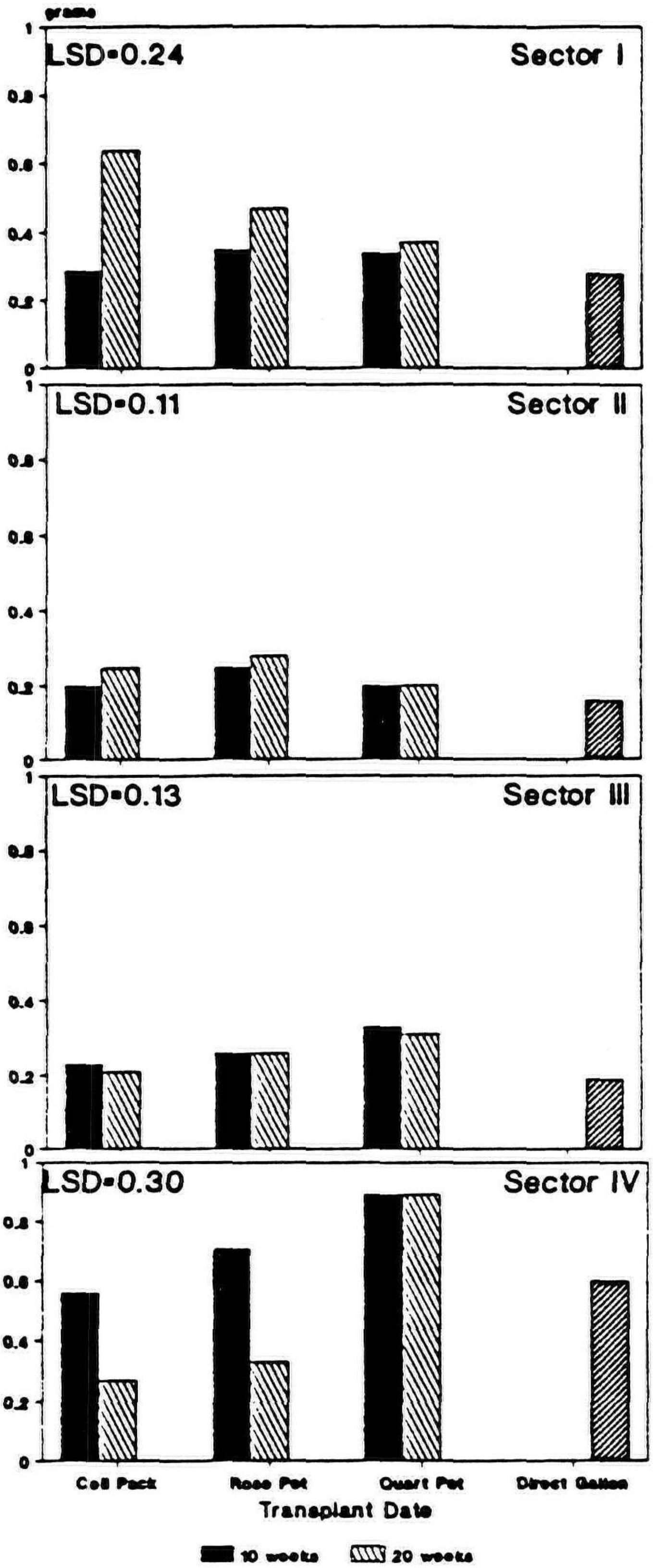

Figure 2. Root dry weight in the 4 root sectors 10 and 20 wk. after transplant.

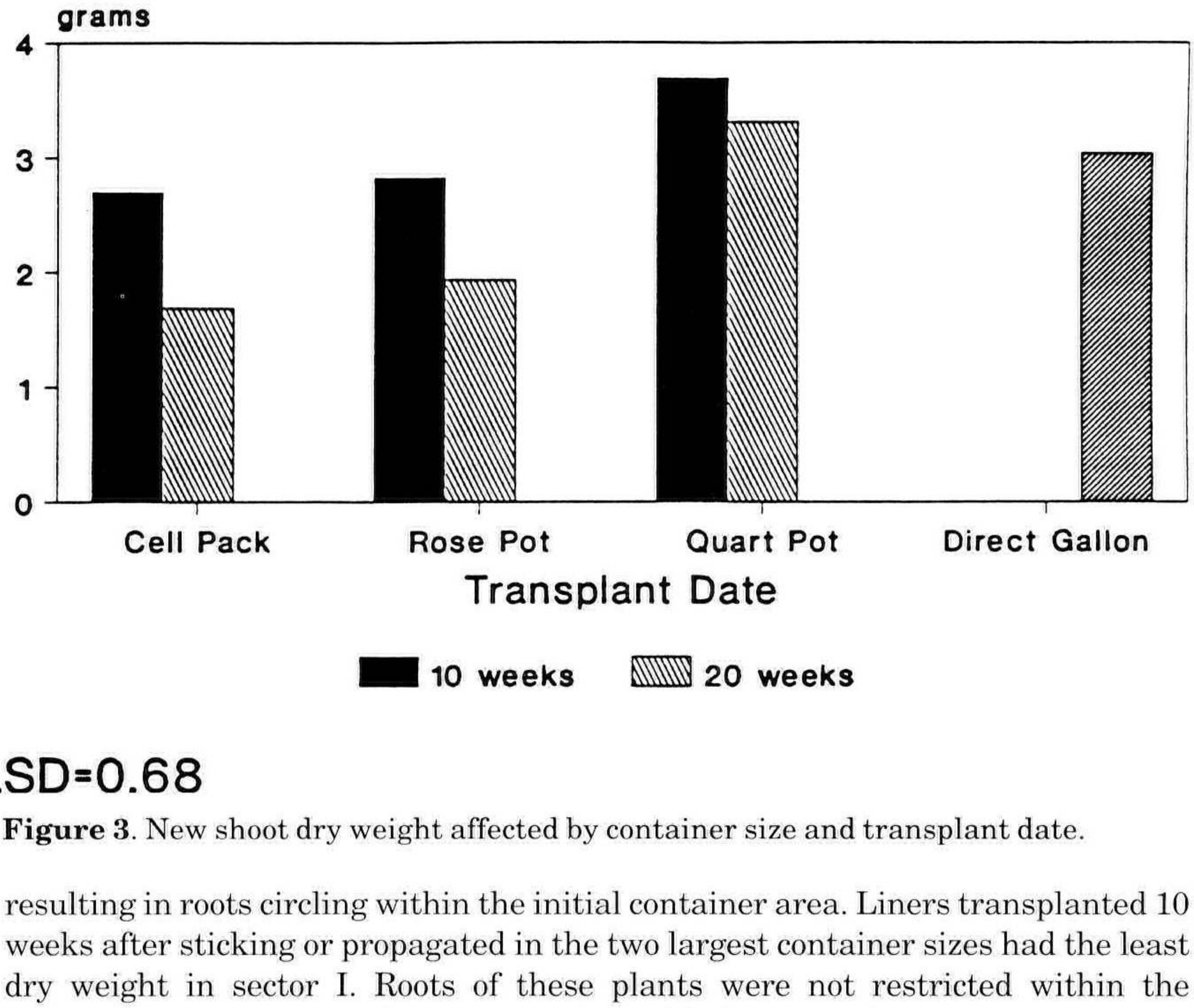

Figure 3. New shoot dry weight affected by container size and transplant date.

resulting in roots circling within the initial container area. Liners transplanted 10 weeks after sticking or propagated in the two largest container sizes had the least dry weight in sector I. Roots of these plants were not restricted within the propagation container and were transplanted before roots began to circle.

In sector II, the rose-pot liners transplanted 20 weeks after sticking had the greatest root dry weight, while the direct-stuck trade-gallon liners had the least (Fig. 2). Again, this probably relates to the condition of the liners at transplanting. The smallest propagation container sizes were pot bound at transplanting and, therefore, had the majority of their root mass confined to a small area.

In sector III, the 10-week quart-pot transplants had the largest root mass (Fig. 2). As with sector II, the direct-stuck trade-gallons containers had the least root dry weight in this sector. Ten-week transplants were not pot bound and had more time to fill the container. Roots of the liners in the trade-gallon containers had already grown past this sector.

In sector IV, the quart-pot transplants had the greatest dry weight regardless of transplant date (Fig. 3). The direct-stuck trade-gallon, the 10-week cell-pack, and the 10-week rose-pot transplants were similar. The 20-week cell-pack and 20-week rose-pot transplants had the least root dry weight in sector IV. These data show that delayed transplanting results in pot-bound liners that respond slowly when transplanted into larger containers.

New shoot dry weight was greatest for plants that were propagated in large container sizes or transplanted at 10 weeks after sticking (Fig. 3). Quart-pot transplants had the greatest shoot dry weight regardless of transplant date, followed by the direct-stuck trade-gallon containers, 10-week rose-pot transplants, 10-week cell-pack transplants, 20-week rose-pot transplants, and the 20-week cell pack transplants. Plants with the lowest root dry weights in the outer container

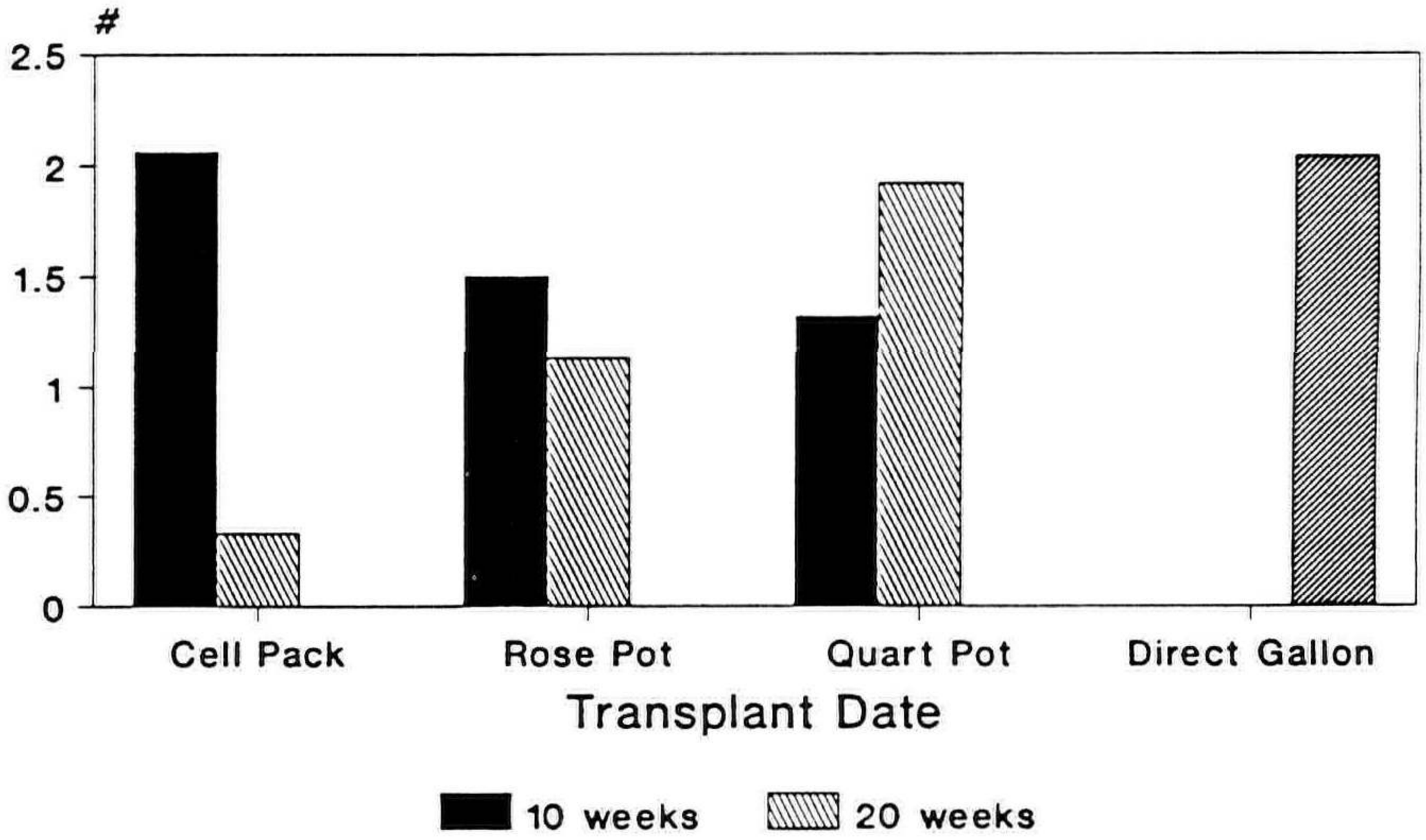

Figure 4. Shoot number affected by container size and transplant date.

sectors generally produced the least new shoot dry weights.

Shoot numbers were greatest for plants propagated in large container sizes or transplanted 10 weeks after sticking (Fig. 5). Liners from direct-stuck trade-gallons, 10-week cell-pack transplants, and 20-week quart-pot transplants had the greatest number of shoots, followed by the 10-week rose-pot and 10-week quart-pot transplants, which were similar, the rose pot transplanted 20 weeks after sticking, and the cell pack transplanted 20 weeks after sticking.

Container size in propagation and transplant date after propagation influenced root distribution of two *Ilex* species, but not total root mass. The smaller the initial container size and the later the transplant date, the more restricted the root system and the longer time required for shoot initiation and elongation to occur. These results are consistent with the findings of Harris et al. (1971), Whitcomb et al. (1977), and Whitcomb and Appleton (1983) who reported early transplanting enhanced shoot and root growth for several species of tree seedlings.

These data demonstrate what can happen in a nursery. If small propagation containers are used, liners must be transplanted soon after rooting to avoid root circling, delayed root regeneration, and slower shoot growth. Growers planning to hold liners for extended periods of time should consider using large pots during propagation.

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