

A Demonstration of the Theoretical and Practical
Aspects of Year-Round Fertility for the Growth and Development
of Woody Perennial Plant Species

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Introduction

It is generally agreed among nurserymen that the profitable production of woody perennial nursery stock calls for the growing of the biggest and best plants in the shortest period of time. To do this, however, it appears to be absolutely necessary, in most instances, that the essential nutrient elements be applied in adequate amounts and at the right time. Unfortunately, because of the lack of any good research information on how to fertilize woody perennial nursery plants, and having to resort to the use of fertilizer recommendations based primarily upon agronomic crops research, it is the opinion of the writer that most nursery stock today may be under, as well as, improperly fertilized.

With the present fertilizer practices, fertilizer applied in too large amounts or too late in the active part of the growing season, with the idea in mind of getting just a "little more" out of the plants, usually results in some type of plant injury either as a result of fertilizer burn or through low temperature freezing. Plant losses from these practices continue quite high each year. This very situation prompted the writer, during the middle 1950s while on the staff of North Carolina State University at Raleigh, North Carolina, to undertake an investigation to determine the cause or causes of winter injury and how to prevent it. From this work (results unpublished) evolved the writer's concept of YEAR-ROUND FERTILITY, a method of fertilizing woody perennial plants which has been found to produce that bigger and better plant in a shorter period of time than the conventional fertilizer program used in most nurseries today. This paper is an interim report of results of a test program begun on May 12, 1969, a cooperative effort between the Pachaug State Forest Nursery, Voluntown, Connecticut, Mr. Clarence (Pete) Merrill, Nurseryman, and Dr. Robert J. Schramm, Jr., Extension Nurseryman, Principal Investigator.

Year-Round Fertility - (Theoretical)

Basically, the concept of YEAR-ROUND FERTILITY calls for the adjustment or building up of all plant nutrients in the soil to maximum-optimum levels based upon the proper soil analyses and the maintaining of the nutrients at these levels through systematic soil sampling and periodic application of the required nutrients.

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especially N, P and K, while plants are growing in the subject soil. Under this program no nutrient element in the soil is believed to function under the "law of the minimum."

Previous research in North Carolina showed that plants grown under a program of YEAR-ROUND FERTILITY were, generally, of a much better quality, i.e. , were greener and contained more chlorophyll; were more winter-hardy; were more profusely branched; and with those plant species known for their flowering habit, had more flowers which opened sooner in the spring, stayed open longer with better color and substance, than plants grown with conventional fertility programs, i.e., fertilizer applied only during a specific part of the growing season, with little or no consideration given to soil testing and nutrient adjustments. In addition, and considered to be very important, the YEAR-ROUND FERTILITY program has resulted in a reduction in production time when compared with the conventional fertility program.

Year-Round Fertility - (Practical)

The growing of forest tree seedlings from seed to a pre-determined marketable size at the Pachaug State Forest Nursery in Voluntown, Connecticut, usually requires approximately three and one-half (3 1/2) years, spanning three full growing seasons . Seed beds are normally prepared and seeded in the fall of the year and in the spring following the third full growing season the seedlings are dug for sale. It should be understood that certain species may not require three full growing seasons to reach marketable size, for example, Asiatic Larch which can be grown to marketable size in two full growing seasons . The fertilizer program utilized by this nursery consists of liquid feed N, P and K for rising one-year seedlings, and a 10-10-10 complete fertilizer plus a urea application on 2 and 3 year seedlings; fertilizer applied only during the active part of the growing season.

Tests were initiated in the spring of 1969, utilizing 1, 2 and 3-year seedlings to study the effects and to determine the value of a YEAR-ROUND FERTILITY program on the growth of tree seedlings and to compare the YEAR-ROUND FERTILITY program with a conventional one. Results after 15 months of testing are given in Tables I and 2 and in Figure I attached. An examination of the data shows, without exception, that there is a distinct difference in plant size and quality in favor of the YEAR-ROUND FERTILITY program. There was no observable winter injury on any plant species in any test plot which could be attributed to late fertilizer applications, suggesting that fall and winter applications of fertilizer to woody perennial plants can be made with safety provided there is a balance of nutrients in the soil and in the plant. This is not possible with a conventional fertilizer program.

TABLE 1: COMPARISON OF THE GROWTH OF 3-0 YEAR FOREST TREE SEEDLING 1/
 UNDER YEAR-ROUND AND CONVENTIONAL FERTILIZER PROGRAMS IN THE NURSERY.
 AVERAGES OF 60 PLANTS PER SPECIES. (DATA - APRIL, 1970)

GROWTH CATEGORIES	P L A N T S P E C I E S													
	WHITE PINE		BLACK SPRUCE		WHITE SPRUCE		NORWAY SPRUCE		DOUGLAS FIR		ASIATIC LARCH		HEMLOCK ^{2/}	
	Y-R ^{3/}	C ^{3/}	Y-R	C	Y-R	C	Y-R	C	Y-R	C	Y-R	C	Y-R	C
Total Plant Weight ^{4/}	29.2	14.8	19.9	14.0	47.6	14.3	39.5	29.5	23.3	14.7	15.9	8.5	48.6	--
Shoot Weight ^{4/}	23.9	12.3	15.1	10.1	38.5	11.6	29.8	21.7	13.3	10.0	11.2	6.1	32.1	--
Root Weight ^{4/}	5.3	2.5	4.9	3.9	9.1	2.7	9.7	7.8	10.1	4.7	4.8	2.4	16.5	--
Root/Shoot Ratio	0.221	0.203	0.324	0.387	0.236	0.232	0.325	0.359	0.759	0.470	0.428	0.393	0.514	--
Plant Height ^{5/}	10.7	9.5	7.7	6.9	17.7	12.5	17.9	12.8	8.9	9.0	15.2	13.7	12.2	--

^{1/} All seedlings grown with the conventional fertilizer program for two seasons prior to the initiation of Year-Round fertilizer test program. Seedlings dug and sold in April, 1970.

^{2/} Plants from Conventional Program lost.

^{3/} Y-R = Year-Round Fertility; C = Conventional Fertility.

^{4/} Fresh Weight in Grams.

^{5/} Height in Inches.

PLANT HEIGHT - INCHES

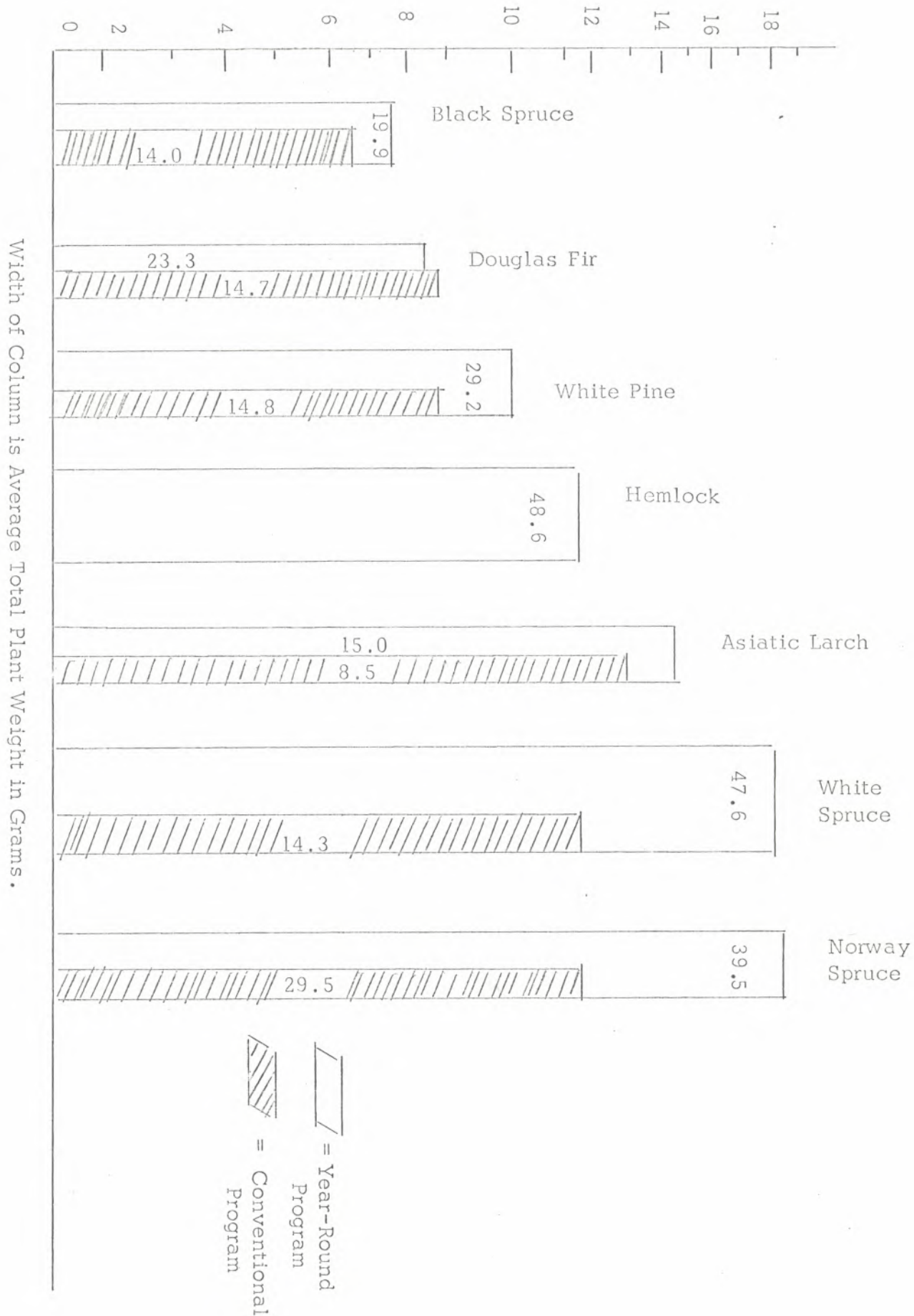


FIG. 1. GROWTH OF 3-0 YEAR FOREST TREE SEEDLINGS UNDER YEAR-ROUND AND CONVENTIONAL FERTILIZER PROGRAMS IN THE NURSERY. AVERAGES OF 60 PLANTS PER SPECIES. (DATA-APRIL, 1970).

TABLE 2: GROWTH OF 1-0 AND 2-0 YEAR FOREST TREE SEEDLINGS^{1/}
 UNDER YEAR-ROUND AND CONVENTIONAL FERTILIZER PROGRAMS IN
 THE NURSERY. AVERAGES OF 30 PLANTS PER SPECIES. (DATA-JULY, 1970)

AGE ^{2/} GROUP	GROWTH CATEGORIES	P L A N T S P E C I E S									
		White Pine		White Spruce		Norway Spruce		Douglas ^{3/} Fir		Asiatic ^{4/} Larch	
		Y-R ^{5/}	C ^{5/}	Y-R	C	Y-R	C	Y-R	C	Y-R	C
0-2	Stem Diameter ^{6/}	7.3	5.5	7.5	4.9	7.1	5.4	6.6	6.6	---	---
	Plant Height ^{6/}	15.7	13.0	18.7	11.7	17.5	10.4	12.4	9.8	---	---
0-1	Stem Diameter	5.0	3.8	5.4	4.2	5.1	3.9	---	---	7.7	6.0
	Plant Height	7.3	6.1	12.4	9.1	12.5	9.1	---	---	19.8	14.0

^{1/} The 1-0 year seedlings were started on the conventional fertilizer program at time of seeding (Fall of 1968) but put on the year-round program on May 12, 1969. The 2-0 year seedlings were grown for one full season with the conventional fertilizer program prior to initiation of year-round test program on May 12, 1969. TEST PROGRAM NOW IN ITS 15TH MONTH (August 12, 1970)

^{2/} Ages of plants at time of initiation of test of May 12, 1969.

^{3/} Visual differences too slight to warrant measurements at this time.

^{4/} No plants of this species grown beyond the spring of the 3rd growing season.

^{5/} Estimates of percent of plants (Average of 30 plants counted) per 2 square feet of bed area showing second growth at time of measurement (July 1970) are: (2-0) 70% for Y-R program and 23% Conventional: (1-0) 47% for Y-R program and 20% for Conventional. Plots to be counted again in October, 1970.

^{6/} Stem diameter in 32nds of an inch at 1 inch above soil level. Plant height in inches.