# CENTRAL HARDWOOD NOTES

## Fertilizing Natural Stands

Given our present knowledge, and under current costs and returns, there appears to be little reason to fertilize natural stands of central hardwoods. Yet, some of the numerous fertilizer tests conducted with hardwoods over the past 50 years have shown very positive--but short-lived-growth responses. One "operational" (non-experimental) use of nitrogen and phosphorus fertilizers on new black cherry stands has been successful on about 10,000 acres in northwestern Pennsylvania, on the fringe of the central hardwoods. Current costs of about 135 dollars per acre are justified by rapid height growth on soils severely deficient in nitrogen and phosphorus. This allows well established seedlings to outgrow severe deer browsing over the short term, avoiding spotty reproduction and occasional complete regeneration failure.

If you are seriously considering fertilization, read this background material and then consult local or regional experts before you proceed.

### Requirements for Growth Responses

Forest responses to fertilizers are affected by many factors and, therefore, will vary greatly throughout the region. Three major requirements essential for responses to occur are: (1) species that will respond; (2) no limiting growth factors such as soil moisture deficits or excesses, or adverse climate: and (3) nutrient deficient soils.

Generally, the lesser the shade tolerance of a species, the greater its response to fertilization. Fast growing intolerants like yellow-poplar, white ash, sycamore, and black cherry have high nutrient requirements and the growth capacity to respond to fertilization. Intermediates like red maple and some oaks may respond to fertilization, but less than the intolerants. Tolerant black gum, beech, sugar maple, chestnut oak, and the hickories are least responsive. Also important is that young stands are more responsive than old stands.

The largest fertilization responses will occur where nothing other than nutrient deficiencies limit the site. Sites with good soil moisture are good candidates for fertilization. Poor sites are hot and dry southern exposures that support unresponsive species, sites with shallow or very stony soils, wet sites, and sites with adverse climate.

Of the 16 elements required for normal tree growth and development, nitrogen and phosphorus are the most important. Throughout the region, nitrogen almost always has been the primary limiting nutrient with phosphorus deficiencies of strictly secondary importance. For the majority of sites this means that nitrogen

alone will produce a response; that a larger response may be possible with nitrogen plus phosphorus; and that little repsonse can be expected with phosphorus alone where nitrogen is the primary limiting nutrient. Potassium can also be limiting on very coarse sandy soils.

## How Fertilizers Increase Growth

When forests are fertilized the trees absorb the nutrients and build up foliage. Nitrogen particularly stimulates leaf size and number. It also produces dark green color leaves with improved photosynthetic efficiency. Bigger crowns and improved photosynthesis mean faster growth.

Diameter growth accelerates during the main part of the growing season and continues longer into autumn. Nitrogen fertilization also seems to sustain growth during dry periods, but does not stimulate growth earlier in the spring. In unthinned stands, fertilization also encourages expression of dominance and accelerates stand development. The larger dominant and codominant trees of responsive species grow faster, and intermediate and suppressed trees grow slower and die due to the increased competition.

Most growth from nitrogen fertilizer is temporary. Growth surges during the first several seasons after a single fertilization, then gradually declines as foliage mass declines and the added nitrogen diminishes to original levels. In hardwoods, growth from a single application of nitrogen rarely lasts more than five years. Continued growth depends on a continued supply of nitrogen over and above natural levels.

## Fertilizer Use

Follow these simple guidelines if you are considering fertilizing hardwood stands:

1. *Be sure there is adequate justification or a special circumstance for a long-term investment in fertilizer.*
2. *Select the proper fertilizer.-High analysis urea* (45 percent nitrogen) and *ammonium nitrate* (33 percent nitrogen) are the most readily available and most commonly used nitrogen fertilizers. Ammonium nitrate provides an immediate supply of nitrate that can be absorbed in large quantities as well as providing a supply of ammonium. It is not subject to volatilization loss and it seems to stimulate growth of certain hardwoods more than urea. *Triple superphosphate* (46) is commonly used to supply phosphorus.
3. Select *stands* to *be* treated.-Young stands of intolerant, nutrient-demanding species are the most likely to respond. Very young seedling stands, such as those that develop immediately after clearcutting, should not be fertilized until they have developed strong roots that have penetrated mineral soil deeply. Very young stands can suffer serious mortality from an overdose of nitrogen. Fertilize stands only on good soils with no obvious site limitations.

4. *Fertilize at appropriate* rates.-Experience has shown that most hardwood stands will respond to nitrogen at rates ranging from 150 to 300 pounds of nitrogen per acre (equivalent to 450 to 900 Ibs per acre ammonium nitrate and 333 to 666 Ibs per acre urea). Appropriate phosphorus rates range from 40 to 80 pounds per acre (217 to 434 Ibs per acre triple superphosphate).
5. *Apply fertilizers at the proper* time.-Apply nitrogen in the spring when leaves are emerging and nutrient demands are high. Earlier applications when the vegetation is dormant are subject to leaching losses. Applications late in the growing season may not provide the nitrogen when needed. Phosphorus is not subject to leaching and can be applied before or simultaneously with the nitrogen.
6. *Apply fertilizers* evenly.-An even distribution of both nitrogen and phosphorus is best but the initial distribution of nitrogen is less critical than for phosphorus. “Double coverage” is best, applications made at right angles to each other.

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