MS 16 4/10/84 Report
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INTRODUCTION

In 1971 the University of Idaho in cooperation with the USDA Forest Service, Potlatch Corporation, the Idaho Department of Lands, and several other land management companies initiated a forest tree nutrition study to evaluate the effects of thinning and nitrogen fertilization.[1/] Thirty-seven installations were located on grand fir, western redcedar, and western hemlock habitat types throughout northern Idaho. Each installation was located in a predominately Douglas-fir or grand fir stand of reasonably uniform structure. Stand ages ranged from 15 to 80 years. Each installation consisted of eight, approximately 1/10 acre (0.04 ha) square plots.[2/] Two replicates of four treatments were randomly assigned:

1) control
2) fertilized only with 200 #/A of nitrogen as urea, applied in the spring of 1972
3) thinned only to approximately 15 x 15 feet spacing the summer and fall of 1971
4) thinned as in (3) and fertilized as in (2), above

Soil parent material underlying these forest stands include:

1) granites of the Idaho and Kaniksu Batholiths
2) basalts from the Columbia River basalt flows
3) metasediments of the Belt Supergroup
4) glacial deposits and
5) aeolian deposits of clay and volcanic ash

Thus, soils represented in this study vary greatly in texture, structure and fertility.

[1/] McIntire-Stennis Project

[2/] Four of the installations were actually a part of the same stand as 4 other installations because each stand was a nearly equal mix of Douglas-fir and grand fir. Therefore each stand with two installations actually consisted of 12 plots (2 control, 2 fertilized only, 4 thinned in favor of Douglas-fir, and 4 thinned in favor of grand fir; fertilization was super-imposed on 2 plots of each thinning group). In the analysis, one of each double installation was considered complete, the other was considered to have a missing fertilizer-only treatment.

Recorded Data

The species and diameter of all trees on the plot were recorded when the plots were installed. For thinned plots these measurements were recorded only after the plots were thinned. On a subsample of trees on each plot (6 to 10 trees), past 10-year radial increment and total tree height was measured. At subsequent two-year intervals over an eight-year period, diameters were remeasured for all live trees on every plot and the heights of live trees with previously recorded heights were remeasured. At each installation, habitat type, stand age, slope, site index, and elevation were recorded.

Growth Summaries

Initial measurements and adjusted (for initial basal area) growth values for 2, 4, 6 and 8 years following treatment were standardized to represent values per acre and then summarized in two ways. First, these values were summed over all trees that were living when the stand was remeasured. Mortality was summarized separately. Sums for successive measurement periods, then, represent total growth on trees surviving since time of treatment application (net growth).

Alternatively, the largest 140 trees per acre represented by the plot trees were evaluated. Trees that were dead by the 8-year remeasurement period and trees with dead or broken tops and old-growth residual trees were excluded.

Mortality

The number and basal area of trees that died during each remeasurement period was recorded. Mortality on fertilized-only plots was compared to control plots for each remeasurement period (Figs 1 and 2). Mortality on plots that had been thinned was low and was not analyzed.

Response Estimates

Net basal area and volume growth response to 200 #/A of nitrogen are presented for unthinned stands in Tables 1 and 2 and for thinned stands in Tables 3 and 4. Response values are presented for 4 remeasurement periods. Comparing response by period should be done with caution, however, since these values represent net response and therefore differ in number and size from period to period.

Net basal area volume growth response to 200 #/A of nitrogen are presented for the largest 140 trees per acre represented by each plot in Tables 5-6, for unthinned stands, and Tables 7-8, for thinned stands.

Responses represent differences in growth means, within thinning levels, adjusted for differences in initial basal area. No data is provided for the comparison of thinned only stands to control or for thinned and fertilized stands to control.

Duration of Response

Because the data set including the 140 largest trees per acre surviving the 8-year period is free from the influence of mortality, response values for each 2-year period following treatment may be compared. Duration of response for basal area and volume growth are presented in Tables 9 and 10, for unthinned stands, and Tables 11 and 12 for thinned stands.

Table 1. Mean basal area growth response to 200 lbs/acre-N applied to unthinned stands.

	2-YR	4-YR	6-YR	8-YR
Basal Area Growth (sq.ft./acre/yr)	0.87	1.11	0.95	0.78
Percent	16	21	18	15

Table 2. Mean Volume growth response to 200 lbs/acre-N applied to unthinned stands.

	2-YR	4-YR	6-YR	8-YR
Volume Growth (cu.ft/acre/yr)	26	41	36	30
Percent	17	27	22	17

Table 3. Mean basal area growth response to 200 lbs/acre-N applied to thinned stands.

	2-YR	4-YR	6-YR	8-YR
Basal Area Growth (sq.ft./acre/yr)	0.81	0.92	0.76	0.61
Percent	18	19	10	11

Table 4. Mean volume growth response to 200 lbs/acre-N applied to thinned stands.

	2-YR	4-YR	6-YR	8-YR
Volume Growth (cu.ft./acre/yr)	25.4	31.1	26.4	22.6
Percent	15	18	14	11

Table 5. Mean basal area growth response to 200 lbs/acre-N by the largest 140 trees per acre represented in unthinned stands.

	2-YR	4-YR	6-YR	8-YR
Basal Area Growth (sq.ft./acre/yr)	0.42	0.53	0.49	0.40
Percent	17	22	18	15

Table 6. Mean volume growth response to 200 lbs/acre-N by the largest 140 trees/acre represented in unthinned stands. Means are adjusted for differences in initial basal area.

	2-YR	4-YR	6-YR	8-YR
Volume Growth (cu.ft./acre/yr)	12.4	19.4	18.7	16.0
Percent	14	21	19	15

Table 7. Mean basal area growth response to 200 lbs/acre-N by the largest 140 trees/acre represented in thinned stands.

	2-YR	4-YR	6-YR	8-YR
Basal Area Growth (sq.ft./acre/yr)	0.54	0.66	0.57	0.46
Percent	19	21	17	13

Table 8. Mean volume growth response to 200 lbs/acre-N by the largest 140 trees/acre represented in thinned stands.

	2-YR	4-YR	6-YR	8-YR
Volume Growth (cu.ft./acre/yr)	18.2	23.9	22.1	19.5
Percent	18	22	18	15

Table 9. Duration of basal area growth response to 200 lbs/acre-N by the largest 140 trees per acre represented in unthinned stands.

	1st 2-Yrs	2nd 2-Yrs	3rd 2-Yrs	4th 2-Yrs
Basal Area Growth (sq.ft./acre/yr)	0.42	0.65	0.38	0.16
Percent	17	26	13	6

Table 10. Duration of volume growth response to 200 lbs/acre-N by the largest 140 trees per acre represented in unthinned stands.

	1st 2-Yrs	2nd 2-Yrs	3rd 2-Yrs	4th 2-Yrs
Volume Growth (cu.ft./acre/yr)	12.4	26.4	17.3	7.7
Percent	14	28	15	7

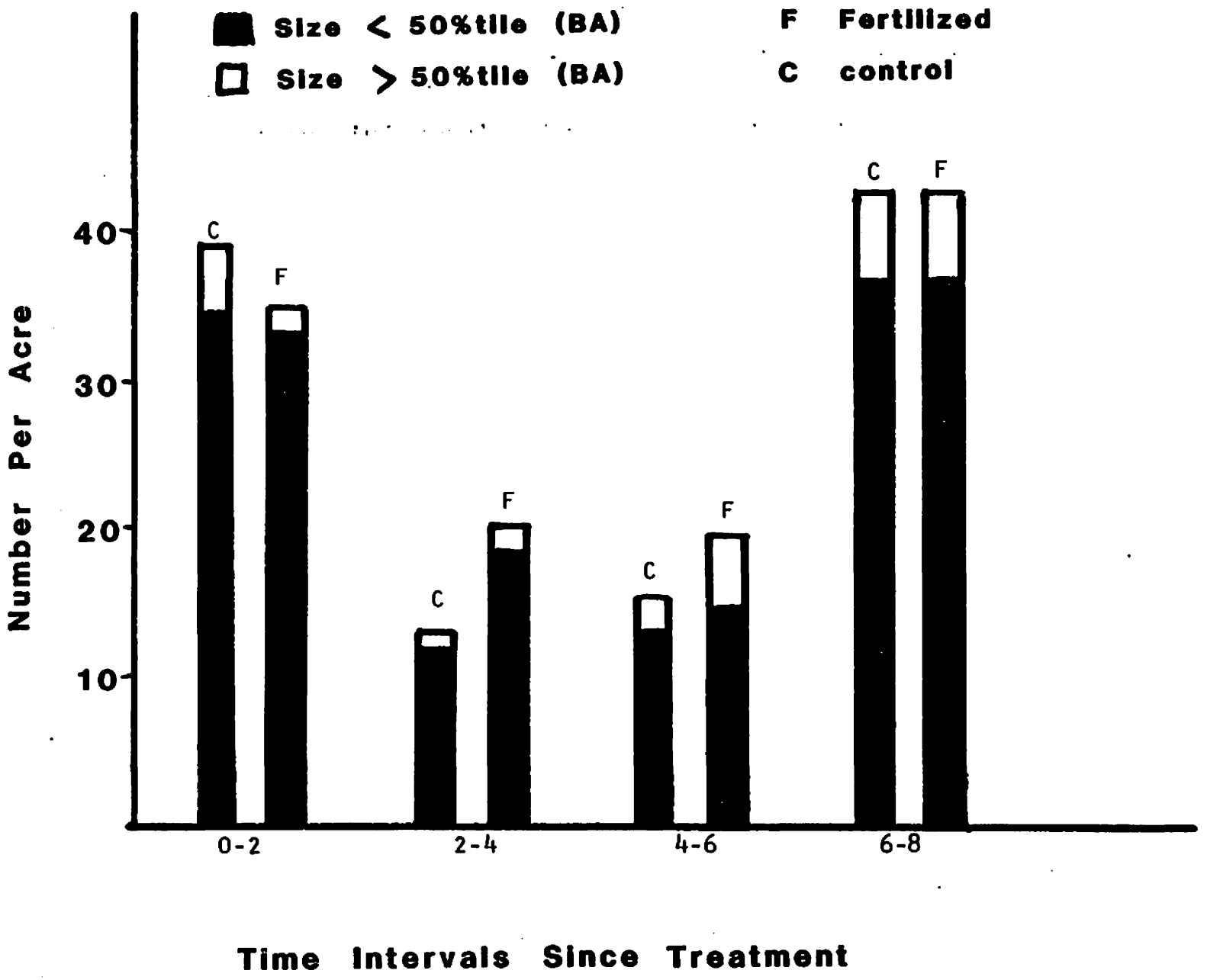
Table 11. Duration of basal area growth response to 200 lbs//acre-N by the largest 140 trees per acre represented in thinned stands.

	1st 2-Yrs	2nd 2-Yrs	3rd 2-Yrs	4th 2-Yrs
Basal Area Growth (sq.ft./acre/yr)	0.54	0.77	0.39	0.14
Percent	19	23	10	4

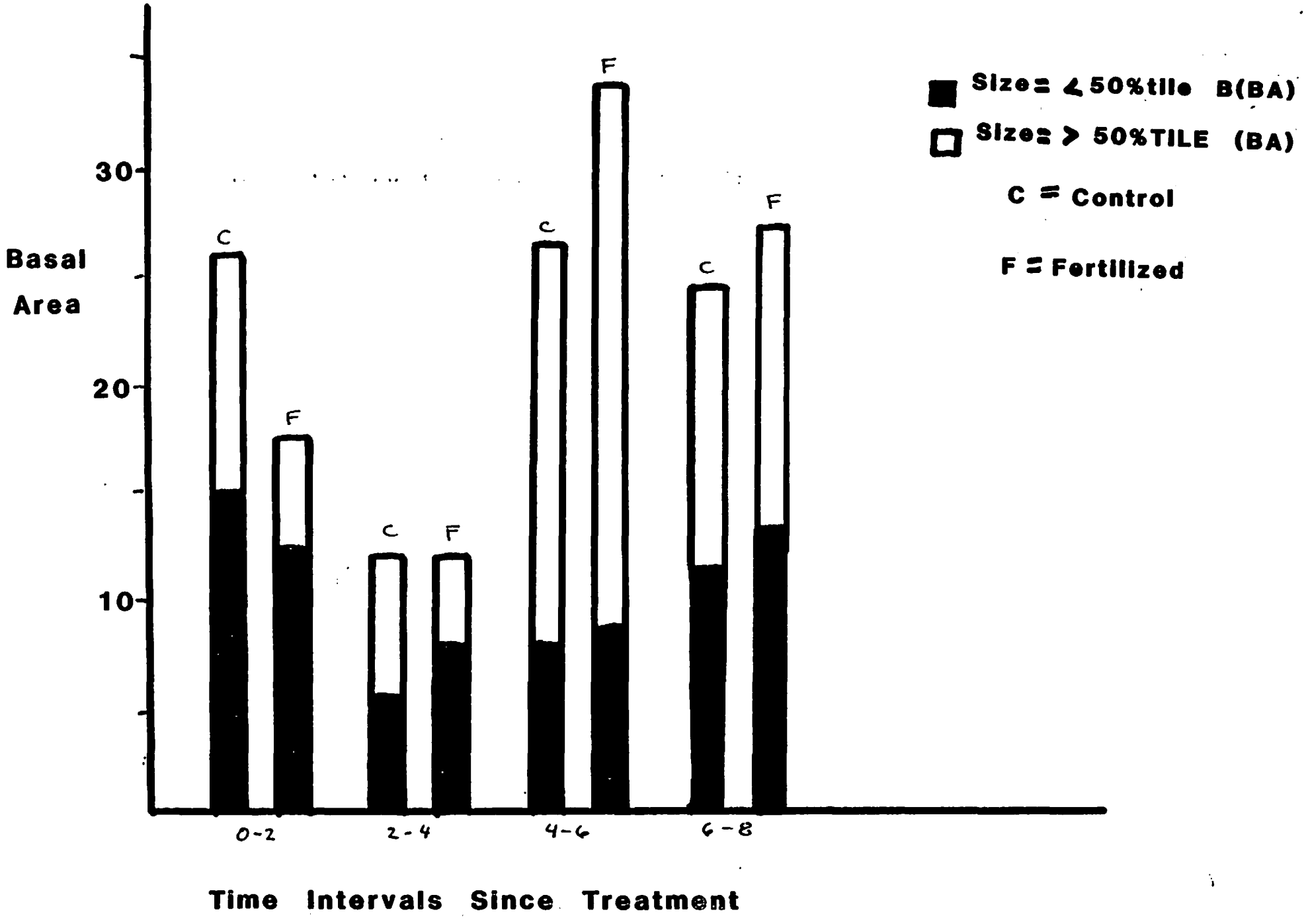
Table 12. Duration of volume growth response to 200 lbs/acre-N by the largest 140 trees per acre represented in thinned stands.

	1st 2-Yrs	2nd 2-Yrs	3rd 2-Yrs	4th 2-Yrs
Volume Growth (cu.ft./acre/yr)	18.2	29.7	18.4	11.6
Percent	18	25	12	8

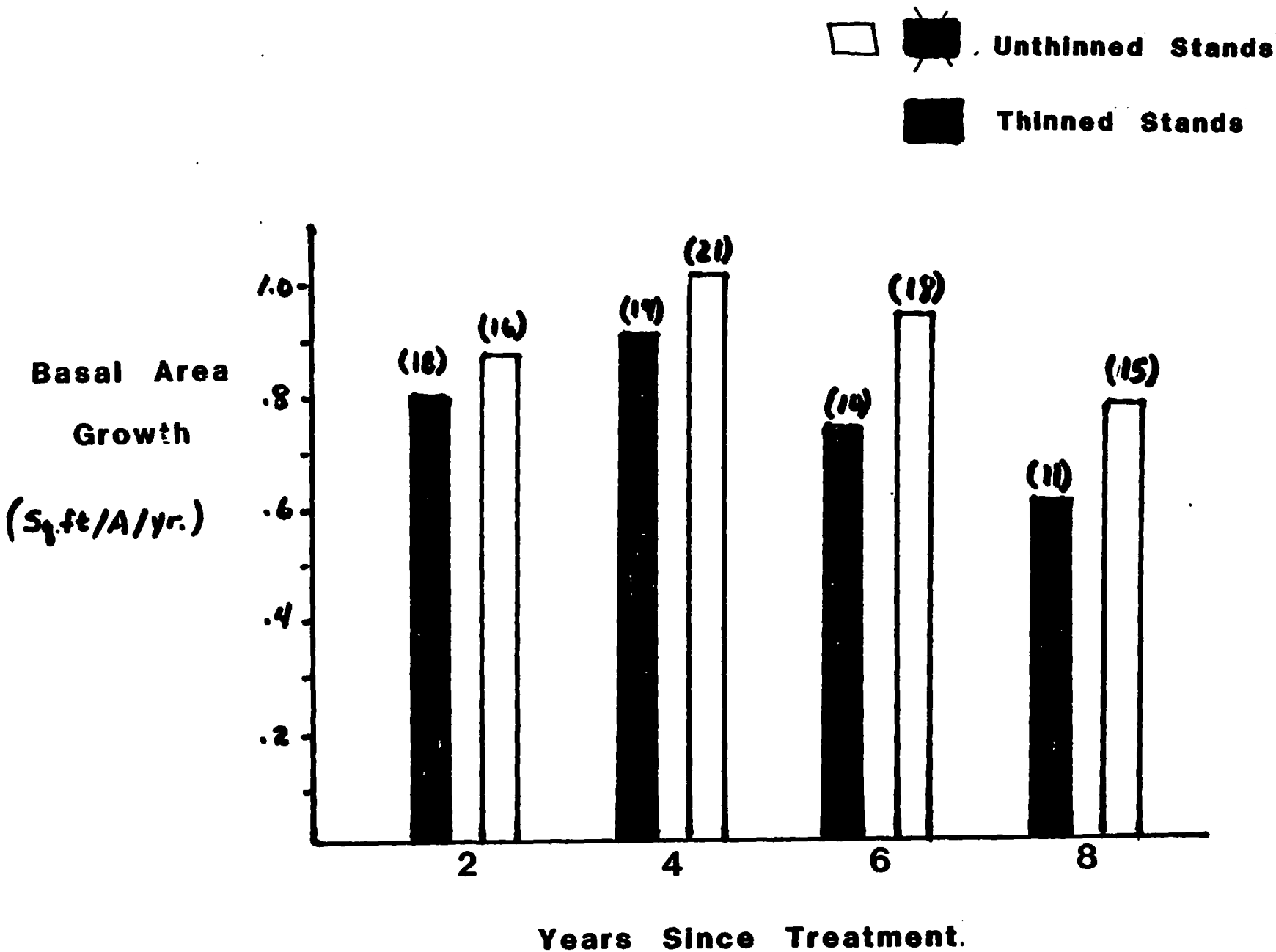
Periodic Mortality IN Unthinned Stands By Size Class



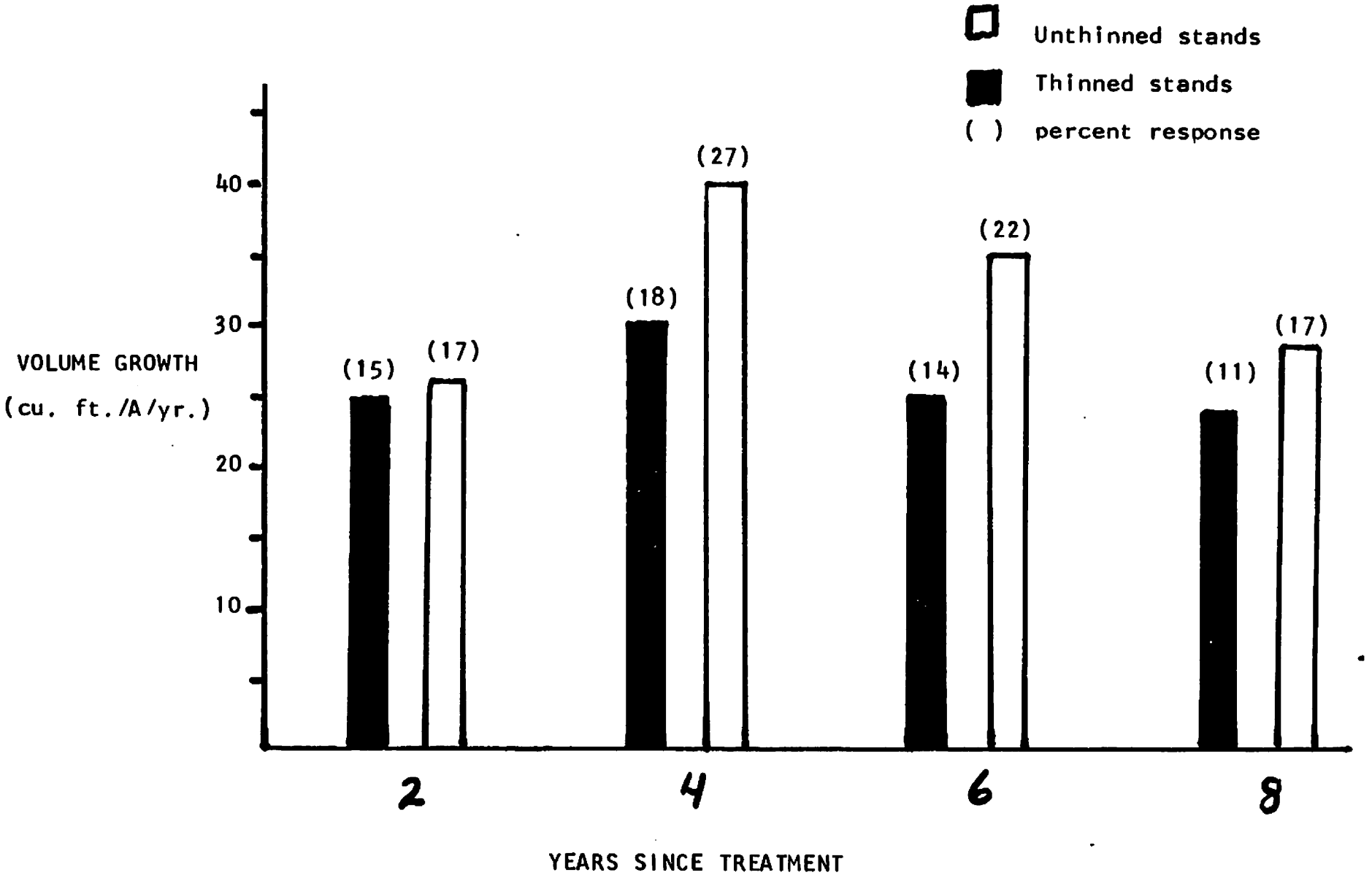
Periodic Mortality In Unthinned Stands By Class Size



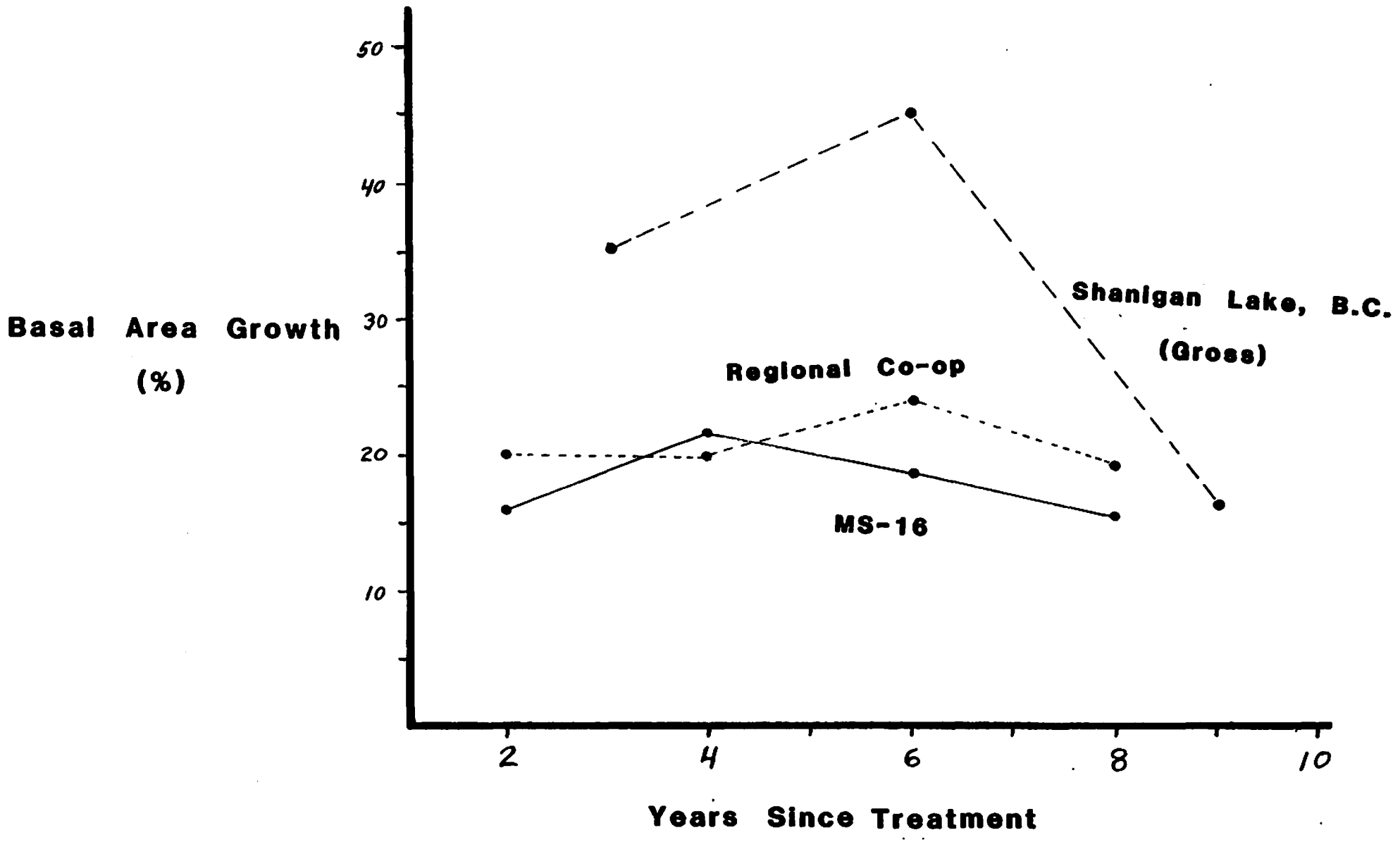
Response To N-Fertilization



RESPONSE TO N-FERTILIZATION

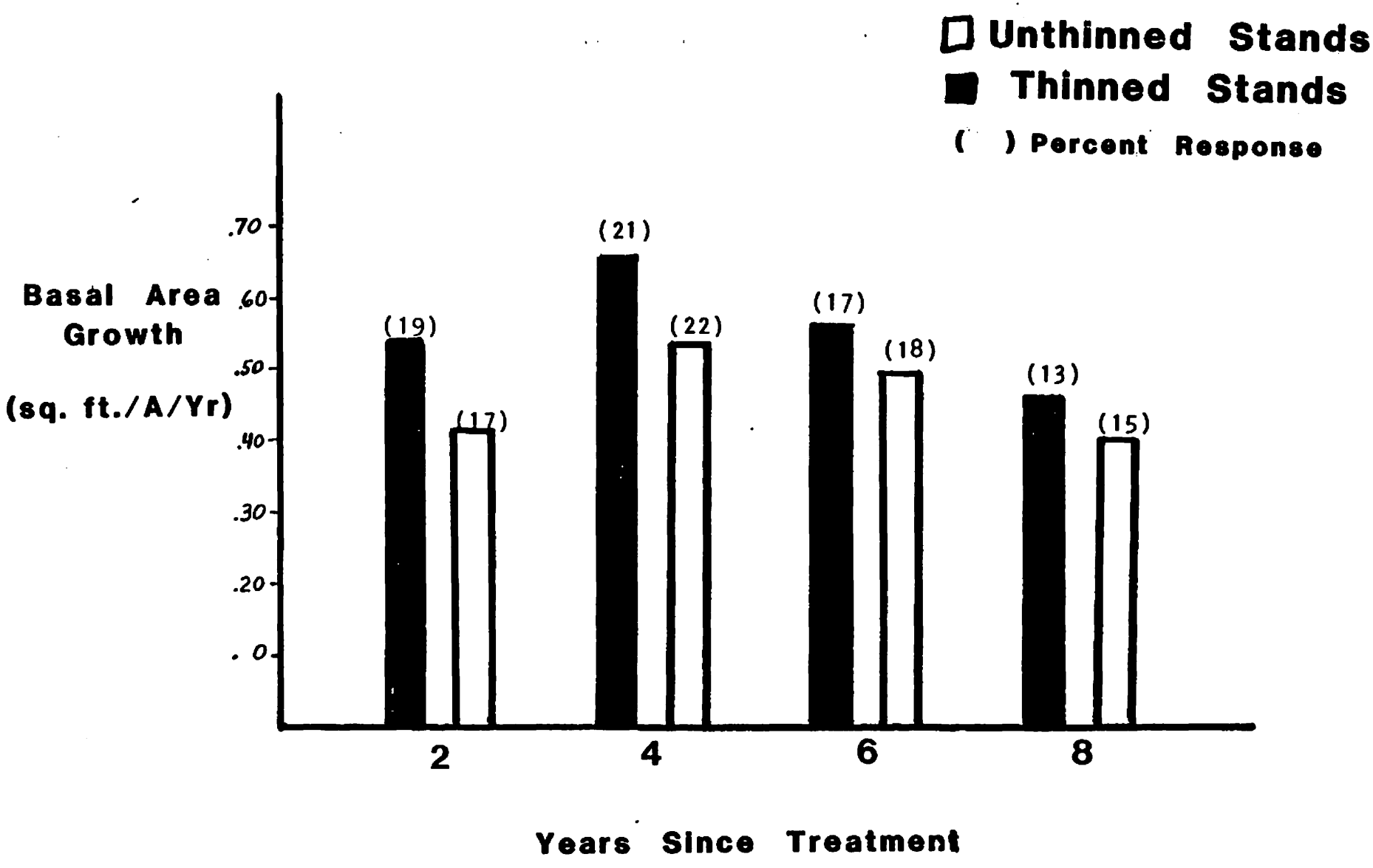


Response Trends



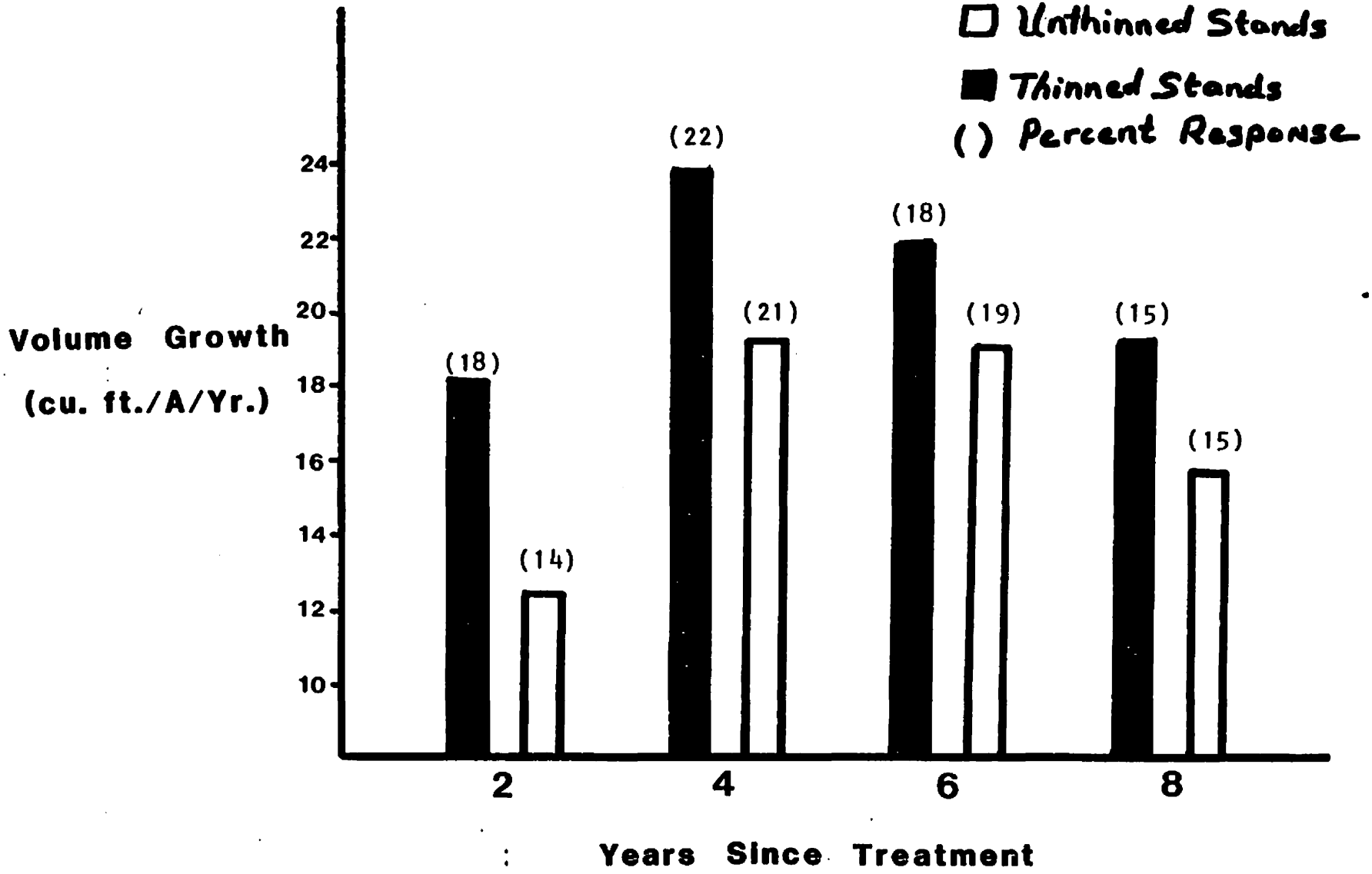
Response To N-Fertilization

By Largest 140 Trees Per Acre



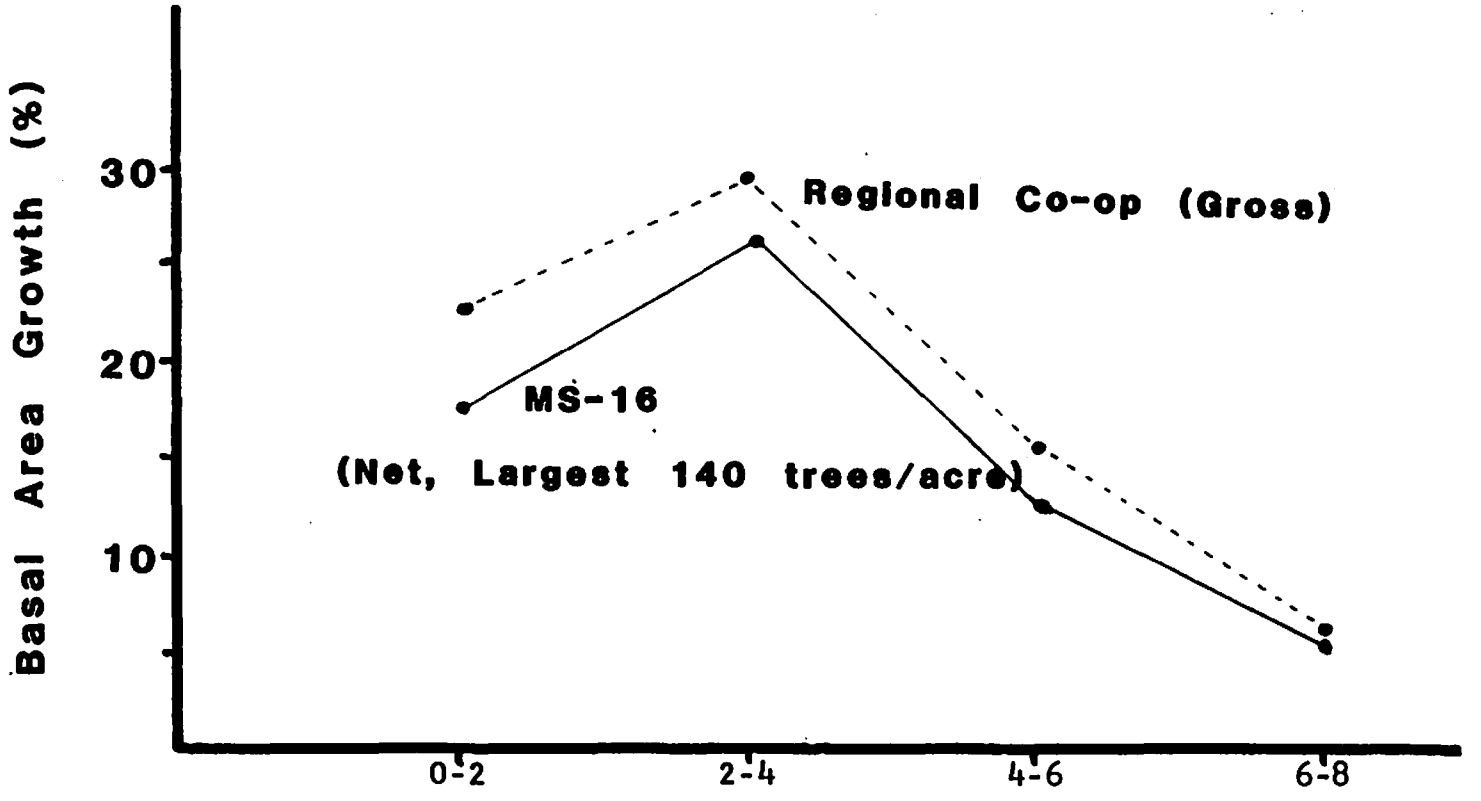
RESPONSE TO N-FERTILIZATION

Largest 140 trees/acre



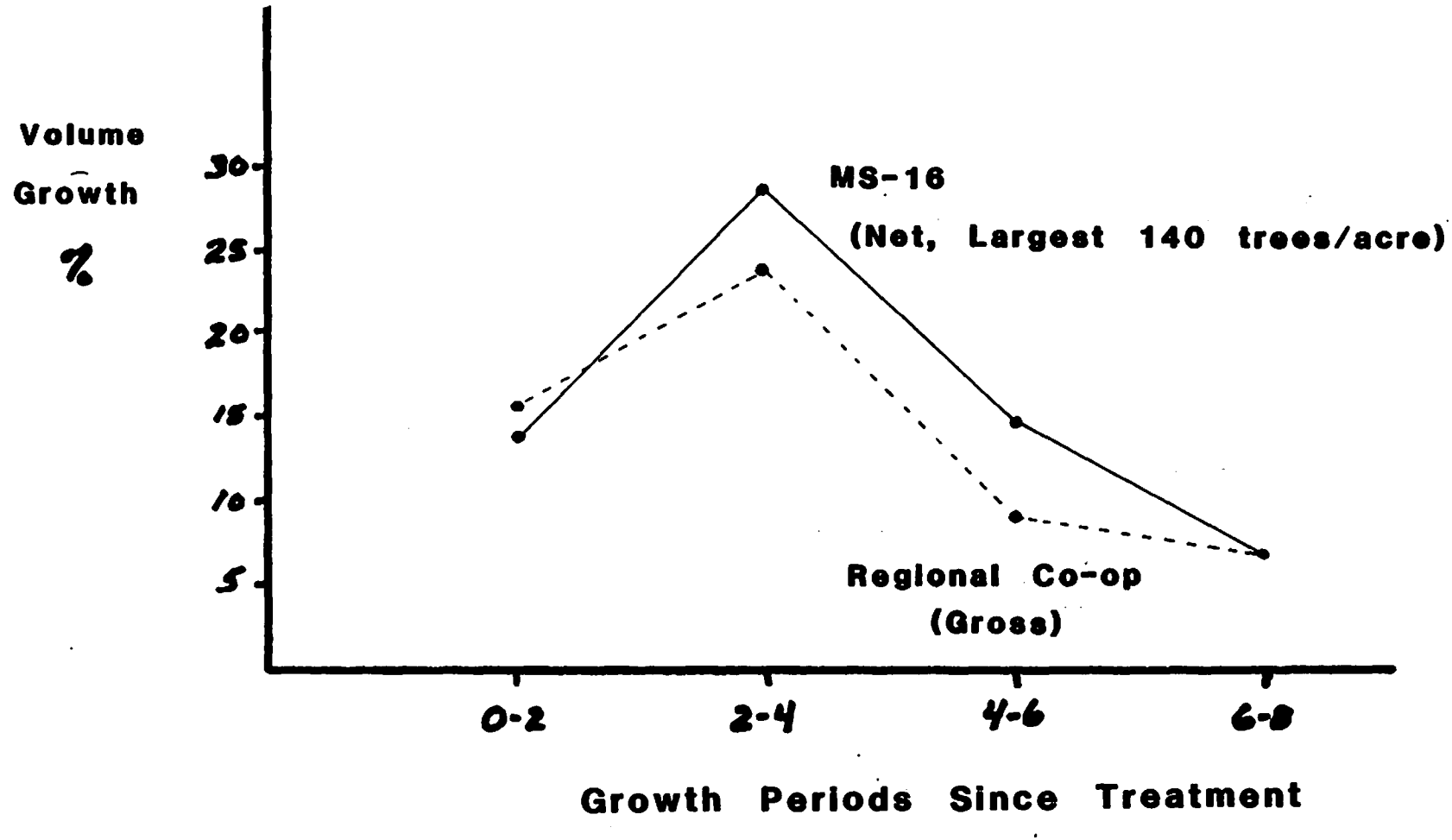
Duration of N-Response

Unthinned Stands

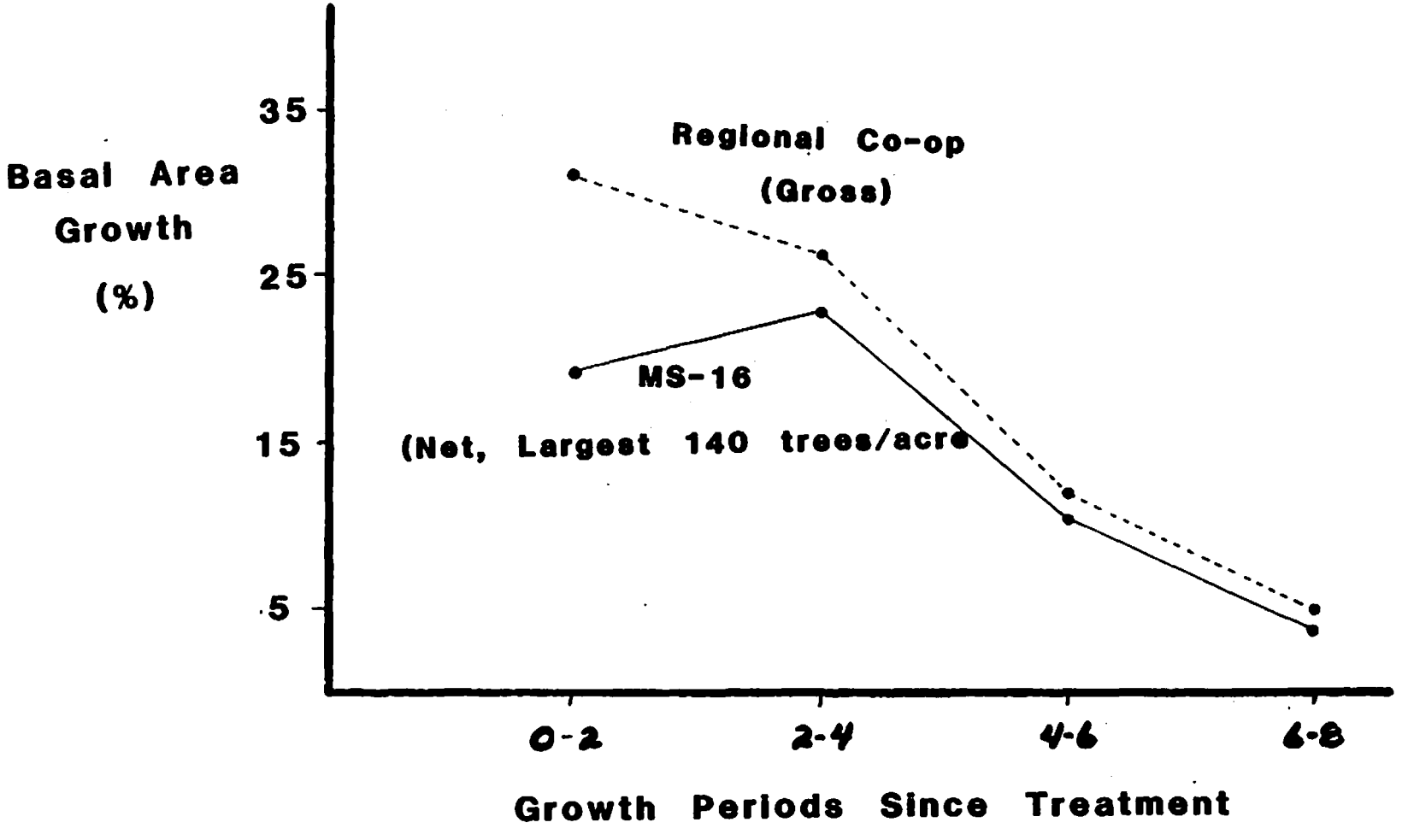


Duration of N-Response

Unthinned Stands

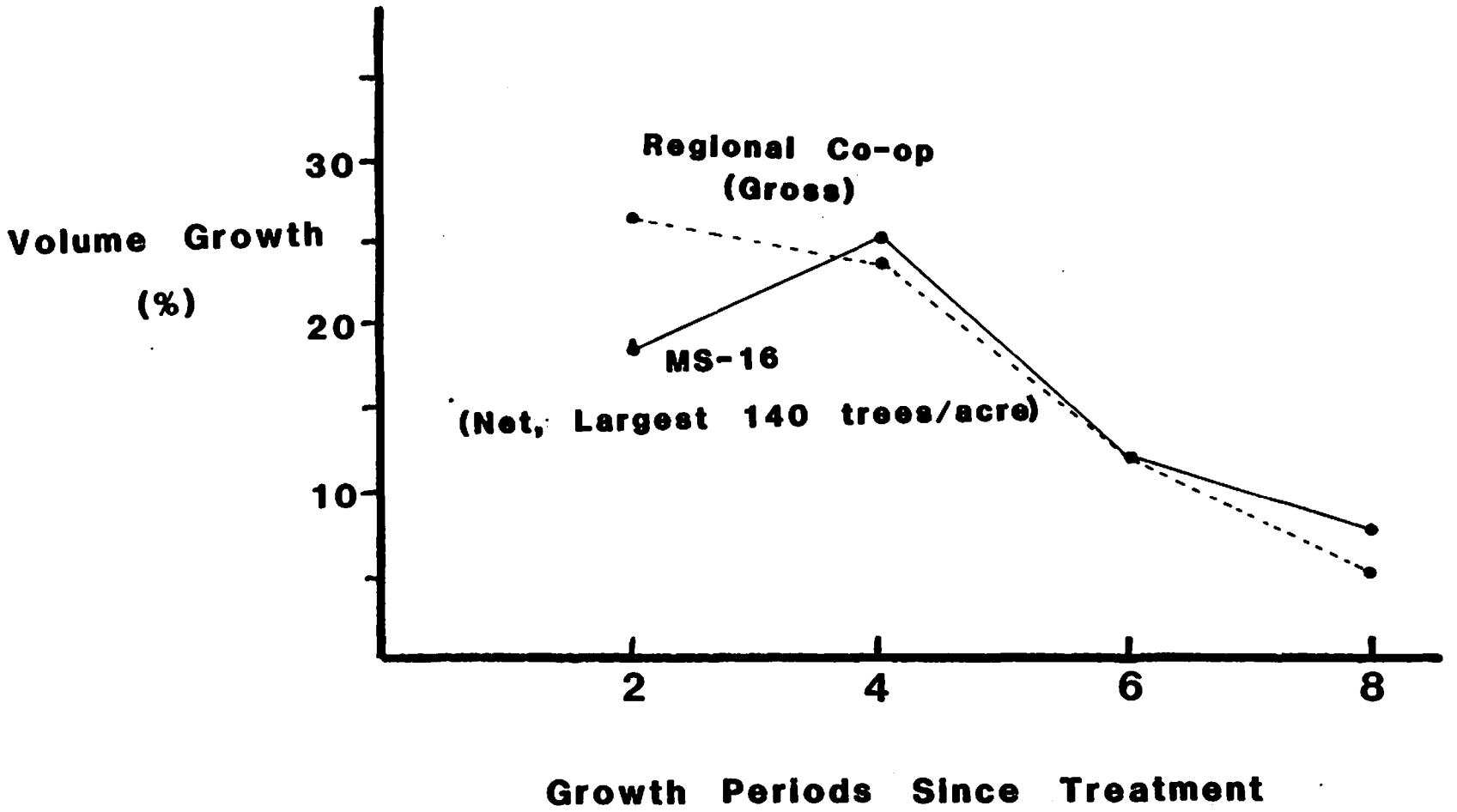


Duration of N-Response
Thinned Stands



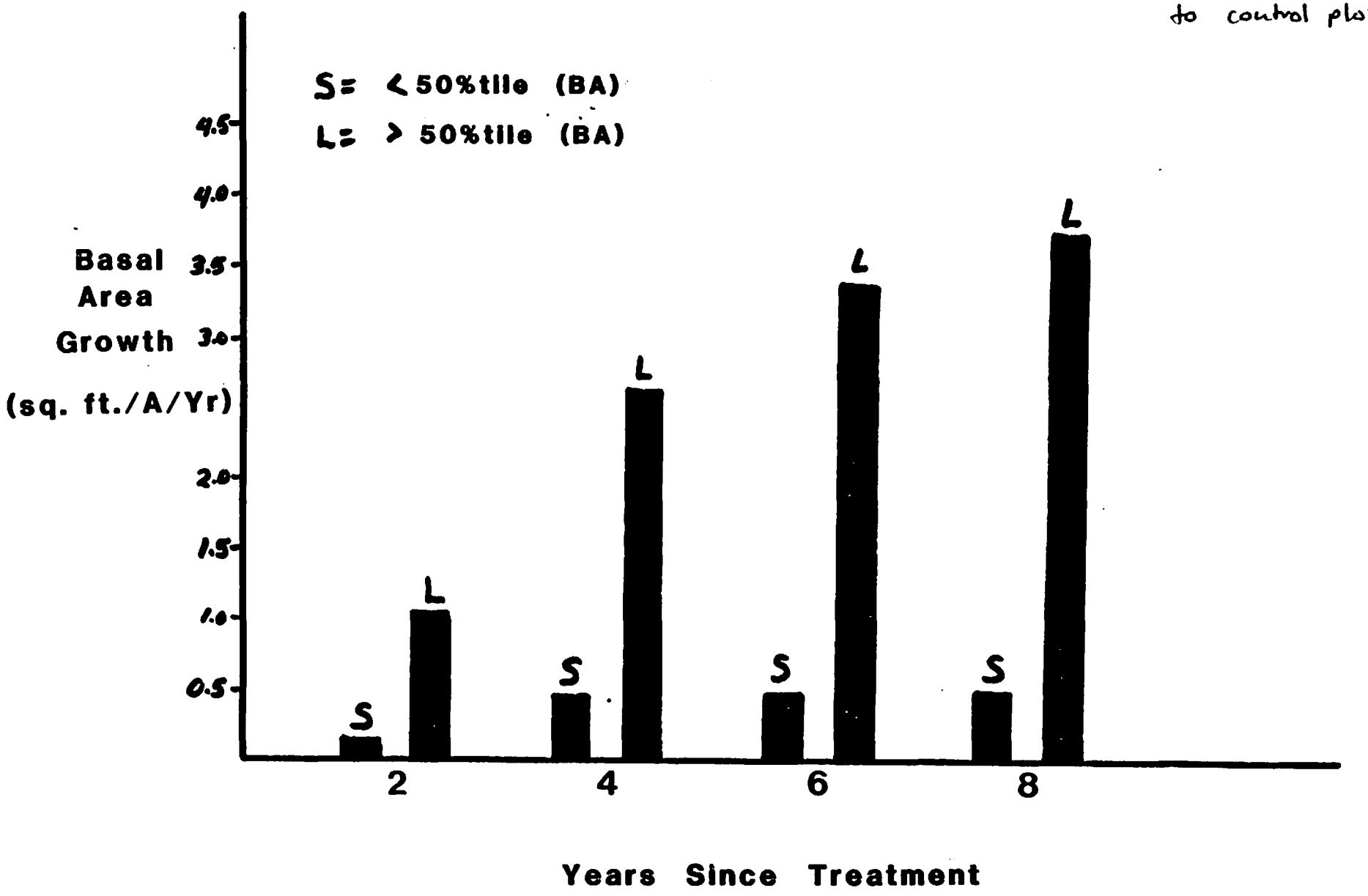
Duration of N-Response

Thinned Stands



Effect of Fertilizing Only By Size Class

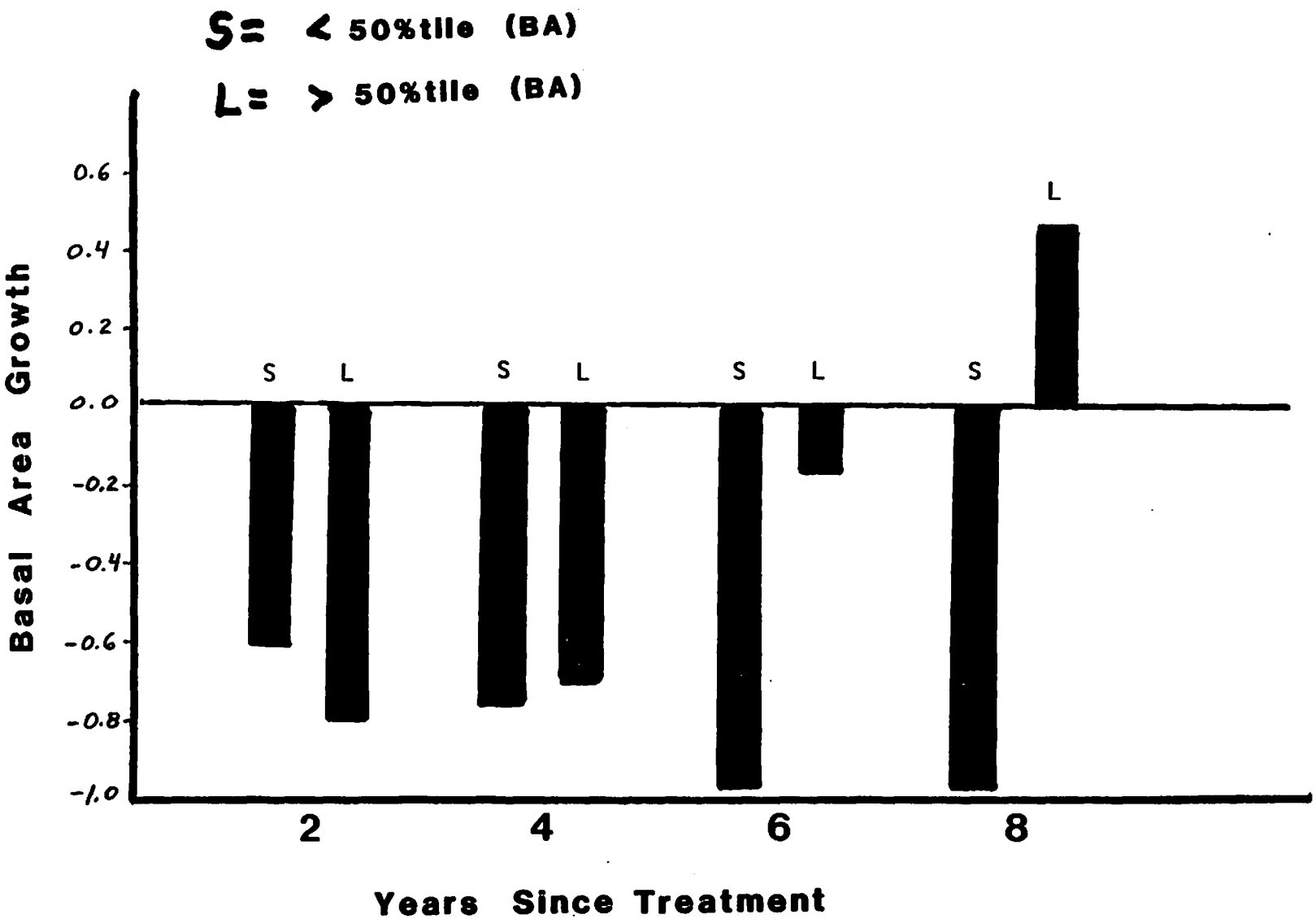
Note: comparisons are to control plots



Effect of Thinning Only

By

Size Class



Effect of Thinning and Fertilizing By Size Class