X. bakeri infested Campbell River soil. After breaking dormancy (8 May), each seedling shoot was immersed three consecutive times into a Vydate solution and the seedling laid horizontally until dry. Seedlings were then arranged in a completely random design on a greenhouse bench, with each treatment (2, 4 or 6 lb. a.i. per 100 Imp gal of water per acre) and control (distilled water) replicated 30 times. Seedlings were not watered for 5 days after treatment; thereafter, water was applied only to the soil surface. The experiment was evaluated (1 – 12 Oct), using the same techniques as described for Experiment 1, except no data transformation was needed for the analysis of variance.

Foliage application of Vydate showed that (disregarding application rate) there was no overall difference ($P = .05$) between the number of *X. bakeri* nematodes on roots of healthy (34 per g) and diseased (49 per g) seedlings, i.e., Vydate nematode control was as good on diseased as on healthy plants. However, Vydate did reduce *X. bakeri* populations on both diseased and healthy seedlings (Table 1), especially at the 2 and 4 lb. application rates. The 6 lb. rate of Vydate reduced root weight of diseased and healthy seedlings. There was no clear-cut trend between seedling shoot weight and Vydate concentration, but the nematicide treatment did increase shoot length. No seedlings died or exhibited any shoot symptoms of phytotoxicity. We do not know why Vydate gave some control of *X. bakeri* here, but not in the first experiment.

Recent evidence (Sutherland and Sluggett, 1972, unpublished) indicates that corky root development depends upon the combined effects of *X. bakeri* root feeding and low soil fertility. Future nematicide tests should determine the value of applying both a nematicide and fertilizer to disease infested nursery areas. Our results indicate that both Nemagon, which has a low mammalian toxicity, and Vydate should be included in such trials.—S. Ilnytzky and Jack R. Sutherland, Pacific Forest Research Centre, Victoria, B.C.

Association of Some Physical and Chemical Properties of Nursery Soils with Corky Root Disease.—The nematode *Xiphinema bakeri* Williams is the "primary" pathogen of corky root disease because its feeding precedes root invasion by the soil-borne fungi *Cylindrocarpon destructans* (Zinnsm.) Schalten and *Fusarium oxysporum* Schletcht. (Bloomberg and Sutherland, Ann. Appl. Biol. 69: 265-276, 1971). Sutherland and Sluggett (Can. J. Forest Res., in press) found diseased seedlings and soil from a disease-infested area in the Campbell River nursery contained statistically lower amounts of several nutrients than their healthy counterparts, which suggested that disease development depends upon the combined effects of nematode feeding and low soil fertility. Related to this latter factor is the field observation that the disease prevails on the sandiest soils within infested fields. Because the implication of soil fertility had been studied only at the Campbell River nursery, the present study was made to determine some physical and chemical properties of Green Timbers and Haney (Alouette Lake) nursery soils where the disease has also occurred.

In August 1972, 10 randomly selected soil cores, taken to a 6-inches (15 cm) depth, were collected and bulked from adjacent 50 x 50 ft (15.2 x 15.2 m) plots with and without corky root disease. When sampled, Haney field 1 and Green Timbers field 4 were in bare fallow and Green timbers field 7 was in 2-0 Douglas-fir. The 4-5 lb. (1-5-2.0 kg) samples were air dried, sieved (10 mm sieve) and passed through a sample splitter, after which subsamples were analyzed for: texture (Bouyoucos, Soil Sci. 23: 343-353, 1927); total N by micro-Kjeldahl; P by acid fluoride extraction; exchangeable K, Mg, and Ca by ammonium acetate extraction; pH and conductance (soluble salts) by saturated soil paste; cation exchange capacity (CEC) by ammonium saturation; and total organic carbon by Leco carbon analyzer. These methods use the standard procedures for this laboratory (McMullan, Can. For. Serv. Inf. Rept. BC-X-50, 1971; McMullan, Can. For. Serv. Inf. Rept. BC-X-67, 1972).

Table 1 shows that corky root soils contained more sand and less silt and clay than non-corky root soils. The results also confirm our earlier Campbell River observation (Sutherland and Sluggett, Can. J. Forest Res., in press) that corky root soils are less fertile than disease free soils, e.g. they contained less N, K, Mg, and Ca and had lower CEC and carbon content values than non-corky root soils. Phosphorus and acidity (pH) levels of the two soils were similar and the conductance reading indicated that neither soil contained harmful amounts, 4000 to 8000 micromhos/cm for most plants, of soluble salts (Bower and Wilcox, pp. 933-940, in Methods of Soil Analysis, part 2, C. A. Black, Ed., Vol. 9 of Agron. Mono., 1965). The lower fertility levels of corky root soils are probably attributable to their lower clay and organic carbon contents, two factors influencing CEC (Lyon et al. The nature and properties of soils, MacMillan, New York, 1952). Their higher sand content likely results in greater available pore space, which favors nematode population build-up. We do not know why these areas of sandy soil occur, but perhaps they are exposed areas of interglacial sand (Fyles, *In* Day et al., Rep. No. 6, B.C. Soil Surv., 1959).

TABLE 1
Some physical and chemical properties of soil from corky root and non-corky root nursery areas[a]

	Non-corky root areas	Corky root areas	Adequate nutrient levels[b]
Physical properties			
Sand, %	58 ± 3.5	67 ± 3.3	—
Silt, %	14 ± 2.1	9 ± 0.9	—
Clay, %	28 ± 1.7	23 ± 2.4	—
Chemical Properties			
N (total), %	.59 ± 0.20	.36 ± 0.05	.20
P, ppm	14 ± 5.4	15 ± 3.7	100
K, ppm	86 ± 7.3	51 ± 14.2	78
Mg, ppm	55 ± 25.9	28 ± 8.5	170
Ca, ppm	625 ± 285	497 ± 207	1000
pH	5.7 ± 0.4	5.5 ± 0.3	—
conductance[c]	637 ± 115	425 ± 77	—
CEC[d]	44 ± 5.3	36 ± 1.2	—
Carbon (total organic), %	4.3 ± 1.3	3.2 ± 0.4	—

[a] Value are means of three samples, ± SE of the mean.
[b] For Douglas-fir nursery seedlings (van den Driessche, B.C. For. Serv. Res. Note No. 48, 1969).
[c] Micromhos/cm.
[d] Cation exchange capacity = meq/100 g air-dry soil.

The adequate nutrient level values (Table 1) indicate that N is adequate in both corky root and disease free soils while P, Mg, and Ca are deficient in both soils and K is adequate in "healthy" but not corky root soils. Such comparisons may be misleading because they do not consider the minimum nutrient levels at which seedlings can grow and still not exhibit deficiency symptoms. For example, 170 ppm Mg is adequate for seedling growth and even a 55 ppm in non-corky root soils (Table 1) growth may be uneffected, but the low (28 ppm) Mg levels in corky root soils may be critical, especially when seedlings are subjected to the additional stress of *X. bakeri* nematode root feeding.

Because past cultural and cropping practices have varied widely within and among nurseries, it may not be possible to pin-point specific nutrient deficiencies for corky root soils. Probably their only common characteristics are that they are sandier and less fertile than their "healthy" counterparts. Fallowing increases the organic matter and nutrient content of corky root soils would help seedlings offset the effects of *X. bakeri* feeding.—Jack R. Sutherland, L. J. Sluggett, and W. Lock, Pacific Forest Research Centre, Victoria, B.C.