SYNTHETIC BALL PLANTING ON THE UNIVERSITY OF BRITISH COLUMBIA RESEARCH FOREST, HANEY, B. C.

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Ball planting is defined by the Society of American Foresters (1950) as the planting of young trees with balls of earth around the roots. The young tree is planted with its roots *in situ* within the nursery soil in which the seedling grew. The biological advantages of this type of planting have been acknowledged in forestry and horticulture for at least a century, but the limited application of ball planting is directly related to its high cost and low potential for technical innovation. Recently, however, synthetic growing media have been developed, which may allow the introduction of mass production techniques without loss of the biological advantages. This report summarizes results of planting trials on the University of British Columbia Research Forest, Haney, B.C. using Douglasfir seedlings grown in polyurethane foam from 1964 to 1968.

Material

The growing medium used in the tests was a stable open-celled foam of polymeric material referred to as polyurethane foam. Because of their shape (fig. 1), the samples were called "buns." Buns were approximately 9 centimetres in height and 245 cubic centimetres in volume. Invented by Malcolm E. Pruitt of the Texas Division of The Dow Chemical Company, Freeport, Texas, this product was marketed under the propietrary name of "Nutri-Foam" by Texas Tennessee Industries Inc., Houston, Texas. The author wishes to acknowledge his indebtedness to these companies and, in particular, to J. M. Baggett of The Dow Chemical Company and F. R. Hutchinson of Texas Tennessee Industries Inc., for their generous assistance in obtaining samples.

Tests were made with 2,500 polyurethane foam buns of eleven formulations including the standard Nutri-Foam products, described in table below.

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Method

A small cavity to hold the seed was torn in the centre of the top surface of each bun by pinching the foam between the fingers. Before sowing the seed, the buns were placed under water and worked with the hands until the foam was saturated. Removed from the water, the buns were squeezed until merely damp. A seed was placed in the cavity in each bun, and the buns placed on benches in a lath

COMPOSITION

Formulation	Polyether isocyanate prepolymer 10% N = C = O	Foaming catalyst 3% "Dabco" in water	Stannous Octate catalyst	Cell control agent silicone oil	Vermiculite tailings	Horticultural perlite
	Parts by weight					
1	200	5.3	4.0	1.3	550	0
2	200	5.3	4.0	1.3	800	0
3	200	5.3	4.0	1.3	800	143
4	200	5.3	4.0	1.3	400	100
5	200	5.3	4.0	1.3	400	0
6	200	5.3	4.0	1.3	350	0
7	200	5.3	4.0	1.3	150	0
8	200	5.3	4.0	1.3	200	0
9	200	5.3	4.0	1.3	250	0
10	Nutri-Foam					
11	Nutri-Foam (plus slowly soluble fertilizer)					

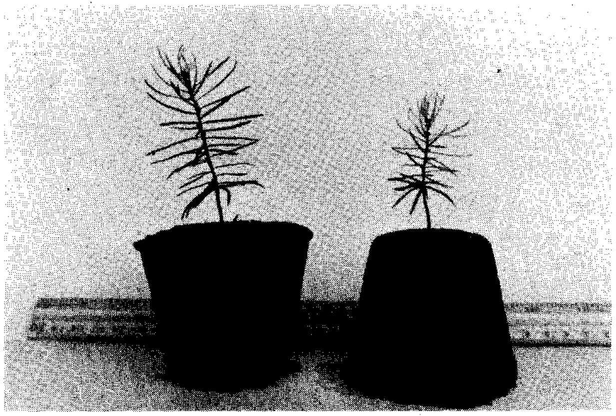

Figure 1.—One-year-old Douglas-fir seedlings growing in Nutri-Foam buns.

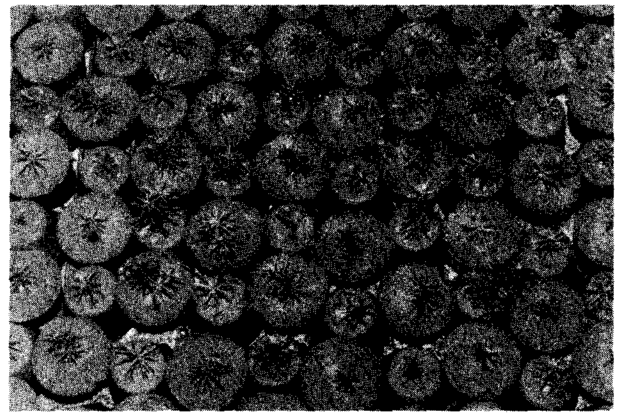

Figure 2.—One-year-old Douglas-fir seedlings in Nutri-Foam buns as arranged on bench in lath house.

house (fig. 2). Considerable difficulty was experienced in maintaining satisfactory moisture regime throughout the buns because of poor capilliary properties. Water applied by overhead sprinkling or misting tended to gravitate quickly to the bottom of the bun, and water in the upper 6 centimeres of the buns quickly drained into the lower 3 centimetres. Attempts to improve moisture conditions by subirrigating failed because of poor capillarity. String wicks inserted vertically through the centre of the buns also failed to improve moisture relations substantially. Frequent and light mist application was the most successful method of watering the buns.

After 1 year, surviving seedlings (fig. 1) were planted with the upper surface of the buns level with the soil surface.

Results

Tests were commenced in 1964 but failed in that year because of the difficulty of maintaining satisfactory water relationship in the buns. A second attempt was commenced in April 1965 and was partially successful under light and frequent mist applications.

Buns were seeded in April 1965 with Douglas-fir, western white pine, and western hemlock. Although

TABLE 1.—*Growth and survival of Douglas-fir seedlings in polyurethane matrices*

Formulation	Lath house		Survival and growth of planted seedlings[1]					
	April 1966		April 1967		April 1968		November 1968	
	Growth *Cms.*	Survival *Percent*	Growth *Cms.*	Survival *Percent*	Growth *Cms.*	Survival *Percent*	Growth *Cms.*	Survival *Percent*
1	4.1	25	11.7	51	25.5	44	50.8	41
2	3.7	12	9.8	36	23.3	21	47.5	19
3	3.6	16	0	0	0	0	0	0
4	0	0	—	—	—	—	—	—
5	4.0	12	9.9	18	0	0	0	0
6	3.3	36	10.4	41	19.8	34	39.6	32
7	3.0	17	10.0	28	23.7	21	40.0	19
8	0	0	—	—	—	—	—	—
9	2.4	22	8.6	14	0	0	0	0
10	5.8	58	13.6	46	27.3	45	60.3	45
11	3.8	59	10.0	50	25.8	48	58.3	46

[1] N.B. Survival figures apply only to planted seedlings and are not inclusive of survival in the lath house.

the pine and hemlock germinated, none survived for longer than 3 months, and the results (table 1) apply only to Douglas-fir. Seedlings in 'buns were planted in April 1966.

Results (table 1) clearly reflect the difficulty experienced in the lath house in maintaining survival through the first growing season especially with formulations 1 to 9 inclusive. The results demonstrate the superiority of formulations 10 and 11 in the lath house, as well as for survival and growth in the plantation. Drought was the main factor responsible for mortality and accounted for approximately 44 percent of the seedlings in formulations 10 and 11 during the first growing season after planting. The relatively high mortality of planted seedlings might have been reduced if the planting technique had buried the top of the buns instead of exposing them to the dessicating effects of sun and air. Frost heaving during the first winter after planting was responsible for the death of approximately 10 percent of the seedlings and the reduction in growth of approximately 26 percent of the seedlings (fig. 3).

The growth of typical seedlings 2 and 3 years after planting (fig. 4 and 5) is sufficiently impressive to justify further experiments with polyurethane in particular and with other inert matrices in general. The form and growth of the shoot and roots of the tree (fig. 6, 7, and 8) demonstrate that the biological advantages long claimed for ball root planting need not be lost when soil is replaced by plastic.

Improvements in the capillarity of the foam was necessary before polyurethane will be useful in forest nursery practice. This may be accomplished chemically or by the addition of absorbent materials during or subsequent to the manufacturing process.

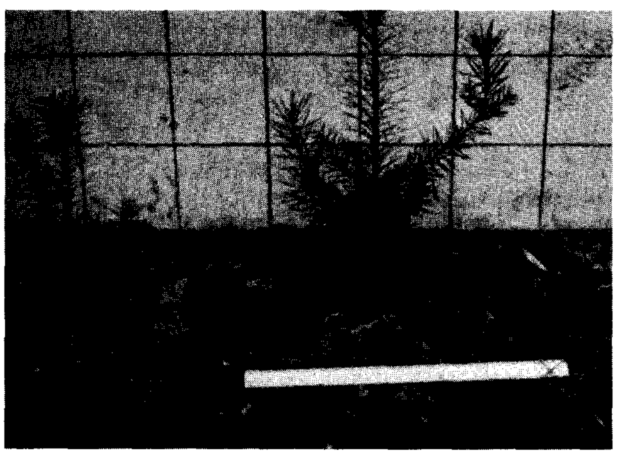

Figure 3.—Three-year-old Douglas-fir seedling in frost-heaved Nutri-Foam buns.

Literature Cited

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1958. Forest terminology. Soc. Amer. Forest., p. 97.

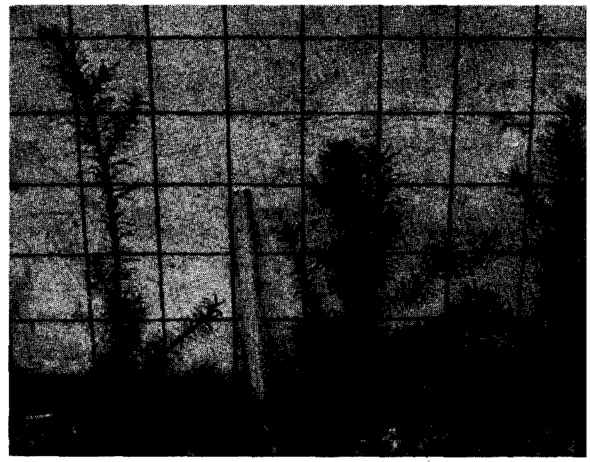

Figure 4.—Three-year-old Douglas-fir seedlings in Nu Foam buns. Note vigour of leader growth in third year

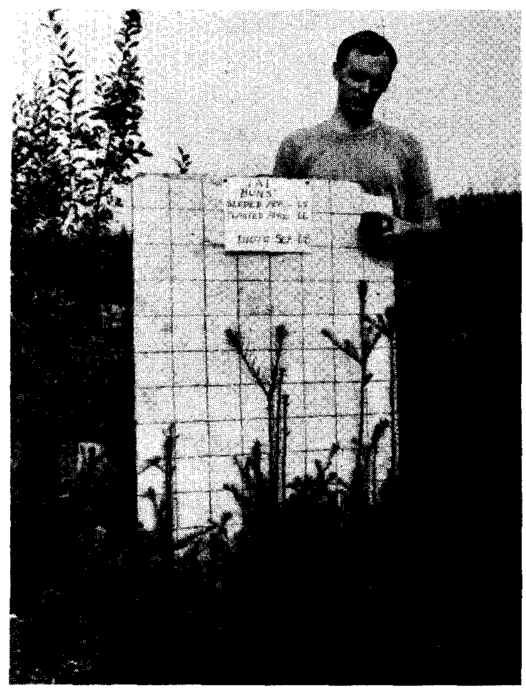

Figure 5.—Four-year-old Douglas-fir seedlings in Nutri-Foam buns. Background grid is 10 cm. by 10 cm.

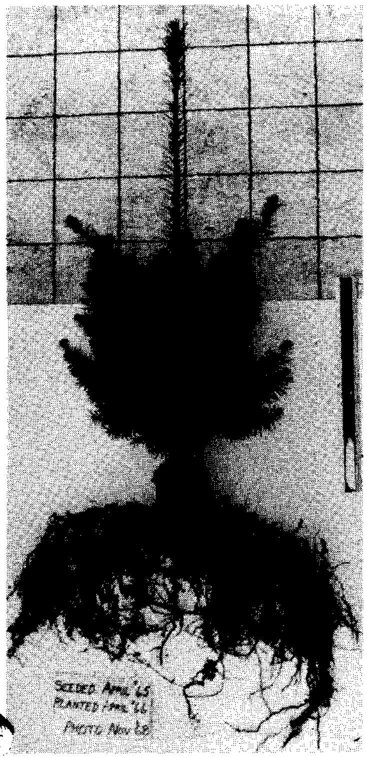

Figure 6.—Four-year-old Douglas-fir seedling in Nutri-Foam bun. Note. excellent shoot and root density.

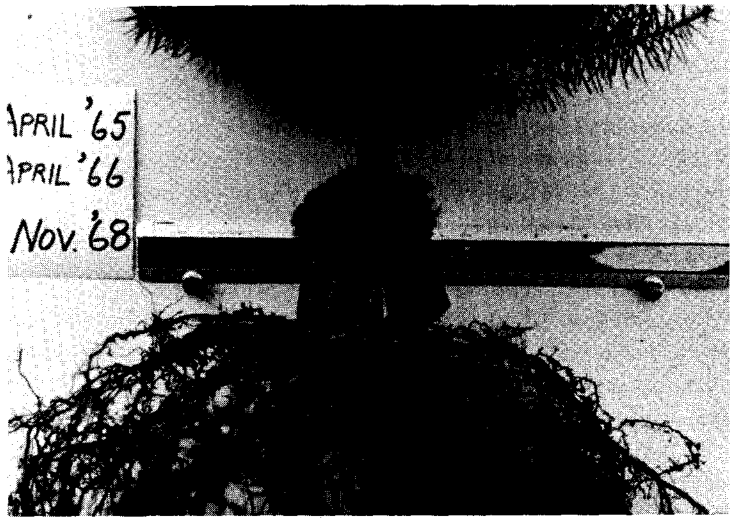

Figure 7.—Close-up of roots emerging from Nutri-Foam bun. (Same seedling shown in figure 6.) Note moss on top of bun.

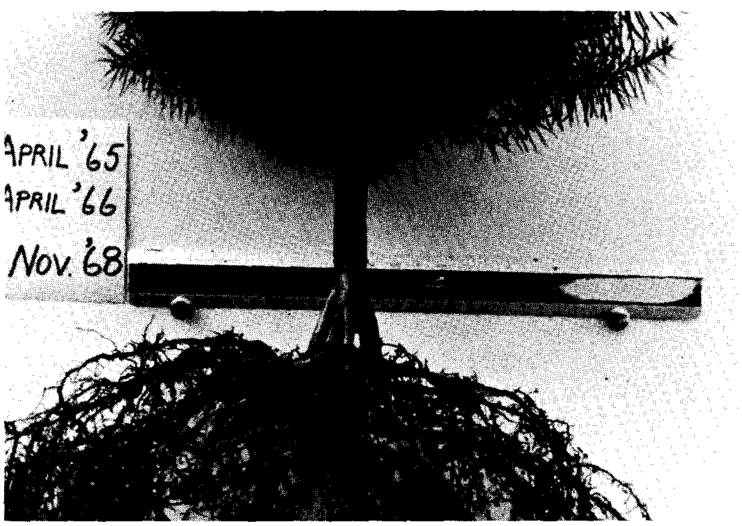

Figure 8.—Bun removed from seedling (figures 6 and 7).