Intensive Culture Of Black Cherry

By L. R. AUCHMOODY

The recently-released Timber Resources Review forecasts increasing demands for wood and wood products through the end of this century. If these demands are to be met, particularly in view of a shrinking forest-land base, then widespread use of intensive culture must ultimately be adopted.

Two cultural techniques being looked at more and more closely as ways of increasing productivity are the use of genetically-improved planting stock having the ability to produce more wood than is obtainable from wildland populations, and the application of fertilizers to nutrient-deficient forest sites.

At Warren, Pennsylvania, Northeastern Forest Experiment Station researchers are studying ways to increase yields of black cherry and other important associated species by application of fertilizers. Through our present research program we expect to develop prescriptions for use of fertilizers, including criteria for diagnostic evaluation of nutrient deficiencies and fertilizer needs in managed and unmanaged black cherry stands.

Also, in cooperation with Forest Service Region 9, we hope to select black cherry genotypes that produce maximum response to applied fertilizers.

Research Under Way

Our current effort in intensive culture began in 1971. That spring we established a cooperative study with the Allegheny National Forest to determine the effects of nitrogen and phosphorus fertilizers on vegetative growth and early flowering and fruiting of seed-orchard black cherry.

The objective of this study is to enhance the growth of the orchard trees and hasten the availability of genetically-improved materials by stimulating seed production at an early age. This test includes 17 open-pollinated black cherry families selected for superior form and growth rates (fig. 1). To date the orchard trees—located in Pennsylvania—have been fertilized twice annually for the past three years and are now in their fifth season since planting.

With some evidence of the growth responsiveness of black cherry to fertilization from first-year results of our seed-orchard program, we began in the following spring (1972) additional fertilizer trials with natural populations. Plots were established in 50- to 70-year-old unmanaged cherry-maple stands and with three-year-old regeneration obtained after a harvest cutting. Each trial was designed to identify growth-limiting nutrients and/or nutrient combinations, and to assess the potential growing impact from fertilization in unmanaged black cherry stands growing on the most common soils of the northern Allegheny Plateau.

FIGURE 1. *This plus-tree candidate was 105 feet tall at age 60.*

The series of plots in 50- to 70-year-old stands were replicated at six locations on the Allegheny National Forest, four plots per replicate for a total of 24. All test stands were fully stocked, contained a high proportion of black cherry, and showed no evidence of nutrient disorder.

Treatments included a control, and addition of nitrogen alone, nitrogen plus phosphorus, and nitrogen plus phosphorus plus potassium, applied annually for two successive years.

Plots were 1.2 acres in size, including a 40-foot-wide fertilized buffer zone surrounding a centrally located ½-acre plot upon which growth measurements are being made. All trees larger than 4.5 inches at breast height were fitted with aluminum band dendrometers to insure accurate growth measurements. Other trees, down to one-inch, are measured with a diameter tape at permanently marked points.

The study includes about 9,000 trees, of which approximately 4,000 are equipped with dendrometers. Growth on 320 of these trees is being monitored at weekly intervals throughout the growing season in addition to the annual measurement of all trees.

We feel that these plots are large enough to simulate a commercial fertilizer operation and will therefore provide some reliable estimates of basal-area growth response and its duration for the water-soluble fertilizer formulations that were used.

The series of plots established with three-year-old regeneration were comparatively simple in design. There were three treatments: control, nitrogen only, and nitrogen plus phosphorus. Treatments were replicated six times in one contiguous area. The objective is simply to see if nitrogen and phosphorus are limiting factors to growth on recently cut-over forest sites. Soils are moderately-well to well drained sandy loams, identical to those tested in the series of plots in middle-aged stands. Positive results obtained in the work with regeneration led to

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installation of a more comprehensive test the following spring (1973).

There were 20 treatments in all. Treatments were replicated three times in young cherry stands ranging in age from five to 12 years. Also, series of plots were established with smaller regeneration at three other test sites. In this series, nitrogen was broadcast at rates assumed high enough to produce maximum yield without having phytotoxic effects.

In total, height and basal-area growth are being monitored on 1,400 saplings and seedlings in these trials. In addition to measuring growth response, we are also developing diagnostic criteria, based upon foliar nutrient concentrations, that can be used to delineate areas that need fertilizer treatment.

Interim Results

In the past three years we have established fertilization tests at 14 independent sites on the Allegheny National Forest, representing some 116 individual plots. Although most of the growth data have not yet been completely analyzed, the following is a capsulized account of what we have observed so far:

1. Fertilization tests with open-pollinated black cherry families show that certain families are quite responsive to fertilization, while others respond only slightly or not at all (fig. 2). This means that black cherry is variable in its nutrient requirements for maximum growth and that an opportunity exists for producing genetically improved stock that will respond to fertilization. For example, after two years of fertilization, the five fastest-growing families with fertilization grew 53 per cent more in height and 146 per cent more in basal area than did the five fastest-growing families without fertilization.

In addition to stimulating growth, fertilization with nitrogen and phosphorus promoted early flowering. Though it is still too soon to draw firm conclusions, the fact that all flower-bearing trees were fertilized and that only four of the 17 families produced flowers suggests that early flowering can be induced by fertilization and that it is under strong genetic control in black cherry.

2. In the test series with middle-aged stands we have not yet progressed far enough in the growth analysis to know whether or not any of the added nutrients have produced a clear-cut response in stem growth. However, it is clear at this time that all the fertilizer treatments have resulted in greater branch growth in the uppermost sections of the crown, larger leaves, larger total quantities of foliage per tree, and a change in leaf color from a lighter to a darker green.

Broadcasting nitrogen as urea at a rate of 150 lbs/acre N has consistently been toxic to four- to six-inch tall advance regeneration of black cherry, red maple, sugar maple, and other ground cover in un-cut stands. Because these plants are shallow-rooted, death is probably the result of desiccation due to high salt concentrations within their zone of rooting. Larger advance regeneration having well-established root systems is unaffected.

3. Our tests in young stands (three to 12 years old) have shown consistent and dramatic response of black cherry to nitrogen and phosphorus. Appreciable response is obtainable from nitrogen alone, but the full

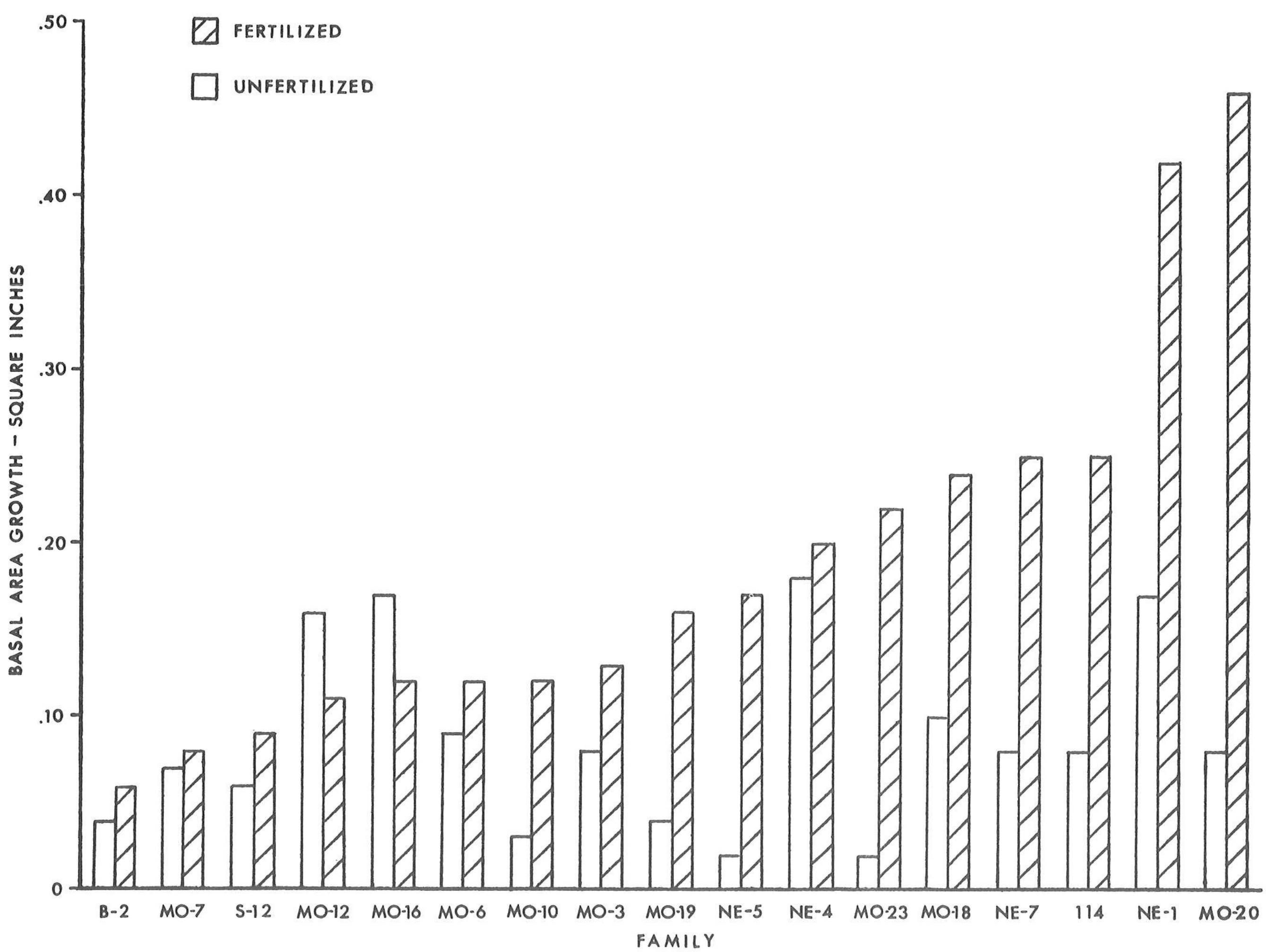

FIGURE 2. *Two-year basal-area response of 17 black cherry families to nitrogen and phosphorus fertilization.*

growth benefits from fertilization can be obtained only when phosphorus is applied simultaneously. The addition of potassium, even at high application rates of nitrogen and phosphorus, has had relatively small effect.

Maximum growth rates were reached when nitrogen was supplied at 300 lbs/acre N in combination with 100 lbs/acre P_2O_5; higher fertilization rates produced no additional growth response. Field observations have confirmed that as much as eight feet of terminal growth is obtainable with young black cherry in a single growing season by fertilization—a four-fold increase over normal growth rates for unfertilized stands. From these results, we feel that fertilization will become an important cultural technique in management of young black cherry stands in this region.

Future Plans

Our current studies have shown that there are real possibilities for substantially increasing yields of black cherry through genetic selection and by fertilization. However, much additional work is still necessary for complete understanding of stand nutrient requirements, their behavioral patterns after fertilization, and in identifying nutrient-deficient sites.

In addition to following up on work now under way, in forthcoming years we plan to expand our effort in four general areas:

1. Evaluate different fertilizer materials. This includes slow-release nitrogen sources, sources of phosphorus not prone to fixation in acid soils, and lime.

2. Evaluate thinning/fertilizer interactions in middle-aged and young stands.

3. Evaluate the responsiveness to fertilization of an enlarged number of half-sib black cherry families. We will also be on the look-out for exceptionally responsive trees located in field plots that can be added to our present population.

4. Evaluate the use of fertilizers in a pilot-scale operation for improving the success of newly regenerated stands in the presence of an exceptionally heavy deer population.

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