FIELD-GROW FABRIC CONTAINERS DO NOT AFFECT TRANSPLANT SURVIVAL OR ESTABLISHMENT OF GREEN ASH

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Abstract. Survival and growth of green ash (*Fraxinus Pennsylvania*) transplanted as balled and burlapped or from field-grow fabric containers (FGFC) filled with field soil alone or field soil amended with hydrophilic gel, peat, or slow-release fertilizer were studied for two years at two locations. Height and trunk caliper increases were not affected by treatment at either location. Canopy width, dry weights, and root numbers also did not differ among treatments when the study was terminated. Plants grown in FGFC had roots which tended to circle in a manner similar to container-grown trees.

Field-grow fabric containers (FGFC) provide an alternative to balled and burlapped plants for installation in landscape sites. Proponents of FGFC suggest that establishment may be faster after transplanting since about 80 percent of the root system is retained in the bag during production (10), compared to as little as 2 percent of the root system remaining after balling and burlapping (9). Physiologically, there is evidence that supports more rapid establishment and higher survival rates for plants produced in FGFC. Chong, et al, (2) noted that carbohydrate concentration was 7 percent higher in leaves of poplar trees (*Populus* sp.) grown in FGFC in container mix and in the roots which were inside the bag compared to trees grown without the FGFC in the same mix. The total sugar content of primary roots of live oak (*Quercus virginiana*) was also greater in FGFC-grown than in field-grown trees; however, the sugar content of sweetgum (*Liquidambar styraciflua*) roots was less in FGFC-grown plants than in those grown without fabric containers (6).

Similarities in root regeneration of plants in FGFC, compared to the same type grown without FGFC, appears highly species dependent. Some trees produced in FGFC regenerated roots at the same rate as those produced without FGFC (3). Gilman and Harris (4), however, showed greater root regeneration in FGFC-grown slash pine (*Pinus elliotti*) and leyland cypress (x *Cupressocyparis leylandii*) than in field-grown plants without fabric containers ten weeks after transplanting. The production method did not affect root regeneration or growth of laurel oak (*Quercus laurifolia*) and other species.

The objective of this study was to determine whether post transplant establishment and short-term growth (one and two years) of green ash is influenced by the production and harvest method.

Materials and Methods

Green ash trees were grown under nursery conditions for two years in 30 cm diameter by 30 cm deep FGFC (Root Control, Oklahoma City, OK) containing field soil or field soil amended with 25 percent (by volume) peat, 4.7 kg/m^3 18 N-2.6 P-10 K slow release release fertilizer (Osmocote, Grace-Sierra, Milpitas, CA), 1.2 kg/m^3 hydrophilic gel (Hydrosource, Western Polyacrylamide, Castle Rock, CO), peat + hydrophilic gel, peat + slow release fertilizer, or hydrophilic gel + fertilizer (5). The trees were harvested and transplanted into a Norge loam (fine-silty, mixed, thermic Udic Paleustolls) soil at the same site at Stillwater, OK or into a Haynie very fine sandy loam (coarse-silty, mixed calcareous, mesic typic Udifluvents Entisols) soil at Manhattan, KS. Root bags were removed at the time of transplanting. Control trees were grown without root restriction in the same field. The control trees were balled and burlapped with ball diameters of approximately 36 cm, as recom-

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mended by the American Association of Nurserymen (1), and transplanted with the burlap intact around the root ball. Plantings were completely randomized with eight treatments and eight replicates per site. Trees were planted at both sites on November 21, 1990, and remained in the field for two growing seasons in Oklahoma and for one year in Kansas before harvesting.

The trees at both sites received overhead sprinkler irrigation as needed. The trees transplanted in Oklahoma were fertilized with 227 kg/ha N as urea (43-0-0) broadcast over the entire study area each spring, while plants in Kansas received 112 kg/ha N as ammonium nitrate (33-0-0) in bands in April. Weed control was accomplished through an annual application of (2-chloro-*N*-(2-ethyl-6 methylphenyl)-*N*-(2-methoxy-1-methyl-ethyl)acetamide) (metolachlor) in Oklahoma or (3,5-dinitro-N^4,N^4-dipropylsulfanilamide)(oryzalin) in Kansas and periodic hand cultivation.

Plant heights and calipers at 30 cm above the soil surface were measured monthly during 1991 and three times during the growing season beginning in mid-April (bud break) and ending in October (leaf abscission) in Oklahoma. Trees in Kansas were measured at the time of planting and at harvest. Canopy width was measured at the widest point. Upon completion of the study, the Oklahoma plants were harvested with a 76-cm diameter tree spade (Vermeer TS30, Baltimore, MD). The root balls were power washed and small (< 1cm) and large (> 1 cm) diameter roots were counted. Leaves, stems, and roots were separated and oven dried at 45°C for seven days before weighing. Analysis of variance procedures and Tukey's *w* Procedure (8) were used to determine differences among the treatments.

Table 1. Initial height (cm), height increase (cm), initial caliper and caliper increase of green ash during 1991 and 1992 in Oklahoma and Kansas.

						Oklahoma		Kansas
Bag	Gel	Peat	Fertilizer	Oklahoma	Kansas	1991	1992	1991
				Initial height (cm)		Height increase (cm)		
No	No	No	No	213a[z]	220a	19.6a	7.8a	13.2a
Yes	No	No	No	187ab	190ab	12.3a	8.8a	13.7a
Yes	No	No	Yes	155b	155b	21.6a	11.3a	22.1a
Yes	No	Yes	No	182ab	184ab	19.8a	8.6a	22.0a
Yes	No	Yes	Yes	180ab	181ab	19.5a	9.9a	26.0a
Yes	Yes	No	No	174b	175b	21.8a	8.9a	22.0a
Yes	Yes	No	Yes	165b	177b	18.7a	8.7a	24.7a
Yes	Yes	Yes	No	155b	167b	16.7a	8.8a	23.0a
				Initial caliper (mm)		Caliper increase(mm)		
No	No	No	No	37.2a[z]	35.1a	6.9a	16.6a	3.8a
Yes	No	No	No	26.9b	29.7ab	4.6a	16.1a	7.4a
Yes	No	No	Yes	26.4b	24.0a	4.6a	16.2a	9.1a
Yes	No	Yes	No	25.3b	28.8ab	5.2a	13.1a	4.4a
Yes	No	Yes	Yes	25.5b	30.4ab	4.5a	18.7a	6.2a
Yes	Yes	No	No	24.8b	28.5ab	3.2a	17.6a	5.1a
Yes	Yes	No	Yes	25.3b	25.7b	7.1a	17.6a	8.0a
Yes	Yes	Yes	No	27.1b	26.5b	4.3a	17.3a	4.6a

z Mean separation between columns by Tukey's *w* Procedure. Means followed by the same letter are not significantly different (P = 0.05).

Results and Discussion

All transplanted trees survived in both locations. There was no difference in short-term post transplanting height or caliper increase, regardless of production or harvest treatment, at either location (Table 1). There were also no differences in canopy width, leaf, stem, or root dry weight, or number of large (> 1 cm) or small (< 1 cm) roots, regardless of production treatment, for plants transplanted in Oklahoma (Table 2). Although root numbers did not significantly differ among the treatments, roots of plants in the FGFC tended to circle similar to those produced in container nursery production (Figure 1).

Previous authors speculated that a large majority of the root system is lost when a tree is balled and burlapped(9). The extent of retained root system is proportional to ball size and age of the plant at transplanting. One supposed advantage of the FGFC is that most of the root system is retained during transplanting. A balled and burlapped tree, therefore, would place much of its photosynthetic energy into root regeneration immediately following transplanting, at the expense of plant height. This has been shown with transplanted holly (*Ilex* sp.) (7). Therefore, a tree produced in a FGFC might establish and initiate stem growth more rapidly than a balled and burlapped tree. More rapid establishment has been attributed to higher concentrations of leaf and root carbohydrates of plants grown in FGFC (2). Results of this study, however, do not support this premise. Growth rates of balled and burlapped trees during the first and second season after transplanting equaled the FGFC trees. Production in field bags with or without amendment with peat, gels, or fertilizer did nothing to enhance stem or caliper growth.

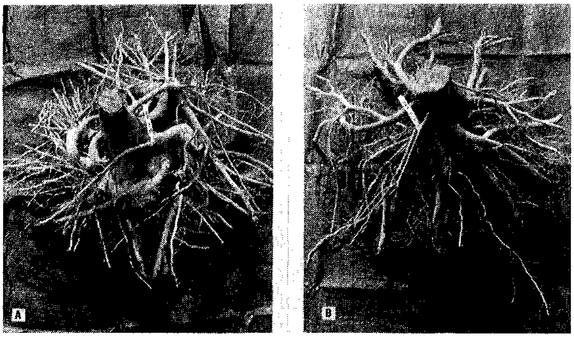

Figure 1. Root system from a balled and burlapped tree (A) and a tree grown in FGFC (B) showing circling of the root system in the FGFC. Both root systems were approximately 76 cm in diameter.

Short term growth rates after transplanting are indicative of "establishment," that is, successful growth of roots into native soil and root function. There were no differences in number of roots, or any stem growth parameter resulting from production or harvest method (Figures 1A and 1B).

Further research is needed to demonstrate

Table 2. Canopy width, leaf stem and root dry weight and number of small (< 1 cm) and large (> 1 cm) roots on green ash two years after transplanting from field grow fabric containers or balled and burlapped in Oklahoma.

				Canopy width	Dry weight (g)			No. of roots	
Bag	Gel	Peat	Fert.	(m)	Leaf	Stem	Root	Small	Large
No	No	No	No	1.77a^z	1017.5a	3524.7a	1945.2a	77a	47a
Yes	No	No	No	1.49a	815.1a	2579.8a	1660.8a	61a	46a
Yes	No	No	Yes	1.90a	928.6a	2491.9a	1748.3a	58a	54a
Yes	No	Yes	No	1.72a	843.4a	2898.0a	1660.8a	53a	39a
Yes	No	Yes	Yes	2.05a	973.9a	3240.5a	2026.2a	61a	51a
Yes	Yes	No	No	1.94a	962.4a	2784.0a	1899.9a	67a	51a
Yes	Yes	No	Yes	1.60a	928.8a	2811.7a	1705.1a	62a	49a
Yes	Yes	Yes	No	1.64a	816.2a	3385.8a	1951.2a	53a	53a

z Mean separation within columns by Turey's *w* Procedure. Means followed by the same letter are not significantly different (P = 0.05).

advantages of FGFC in the production of more difficult to transplant species; however, there appears to be no real benefit to using FGFC when producing easily transplantable materials such as green ash.

Literature Cited

1. American Association of Nurserymen. 1986. American Standard for Nursery Stock. American Association of Nurserymen. Washington, D.C.
2. Chong, C., G.P. Lumis, R.A. Cline and H.J. Reissmann. 1987. *Growth and chemical composition of Populus deltoides x nigra grown in field-grow fabric containers.* J. Environ. Hort. 5: 45-48.
3. Fuller, D.F. and W.A. Meadows. 1988. *Influences of production systems on root regeneration following transplanting of five woody ornamental species.* Proc. Southern Nurserymen Assoc. Res. Conf. 32: 148-153.
4. Gilman, E.F. and J.R. Harris. 1991. *Post-transplanting management effects on transplanting container-grown, field-grown and fabric container-grown trees.* HortScience 26: 689.
5. Henderson-Cole, J.C. and D.L. Hensley. 1992. *Influence of field-grown fabric containers and various soil amendment on the growth of green ash.* J. Environ. Hort. 10: 218-221.
6. Ingram, D.L., U. Yadav and C.A. Neal. 1987. *Production system comparisons for selected woody plants in Florida.* HortScience 22: 1285-1287.
7. Randolph, W.S and S.C. Wiest. 1981. *Relative importance of tactable factors affecting the establishment of transplanted holly.* J. Amer. Soc. Hort. Sci. 106: 207-210.
8. Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics, kA Biometrical Approach. 2nd ed. McGraw-Hill, New York.
9. Watson, G.W. and E.B. Himelick. 1982. *Root distribution of nursery trees and its relationship to transplanting success.* J. Arboric. 8: 225-229.
10. Whitcomb, C.E. 1985. *Innovations and the nursery industry.* J. Environ. Hort. 3: 33-38.

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Résumé. Le taux de survie et de croissance du frêne de Pennsylvanie (*Fraxinus pennsylvanica*), ¡a l'étape de la transplantation, a été étudié sur une période de deux ans en deux endroits différents à partir d'arbres mottés et emballés ou bien d'arbres de plein champs en conteneurs artificiels de tissu (plastique ou géotextile) et remplis de terre végétale naturelle ou bien remplis de terre amendée avec un gel hydrophile, de la tourbe ou encore des fertilisants à libération lente. La croissance en hauteur ou en diamètre du tronc n'était pas influencée par un traitement particulier sur aucun des deux sites. Il en était de même pour la largeur de cime, la masse en tissus séchés et le nombre de racines. Les végétaux en conteneurs artificiels avaient des racines qui tendaient à cercler d'un manière similaire à ceux cultivés en contenants de plastique rigide.

Zusammenfassung. Das Überleben und Wachstum der Grünen Escho (*Fraxinus pennsylvanica*), wurde über zwei Jahre an zwei unterschiedlichen Standorten untersucht. Dabei wurden die Pflanzen teils als umwickelte Ballen verpflanzt, teils in mit Feldboden gefüllten Stoff(Rupfen-)behältern und schleißlich in mit Feldboden gefüllten Stoff(Rupfen-)behältern, die mit hydrophilem Gel, Torf oder langsam freiwerdenem Dünger angereichert wurden. Die Höhe und die Stammdurchmesserzunahme wurden durch keine Behandlung beeinflußt. Kronenausdehnung, Trockengewicht und Anzahl der Wurzeln unterschieden sich ebenfalls bei keiner Behandlung. Die Pflanzen, die in den Rupfencontainern wuchsen, hatten Wurzeln, die zur Ringelung tendierten, ähnlich wie Containerpflanzen.