bi-monthly research notes

Effect of juvenile hormone-like substances on European pine sawfly eggs.

Sampling methods in spruce budworm surveys.

Chemical differentiation of Abies *spp. woods.*

Computer program for stand sampling.

Portable platforms for tree climbing.

Suckering and soluable sugars in trembling aspen.

Vol. 28, No. 5, SEPTEMBER-OCTOBER, 1972.

Environment Canada | Environnement Canada
Forestry Service | Service des forêts

bi-monthly
research notes

"A selection of notes on current research conducted by the Canadian Forestry Service and published under the authority of the Minister of the Department of the Environment. A French edition is published under the title of Revue Bimestrielle de Recherches".

ENTOMOLOGY

Spraying Eggs of the European Pine Sawfly with Technical Grade Substances Possessing Juvenile Hormone Activity.—When substances with juvenile hormone-like activity are topically applied to eggs, they interfere with embryogenesis in a number of insects and in fact may possess a potency comparable to organophosphate ovicides (Walker and Bowers, J. Econ. Entomol. 63:1231-1233, 1970). Some of these materials are now available in technical grade and, as a preliminary to field tests, we have assessed the activity of two such preparations in causing embryo and early larval mortality of the European pine sawfly, [*Neodiprion sertifer* (Geoff.)], when applied in foliar sprays in the laboratory. The substances tested included a mixture of synthetic juvenile hormone with its geometrical isomers (Ayerst Research Laboratory; AY-22342) and a preparation containing 75–84% of the juvenile hormone mimic, 4-ethylphenyl-6, 7-epoxy geranyl ether (Stauffer Chemical Co. R-20458).

Branchlets of Scots pine, [*Pinus sylvestris* L.], containing eggs that had completed prediapause embryogenesis and had fulfilled the diapause requirements under natural conditions, were collected during mid-winter. The cut end of each branch was inserted through a styrofoam plug into a water-filled jar and held at 0 C until required. Upon incubation at 20 C, 70% RH and 17-hr photophase, eclosion occurred in 10 to 12 days. Sprays applied with a Universal Aerosol Spray Kit (Nutritional Biochemicals Corp.) were tested on three or more branchlets bearing a known number of eggs. Only the 1971 foliage from 10–20 cm in length, was sprayed. At the time of treatment, the stages of postdiapause embryonic development were determined and classified as early (B to C), mid (D to E) and late stage (F) embryos, according to Breny's classification (Breny, Mem. Acad. R. Belg. Cl. Sci. 30:88 p. 1957). The effects of the sprays were determined by counting the hatch and the number of first- and second-instar larvae established at feeding sites.

Eggs containing early-stage embryos were treated with the two substances dissolved in acetone and applied at 20 ml/branchlet (Table 1). None or very few of the eggs hatched after treatment with 1.0 mg/ml or greater and reduced hatch occurred at a concentration of 0.1 mg/ml. There was little difference in the activity of the two substances on eggs of the European pine sawfly. This is interesting because the geranyl ether and a number of related compounds were significantly more active than the juvenile hormone in the *Tenebrio* test (Pallos et al., Nature 232:486-487, 1971). Eggs of *N. sertifer* treated with both substances developed well beyond the stage reached at the time of treatment. This contrasts with AY-22342 in tests on the spruce budworm, [*Choristoneura fumiferana* (Clem)], in which few of the embryos developed further (Outram and Neilsen, Can. Dep. Environ., Can. For. Serv., Bi-Mon. Res. Notes 27:34-35, 1971) but agrees with tests utilizing a hydrochlorination reaction mixture on budworm eggs, in which eggs developed but did not hatch (Retnakaran and Grisdale, Ann. Entomol. Soc. Am. 63:907-909, 1970).

To determine the effects of timing of the spray application, the juvenile hormone mixture was applied as described to eggs containing embryos at various stages of development. Treatment of eggs containing early- and mid-stage embryos gave results similar to those listed for this substance in Table 1, i.e., no hatch occurred at concentrations of 1.0 mg/ml or greater and reduced hatch occurred at a concentration of 0.1 mg/ml. In addition, treatment of early-stage embryos followed by 21 days' incubation at 5.5 C, to simulate development under field conditions, gave similar results. Hence, an early spring spray may be effective. Treatment of late-stage embryos resulted in complete mortality only at the 10.0 mg/ml concentration; at 1.0 mg/ml, hatch was poor (41.1%). A similar result was obtained when the spray was applied on the day of peak hatch, i.e., when 50% or more of the larvae had eclosed. Although good hatch was recorded, the larvae treated with 10.0 mg/ml failed to develop beyond the second instar. At a concentration of 1.0 mg/ml, 35.4% of the larvae survived and developed normally through the second instar. Apparently, although the hormone does affect the development of young larvae, it has greater activity when applied to postdiapause embryos in their early stage.

To correspond more closely to field sprays, the juvenile hormone was tested in oil-water sprays containing various surfactants suggested for use in classical insecticide formulations (Metcalfe et al., Destructive and Useful Insects, 4th edition, McGraw-Hill Book Co., 1962). The formulation was oil, 10 ml; surfactant, 1 g; hormone, 1 g; water to 100 ml. The oil (Aerotex A3134; Texaca Ltd.), surfactant (sodium lauryl sulfate; Tween 80; Triton X-100; Ultrawet 60L) and hormone were thoroughly mixed and after adding water were kept emulsified by continuous shaking. The most stable emulsion was formed with Ultrawet 60L. Early-stage embryos were sprayed with freshly prepared formulations or an emulsion of the hormone in which had stood at room temperature under fluorescent lighting for 7 days before application.

TABLE 1

Effect of two commercial preparations of hormone-active substances on eclosion of the European pine sawfly

	AY-22342		R-20458	
Concentration (mg/ml)	Eggs treated	% hatch	Eggs treated	% hatch
Control[a]	611	80.9	—	—
Control[b]	250	78.4	—	—
0.01	271	73.0	336	65.2
0.1	395	50.1	341	41.3
1.0	371	0	246	1.6
10.0	322	0	268	0

[a] Untreated control.

[b] Treated with acetone only.

TABLE 2

The effects of juvenile hormone (AY-22342) in oil-water formulations containing different surfactants on eclosion and early larval establishment of the European pine sawfly

Treatment	Eggs treated	% larvae (second instar)	Remarks
	Sodium Lauryl Sulfate		
Control[a]	247	85.0	good hatch
Hormone added (10 mg/ml)	265	0	no hatch
Hormone added — delayed spray[b]	235	2.6	some hatch (16.2%)
	Ultrawet 30L		
Control[a]	166	77.1	good hatch
Hormone added (10 mg/ml)	254	0	no hatch
Hormone added — delayed spray[b]	309	0	some hatch (1.9%)

[a] Formulation without hormone.

[b] Treatment applied 7 days after preparation of the spray.

The results with two formulations containing sodium lauryl sulfate and Ultrawet 60L are shown in Table 2. Good hatch occurred and the larvae had no difficulty establishing feeding sites on needles treated with control sprays. On the other hand, freshly prepared hormone sprays were totally effective in preventing hatch but some hatch occurred in eggs treated with the 7-day-old formulations. The least hatch occurred in the formulation containing Ultrawet 60L. Finally, in concurrent tests with formulations containing Triton X-100 and Tween 80, hatching was effectively prevented by hormone-containing sprays, but in the spray controls where good hatch occurred, 80–81% of the larvae died. Apparently, the surfactants prevent establishment of feeding.

These results are encouraging and indicate that sprays containing the chemicals AY-22342 and R-20458 are more effective when applied early in postdiapause embryogenesis. Treatments during prediapause embryonic development and in a natural environment will be assessed in 1972.

We are grateful for the advice offered by Dr. G.S. Cooper, Cyanamid of Canada Ltd., and Dr. A.J. Manson, Ayerst Research Laboratories.—C.R. Sullivan and W.H. Fogal, Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario.

Sampling Methods in Spruce Budworm Surveys.—Three sampling methods are currently in use for spruce budworm population surveys and their only common element is that the collection unit is taken from the mid-crown level of the tree. In one, which is particularly useful for third-instar larval surveys, the collection unit is an 18-inch branch tip. The other two use the whole branch as the collection unit and standardize sample size by expressing density in terms of individuals per current shoot or per square feet of foliage (foliated length x mean width of the branch). All three methods were used while monitoring a spray program in New Brunswick in 1971, and the aim of this note is to discuss the efficiency of each and to present equations that convert the density estimates from 18-inch branch tips, to shoots, to square feet of foliage.

Each sampling method has certain advantages. Intuitively, measuring budworm density, particularly larvae, in terms of shoots seems to be the most logical procedure because, in the absence of staminate flowers, the vegetative shoot is the larval feeding site. However, the shoot is less suitable for pupal and egg surveys, particularly if defoliation is severe and many shoots are destroyed and cannot be counted. Furthermore the cost of counting the number of shoots on each sample unit adds to the total cost (time) of sampling.

Although square feet of foliage is a rather abstract unit, it is suitable for determining the abundance of eggs, larvae, and pupae, and conversion to absolute population per tree or per acre is simple. Disadvantages are that it is difficult to measure odd-shaped branches and the longitudinal half of the branch is the smallest collection unit that can be used.

The 18-inch tip is widely used and its advantages are ease of collection, the collection unit becomes the sample unit without further measurement or counting of shoots, and its small size. However, small sample units have a serious disadvantage in that they generate zero counts when density is low. For example, a graphic analysis of 40 sets of plot data gave the following relationship between pupal density per 18-inch tip and percentage of sample units with zero counts:

Density	0.5	1.0	2.0	3.0
Zero counts, % . .	70	41	25	17

Zeros are difficult to deal with biologically and statistically and therefore the 18-inch branch tip is not an efficient unit at low densities.

To test the relative efficiency of each method, we collected mid-crown branches of balsam fir on 10 plots where mean larvae per branch ranged from 0.40 to 258. The new shoots were counted and foliage area determined for each branch, and budworm larvae were counted on the 18-inch tip and the remainder of the branch. Then, for each branch, we calculated larvae per 18-tip, per 100 shoots, and per 10 ft² of foliage. From these data the variance-mean relationship was determined graphically for each sampling method. Next, these relationships were used to calculate the number of sample units required to measure density with a standard error equal to 20% of the mean (Table 1). We also included mean larvae per branch in Table 1 but only recommend this procedure when sampling very uniform stands.

TABLE 1

Number of sample units required for different sampling methods to estimate budworm density with a standard error of 20% of the mean at several levels of budworm abundance.

Sampling method							
Per 18-inch tip		Per branch		Per 100 shoots		Per 10 ft²	
Density	Sample units	Density	Sample units	Density	Sample units	Density	Sample units
5	17	10	8.9	3.9	10	21	10
10	11	20	7.2	7.9	8.4	43	6.1
20	7.5	40	5.8	16	7.1	85	4.0
40	4.7	80	4.7	32	5.5	171	2.5
60	3.5	120	4.2	47	4.8	256	1.9

Note that the density levels are equivalent across each row; i.e. 5.0 larvae per 18-inch tip equals 10 larvae per branch, 3.9 larvae per 100 shoots, or 21 per 10 ft² of foliage and therefore the number of sample units is a measure of sampling efficiency.

The most efficient method in terms of the number of sample units is the whole branch expressed in square feet of foliage. Shoot counts fail to reduce sample size and the 18-inch tip appears to be the least efficient method. However, it must be noted that the time required to examine an 18-inch tip is half that for the whole branch and, consequently, the 18-inch tip is a very efficient larval survey unit particularly at higher larval densities. In summary, no collection or sample unit stands out in all respects so as to warrant immediate conversion to that unit, but for new biological assessment programs the 18-inch branch tip should be considered for larval surveys and whole branches for pupal surveys.

It is useful when comparing budworm densities, or when updating historical data, to be able to convert density estimates from one sampling method to another although conversions must be used with caution in differing stand types. The following equations apply to mid-crown balsam fir branches collected from 40-foot trees in relatively dense stands.

Larvae per 18-inch tip	= 0.51 x larvae per whole branch	(1)
	= 127 x larvae per shoot	(2)
	= 2.34 x larvae per 1.0 ft²	(3)
Larvae per shoot	= 0.019 x larvae per 1.0 ft²	(4)
Pupae per 18-inch tip	= 1.84 x pupae per 1.0 ft²	(5)
Larvae per 1.0 ft²	= 0.42 x larvae per 18-inch tip	(6)
Pupae per 1.0 ft²	= 0.48 x pupae per 18-inch tip	(7)

Equations (6) and (7) were determined by Webb (unpublished report, 1952), and are included to show close agreement with equations (3) and (5).—C.A. Miller, E.G. Kettela, and G.A. McDougall, Maritimes Forest Research Centre, Fredericton, N.B.

FOREST PRODUCTS

A Chemical Test to Differentiate *Abies amabilis* from *A. lasiocarpa* Wood.—There have been instances of amabilis fir [*Abies amabilis* (Dougl.) Forbes] lumber in B.C. being mixed with lumber from alpine fir [*A. lasiocarpa* (Hook) Nutt.]. These two firs can be differentiated when the bark is still on logs, but once sawn into lumber they cannot be differentiated positively. While *A. amabilis* is suitable (on a strength basis) for inclusion in the B.C. Interior spruce-pine-fir group, the inclusion of *A. lasiocarpa* into the coastal hem-fir group is not possible. Since the wood of these firs cannot be differentiated under a microscope, an attempt was made to develop a chemical method of identification based on possible differences in their extractives. The extractives of these species have not been studied extensively, so a number of color tests available from literature to detect various chemical groupings were tried on samples of these woods.

The best color test found makes use of Ehrlich's reagent, originally developed for indole derivatives. Various compositions for this reagent are given in texts, the composition used in this study being p-dimethylaminobenzaldehyde (1 g) in ethanol (23 ml) plus conc. hydrochloric acid (2 ml). Maximum color development was obtained when a stripe of reagent was painted across the edge-grain (radial section) of freshly cut heart-wood. In another method, a sample was ground to a meal and 0.2 g warmed in 5 ml of benzene in a test tube to about 60 C for 15 min. The Ehrlich's reagent (1 ml) was added to the mixture which was then shaken and allowed to stand for 15 min. at room temperature. A positive reaction from alpine fir samples was the formation of a purple color—either as streaks on the wood or in the solution. The samples of amabilis fir gave either no color at all or a green color in both methods.

In a second experiment, 73 samples of *Abies* spp. from several countries were tested. These samples were from the collections of our laboratory and of the Faculty of Forestry, University of B.C. Positive tests (i.e. purple color) were obtained from 10 (out of 12) samples of *A. lasiocarpa,* two samples (out of nine) of *A. balsamea,* one (out of 11) of *A. grandis,* and two Asian firs (*A. koreana* and *A. nephrolepsis*). Negative tests were obtained from 25 samples of *A. amabilis,* five samples of *A. concolor,* two samples of *A. alba,* and one sample each of *A. holophylla, A. magnifica, A. mayriana, A. nobilis, A. pindrow, A. procera,* and *A. sachalinesis.*

The negative tests from the two *A. lasiocarpa* samples above were discounted because the board samples were 40 years old. Presumably, the extractives in these samples had oxidized. Also, it is important to note that we are only interested in differentiating *A. amabilis* and *A. lasiocarpa,* since other positive reactors (e.g. *A. balsamea*) do not grow in B.C. In a third experiment, 34 samples of *A. lasiocarpa* from North American provenances were obtained from the collection of the United States Forest Products Laboratory in Madison, Wis. These samples reacted positively to the painted-on reagent, but six were very weak, from one to three purple streaks. The knots and cambium of these samples reacted positively and the sapwood negatively. These six did not react positively with the benzene extraction method described above. The samples were not very old and their unreactiveness was rechecked on smaller samples cut from the same source, again with negative results. Most of these six samples were from the Cascade Mountains region and were not a variety of *A. lasiocarpa.* These data show that it is important to paint across as much of the edge-grain (radial section) heartwood as possible.

The color formation tests were confirmed as being related to the extractives by examining benzene solubles by thin-layer chromatography on silica gel. Developing solvent was methylene dichloride and detecting reagents were either Ehrlich's reagent or 2,4-dinitrophenylhydrazine reagent. The former reagent showed a major purple spot (R_f 0.5), together with several minor spots of lower R_f; the latter reagent showed the two unknown sesquiterpene ketones (R_f 0.75 and 0.80) previously noted in the extractives from *A. lasiocarpa* (Swan, Can. J. Chem. 45:1588, 1967). Work on the characterization and synthesis of all of these compounds is continuing.

We thank Dr. R.M. Kellogg for suggesting and for discussions of this work, and Mr. S. Rowe for the preparation and coding of samples.—H.S. Fraser and E.P. Swan, Western Forest Products Laboratory, Vancouver, B.C.

MENSURATION

Computer Program for Sampling Forest Stands.—Computer sampling is part of a new approach to the problem: what sampling method should be chosen to obtain the forest inventory data most efficiently? This approach includes three steps: obtaining and storing forest-stand data, specifying a sampling model, and designing a program with which the data are sampled. This paper reports on the design of a compute program for such sampling.

Comparisons of sampling models are made faster and at less cost with the computer than by field sampling and, if computer-generated data are used, even greater savings result. Other advantages of computer sampling are that measurement errors often made in the field are avoided, and that more varied conditions can be investigated. Also, the method can be used as a preliminary screening to eliminate less appropriate models.

Computer sampling has been used in a number of studies, e.g. O'Regan and Palley (For. Sci. 11:99-113, 1965) and Ek (For. Sci. 17:2-13, 1971). A common characteristic of these studies is that the programs are designed for use with specific sampling models. In this they differ from the present program, which is designed for use with a variety of sampling models.

To use the program, actual or computer-generated stand data (tree locations and characteristics) are first stored in the computer. The location, type and size of elements (e.g. sample plots) to be sampled are specified. The element specifications depend on the sampling model being investigated. Next, the program determines which trees and their characteristics, together with other relevant data, are then listed in the output. The simplicity of the basic program is matched by its flexibility. Three are available to specify element locations, while four basic element types and numerous element sizes and dimensions may be specified. Furthermore, the elements may be combined into clusters, and the same set of stand data may be sampled repeatedly. In its present form, the sampling program is designed for use with stand-generating computer programs, but with only minor modifications, it can be made compatible with other input sources.

To illustrate how the program works, a population or stand of 75 trees is generated and sampled by a cluster of two circular 1/20-acre elements and by a point sample with a basal area factor (BAF) of 40. In the stand map (Fig. 1) tree diameters are represented by circles drawn at exaggerated scale.

The input data for the population consists of tree coordinates and characteristics, as well as the measurement unit of the coordinate system. This unit, which is a program variable, is here set at 8 inches. The only tree characteristic used is dbh. The input data for sampling include the coordinates of element centers, and element dimensions. For the point sample, the "dimension" is the BAF. Other specifications state that the first sampling unit consists of two circular elements, that the second sampling unit consists of a single point sample, that the element center coordinates will be supplied by card input, and that repeated sampling using these specifications will be required.

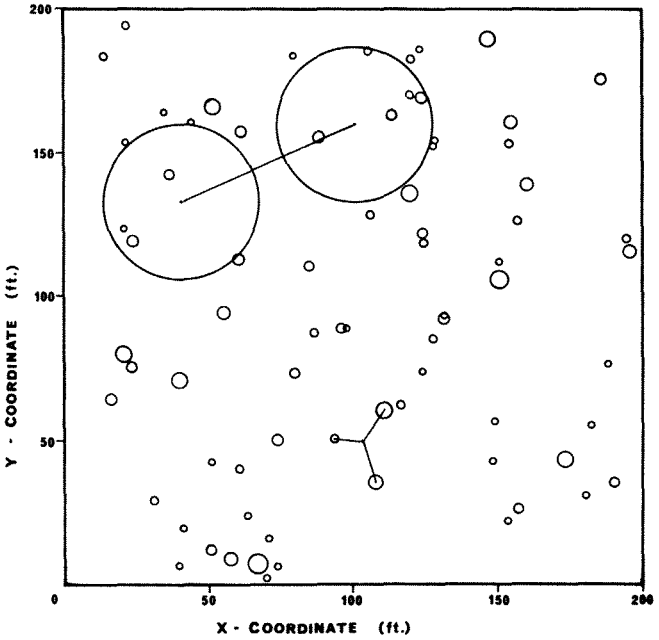

Figure 1. Stand map and sample units used in example.

With this information, the first step of the program is to make sure that the elements are wholly inside the population. Starting with the first element of the cluster, the program then checks each tree in the population to determine if it is inside the element or not. If inside, the coordinates and characteristic (dbh) of the tree are printed. This process is repeated for the second element and for the point sample.

The resulting computer output (Table 2) lists "Population Characteristics", in which "Clumping Factor" refers to the degree of clumping employed in generating the stand, and "Grid Size" to the measurement unit of the coordinate system. Also listed is "Effective Sampling Area", *i.e.* the area within which element centers must be located. Last, the results of sampling are listed, with separate headings for each sample unit. As shown, the first consists of two elements, each being a circle with radius 39.50 measurement units, and the second consists of a single point sample with BAF=40. The coordinates, diameters and number of trees within each element are listed in the last four columns. The symbols LA, LC, AL, and AW refer to code names used in the program.

The complete list of options made available by this program is as follows:—

(a) element type: circle, rectangle, triangle or point sample (Bitterlich point);

(b) number of elements in a cluster: theoretically unlimited;

(c) element dimensions: theoretically unlimited;

(d) method of specifying element-center coordinates: may be set equal to population center, may be input on cards, or may be generated at random by the computer;

(e) sampling may be repeated using a given set of the specifications (a) to (d);

(f) choice of printed or printed-and-punched output.

For a given sampling model and set of stand data, the program may be applied several times, as follows: first, all units in the population are included in the sample. The resulting population parameters will be free of sampling error. Next, the units may be sampled to obtain estimates of the parameters.

TABLE 1

Example of computer output for sampling program

Population Characteristics

Area (acre)	No. of Trees/acre	Clumping Factor	Center X	Coords. Y	Grid Size (ft)
2.0	83	8	150	150	.66

Effective Sampling Area

X Coord min	X Coord max	Y Coord min	Y Coord max	Effective Area (acre)
50	250	50	250	.9

.050-Acre Circle

No. of Elements (LA)	Element type (LC)	Element Dimensions (AL)	Element Dimensions (AW)	Element number	Element Center Coordinates (X)	Element Center Coordinates (Y)	Trees Within Element Coordinates (X)	Trees Within Element Coordinates (Y)	dbh	number
2	1		39.50	2	60	200	53	214	10	1
							31	181	6	2
							34	179	12	3
				1	150	240	157	278	8	1
							169	245	10	2
							131	233	12	3
							183	253	12	4
							178	256	8	5

Point, BAF = 40

No. of Elements (LA)	Element type (LC)	Element Dimensions (AL)	Element Dimensions (AW)	Element number	Element Center Coordinates (X)	Element Center Coordinates (Y)	Trees Within Element Coordinates (X)	Trees Within Element Coordinates (Y)	dbh	number
1	4		40.00	1	155	75	140	76	8	1
							161	54	16	2
							166	91	20	3

These estimates are checked against the population parameters obtained in the first application of the program. The sampling is repeated for the given model to obtain reliable estimates. A new sampling model is then selected and the process is repeated. Results are compared and the most suitable model for the given stand data is identified. By choosing the card output option, the sampling data can easily be applied to computer programs for analysis of the different models.

The measurement unit of the coordinate system identifies the minimum distance between trees. In the computer-generated stand, if the desired minimum distance is 6 inches, the measurement unit is set equal to 6 inches. As a result, tree coordinates always appear as integers. In the natural stand, the measurement unit may be set equal to the lesser of stand-mapping precision limits and minimum dbh.

The program can be modified to accept additional tree characteristics, for example tree height, volume, and species. Also, adaptations for different sampling rules, for example 3-P sampling, or for inclusion of cost functions, are possible. Such changes, which depend on the sampling models being tested, can be made with little difficulty, due to the simplicity of the program.

This program may be used to effectively sample a typical stand by computer. It may thus serve as a basis for choosing the most efficient sampling method for measuring the forest.

The study was funded by Project Nos. FM-1, FM-9, and FM-11, 10-272-D, Project I, McIntyre-Stennis Act.—G.M. Bonnor, Forest Management Institute, Ottawa, Ont. and J.D. Kasile and C.A. Bickford, State University College of Forestry, Syracuse, N.Y.

SILVICULTURE

Suckering and Soluble Sugars in Trembling Aspen Root Cuttings.—There is strong evidence to suggest that apical dominance, surface-soil temperature, and season are the principal factors controlling the suckering of trembling aspen [*Populus tremuloides* Michx.] (Farmer, Ph.D. thesis, Mich. State Univ. 1961; Maini and Horton, Can. J. Bot. 44:1183, 1966). However, the variation in suckering between and within clones is little understood (Sandberg, Master's thesis, Univ. Minn. 1951; Garret and Zahner, J. For. 62:10, 1964). Here we report on a study to determine whether this variation in aspen suckering is related to the amount of soluble sugars present in the parent roots.

Thirty 7-inch root cuttings from each of 13 clones were collected before and just after leaf-flushing, and in late summer for a total of 1170 cuttings. The cuttings were obtained from a 40-year-old pure aspen stand growing on a heavy clay-loam till within the B18a Mixedwood Section (Rowe, Can. Dep. North Aff. Natur. Resources, Bull. 123, 1959) in Riding Mountain National Park, Manitoba. A 1-inch piece was cut from one end of each cutting and used for sugar analysis. The remaining 6-inch pieces were then placed in a propagation chamber. Suckering began after about 10 days and continued for about 3 weeks. The number of suckers produced and the total length of the three tallest shoots per root cutting (sucker growth) were recorded. For sugar analysis, the 1-inch root segments were first washed with a 30% chlorox solution, oven-dried at 70 C, ground, and the sugar extracted with 0.1 $\underline{\underline{N}}$ H_2SO_4. The procedure described by Couckell (Master's thesis, Univ. Man. 1963) with the use of 3, 1-dinitrosalicylic acid as a color reagent, was adopted for the determination of sugars. The thirty 1-inch roots per clone and collection date composed a sample. Simple regression analyses were conducted between average sugar content and each of the other three variables: collection time, sucker production and sucker growth (Table 1).

An analysis of variance indicated significant differences ($P < 0.01$) in soluble sugar content of the clones between collection dates. Sugar concentrations decreased from early spring (0.27%) to summer (0.21%). Sucker growth showed a corresponding decrease from early spring to summer. No such decrease was observed in sucker production. Standard deviations in the table indicate a much greater variation between clones in sucker production and sucker growth than in soluble sugar concentrations. No significant correlation could be established at any collection time between average sugar content and sucker production of the clones examined. Only the late spring and summer collection showed a significant positive correlation ($P < 0.05$) and 0.01 respectively) between average sugar content and sucker growth (Table 1).

An attempt to find a relationship within clones between sucker production, sucker growth, and amount of soluble sugars, for three clones selected at random from the late spring collection, was unsuccessful. However, significant differences ($P < 0.05$) in the amount of soluble sugars between these clones were demonstrated.

There could be several reasons for the lack of strong correlation between the growth responses measured and the concentrations of sugars. The method of analysis did not provide for the extraction of starch which, as a food reserve, may have influenced suckering (Tew, For. Sci. 16:318, 1970). In addition to sugars, plant growth regulators such as auxins, gibberellins, and cytokinins may actively influence sucker production and sucker growth. The use of linear growth to estimate sucker performance may be questioned. Dry weight measurements might have provided a more reliable parameter but since leaf growth begins after suckering, this measure would have presented additional complications. Although none of the samples collected during the early spring were from trees that had flushed, the trees may not all have been at the same state of metabolic activity; this could account for the weak correlation between sugars and sucker growth for this collection. Sucker production and initial growth may primarily be controlled by food reserves in the extra-xylary tissues rather than reserves throughout the entire root section. In conclusion: soluble sugar concentrations in aspen roots appear to decrease significantly from early spring to late summer, and may account for up to 50% of the variation in sucker growth.—G.A. Steneker, Northern Forest Research Centre, Edmonton, Alta., and R. Prasad, Chem. Control. Res. Inst., Ottawa, Ont.

Portable platforms for tree climbing.—An inexpensive, portable platform has been devised to aid foresters in tree climbing, tree sampling and bark inspection. (Can. J. Forest Res. 2:66 has some bearing on this subject). More convenient than ladders in rough terrain, it provides access to both sides of the tree and affords a flat surface on which to work.

Made of 10-gauge aluminum checker plate, the platform measures 10 x 10 inches. Two vertical supports, welded onto the underside of the foot plate, are right triangles with a base of 8 inches and a height of 10 inches. They are fastened under the platform, 8 inches apart, so as to project 1.3 inches beyond the inner edge of the foot plate allowing a more stable fit against trees of various diameters. The lower parts of the support plates are braced by welding a piece of 1.5-inch, 10-gauge angle aluminum between them, so as to avoid contact with the tree trunk when in use (Fig. 1—front). An 8-foot long, 1/8-inch stock galvanized chain is fastened to one inner corner of the foot plate by a 3/16-inch high-carbon steel bolt, 1-inch long, through one terminal link. The remainder of the chain encircles the tree and is secured with the grab-hook on the other inside foot-plate corner (Fig. 1-2, page 35). The approximate weight of a single unit and chain is 5 pounds.

The number of units required is based on a rise of 2.5 feet per unit. Several units may be mounted in a helical style for easier climbing, and two may be mounted diametrically. The platform also provides a firm base for microscopes, cameras or other apparatus. It has been used on trees 10 to 22 inches dbh. A standard safety rope should be used when working or resting. —D.W. Taylor, Pacific Forest Research Centre, Victoria, B.C.

TABLE 1

Sucker production and growth and soluble-sugar content of root samples from 13 trembling aspen clones collected at three different times

Sampling time	n	Avg sugar content (% dry wt)	SD	Avg number of suckers per clone	SD	Avg total length of three tallest suckers (inches)	SD	r sucker growth vs. % sugar	b sugar growth vs. % sugar
Before flushing	13	0.27	0.033	399	172	4.24	0.95	0.434	12.50
After flushing	13	0.24	0.039	350	190	3.74	1.14	0.558*	16.13*
Summer	13	0.21	0.024	414	170	3.47	1.29	0.693**	37.00**

r = correlation coefficient; b = regression coefficient; * $P < 0.05$; ** $P < 0.01$; SD = standard deviation

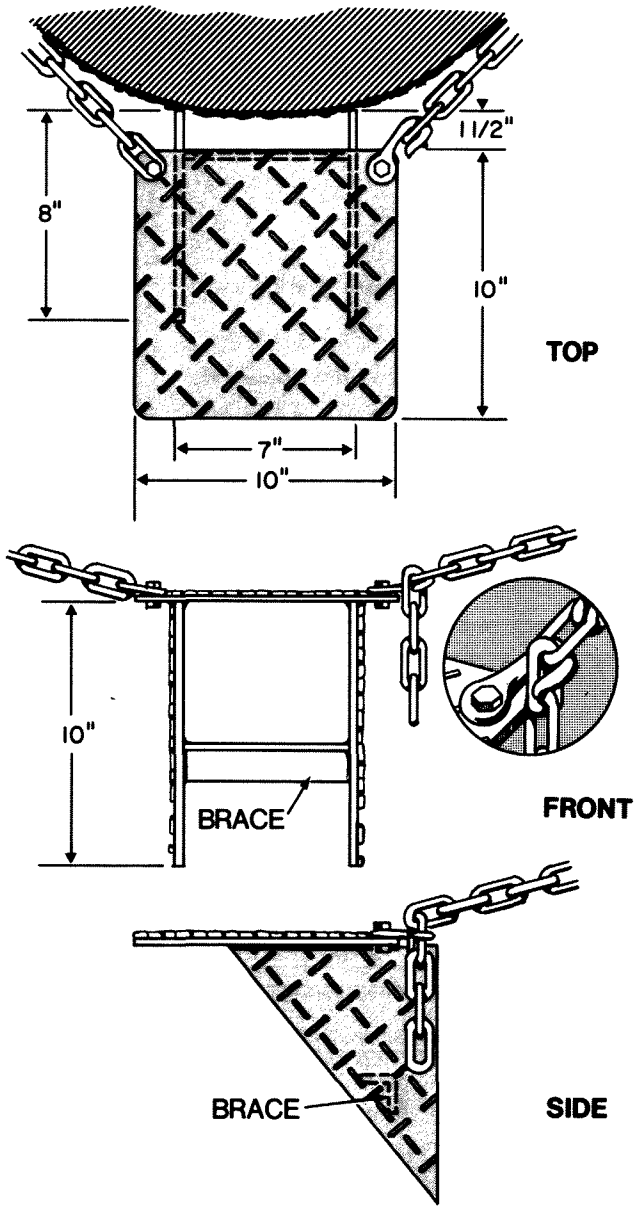

Figure 1. Detailed drawing of a single platform.

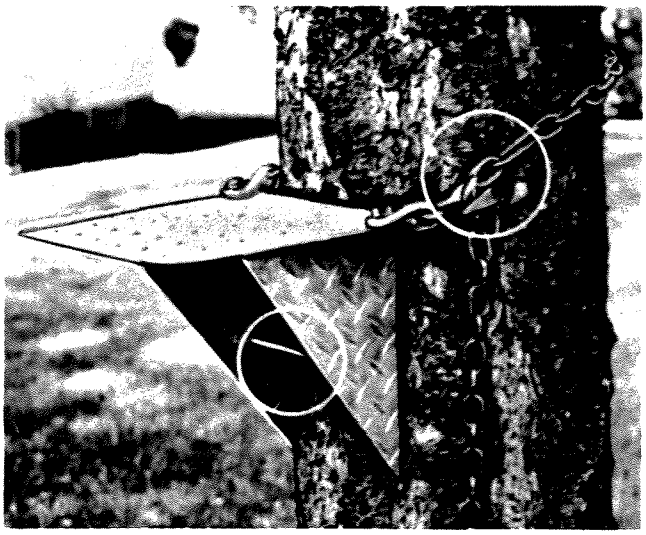

Figure 2. Installation of Porta-platform on a 14-inch dbh tree, showing stabilizing piece and securing method.

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(Continued on page 35)