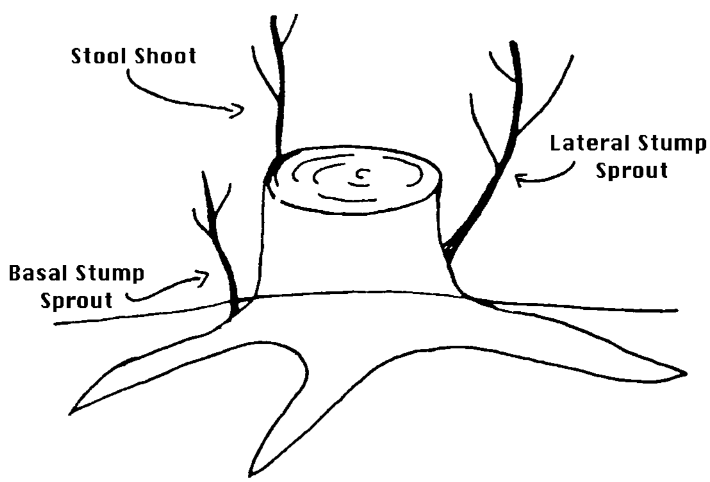
FORESTRY EXTENSION NOTES

COPPICE MANAGEMENT OF IOWA HARD WOODS

Many tree species found in Iowa forests are capable of resprouting from the stump or root system after they are cut. This is referred to as coppice regeneration. It can be a valuable asset in regenerating Iowa forests after timber harvests, and it is a very efficient way of starting successive crops of trees in fuelwood management of hardwoods. It can also be used as a means of renovating young hardwood plantations (for example, walnut) that have poorly formed stems due to establishment problems. On the other hand, sprouting of low value hardwoods sometimes interferes with more desired species and one may wish to suppress coppice regeneration. This bulletin specifies the principles and techniques that should be followed to either promote or retard coppice regeneration.



Sprouts arising from a stump

Sprout Origin

Stool shoots, lateral stump sprouts, basal stump sprouts, seedling sprouts and root sprouts are the major types of coppice regeneration.

STOOL SHOOT - Shoots may grow out of the wound tissue *(callus)* that forms between the bark and wood when a tree is cut. A large number of such shoots may arise, but they usually are short-lived and undesirable because they lack a good connection to the root system.

LATERAL STUMP SPROUTS - When the top of a tree is cut or injured, the flow of hormones down the stem is interrupted. This releases dormant buds at scattered positions along the stem and allows them to develop as new shoots. The shoots nearest the top of the stump tend to shade out lower sprouts and become dominant. However, the sprouts high on a stump are not desirable because they remain dependent on the old stem and roots. They are often invaded by decay organisms as the old structures rot, and may be easily broken off because of the sharp angle of attachment.

BASAL STUMP SPROUTS - Many hardwood tree species have a large number of dormant

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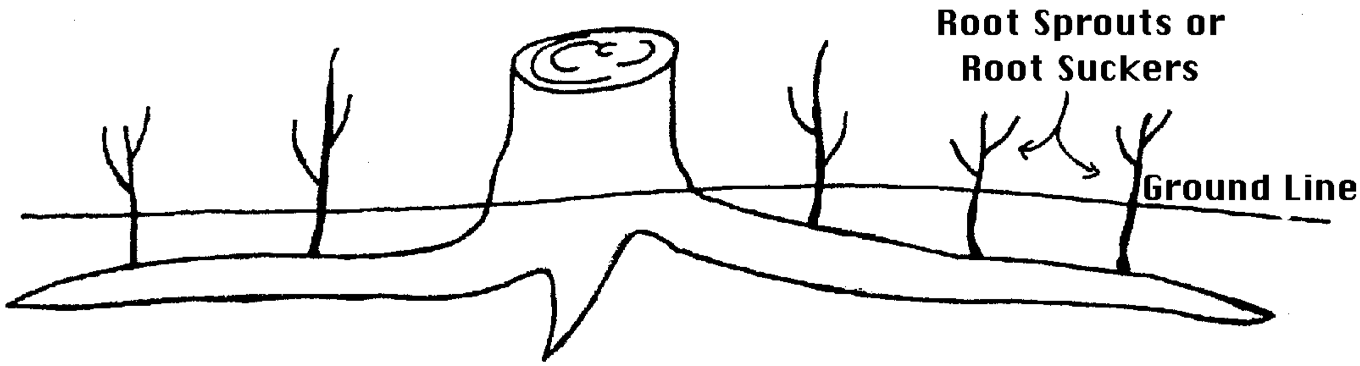
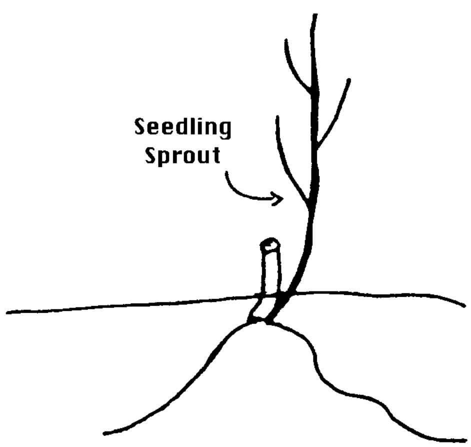


Sprouts arising from a root system

buds clustered at the *root collar,* which is the transition zone between the stem and the roots that occurs just below the ground line.
These buds are also released from dormancy when the tree is cut or injured. They form the most desirable stump sprouts because of their below-ground attachment. Basal stump sprouts will eventually form their own roots, will have a stronger, less acute angle of attachment to the old tree, and will often have sealed off possible entry of decay organisms by the time the stump rots down to their level.



Sprouts from a small tree

SEEDLING SPROUT - Stump sprouts arising from stumps less than two inches in diameter are given this special name because they often will grow rapidly enough to engulf the old stem and take on the same desirable form and qualities as a seedling does. Growth, death, and resprouting may be repeated over the years in the understory of a forest until an opening is available in which the trees may grow. Hence, the roots may be as much as 40 years older than the stem of a seedling sprout.

ROOT SPROUTS OR SUCKERS - In some species there is little or no potential for stump sprouting; instead, sprouts arise from various points along the roots when the flow of hormones from the tree top is interrupted. These sprouts can arise at considerable distance from the main stem and give rise to much greater tree densities than in the original forest. Within one or two seasons after sprouting, these suckers begin forming their own root systems and gradually become independent of one another and the parent tree. They generally are not invaded by rot unless it spreads very early in their development.

Because stump and root sprouts inherit the root system of the original tree they are usually capable of much more rapid growth than comparably sized seedlings. For example, oak sprouts typically grow at a rate of about two feet per year for the first 8 to 10 years; this is at least four to eight times faster than the growth rate of seedlings. However, later in the growth cycle stump sprouts may grow slower and be less windfirm than trees of seed origin because of the asymmetric attachment to a root system. Some basal stump sprouts and all lateral sprouts will have undesirable basal sweep where they attach to the stumps. All genetic qualities and deformities of the original tree are carried over into the new stand by coppice regeneration.

Species Characteristics

The type and vigor of coppice regeneration varies by species. Oaks, maples, chestnut, and basswoods are the most vigorous of the stump sprouters. In many oak forests as much as 75 to 80 percent of all the trees are the result of stump or seedling sprouts. Ashes, hickories, sycamore, cottonwood, alder, willow, and elm are good stump sprouters at young ages but lose much of this potential as they age. Walnut and hackberry sprout well only as seedlings and saplings. Significant natural reproduction from root sprouting occurs only in aspens and black locust, although old hickory, hard maple, and elm trees may also give rise to limited numbers of root sprouts.

Considerations and Techniques in Coppice Management

In addition to species differences, sprouting varies by age, stump diameter, site quality, season of harvest, and stump height.

As a general rule, sprouting is most vigorous from juvenile trees (before trees reach the age of seed production). In oaks, the number and vigor of sprouts produced increases up to a stump diameter of six to eight inches. Beyond that size the capability for and growth potential of sprouts decline gradually to zero at an age of 100 to 150 years. The smaller the stump diameter, the less likely the sprouts will be infected with decay.

The better the site is for tree growth, the better the sprouting. On moist sites, sprouts will tend to arise higher on the stump.

It is quite important to consider the season of harvest because good sprout growth depends on food reserves stored in the root system. These stored reserves are highest during the dormant season from November to early March. They are lowest just after full leaf expansion in the spring. Therefore, sprout success and growth will be about three times better if harvesting of the original stems is done in the winter. To retard regrowth of unwanted trees they should be cut after leaf expansion or late in the summer when the new sprouts will not have sufficient time to harden off before winter.

With small trees stump height has an effect on sprouting vigor and with larger trees it has an effect on sprout quality. In trees with a stump diameter of less than five inches the stump height left above ground should be six to eight inches; the increased food storage left in this stump can double subsequent growth. On larger trees it would be best to cut as close to the ground as possible to favor the formation of basal sprouts. In any case, stump height should not exceed 12 inches because high stumps are likely to product high lateral sprouts that shade out the better basal sprouts. These are likely to fail later due to breakage, poor moisture uptake, and/or decay. In renovating young plantations of walnut or other species it would be best to cut close to the ground, foregoing some growth potential to improve the form of the sprout base. One problem species in Iowa forests, ironwood, has few basal sprouts. By cutting it next to the ground it can be retarded in its resprouting capacity.

Most stumps more than one-half inch in diameter will give rise to two or more sprouts. In one Iowa study of white oak, there was an average of 23 sprouts per stump at the end of the first year. These sprouts compete for light and control over the old system, and there will be considerable natural thinning by mortality over the first few years. In the study previously mentioned, the 23 sprouts declined to an average of five to eight per stump at age 10. Often two or three sprouts will persist to maturity giving undesirable tree form and diluting potential growth into multiple stems. Therefore, some thinning of sprouts is recommended. If form is a prime consideration (as it would be for walnut sprouts), the sprouts should be thinned back to the best single sprout during the second or third growing season. In other cases it is probably best to let natural thinning do most of the work, waiting until there is only a few stems to remove at about age five to 10. This thinning should yield some stems meeting fuelwood dimensions. One caution should be observed; if the stems are large enough to have begun forming heartwood, their removal opens the stump sprouting system to potential invasion by decay.

When harvesting is done in natural stands or plantations with a goal of obtaining good coppice regeneration, the harvested areas should be at least one-half acre clear-cuts. The developing sprouts need full sunlight to have enough energy to maintain the large root system they have inherited.

Little or no site preparation is needed for coppice regeneration since no seedbed is needed. Young, poorly formed advance regeneration in the understory should be broken off to the extent feasible. This will give rise to more, well-formed, fast-growing seedling sprouts. In disposing of the slash from a timber harvest, up to two feet of brush can be piled on stumps that are likely to produce multiple sprouts. This will cut the number of sprouts produced to about half and speed the growth of the remaining sprouts.

Two U.S. Forest Service publications listed below are available that allow one to predict the success of coppice regeneration of oak stands.

The foregoing considerations and techniques can be used to promote vigorous sprout growth where desired. Alternatively, these principles can be used against sprouting vegetation to favor planted or seeded trees.

References

McQuilkin, Robert A. 1975. Growth of four types of white oak reproduction after clearcutting in the Missouri Ozarks. USDA For. Serv. Res. Rep. Pap. NC-116, 5 p., illus. North Cent. For Exp. Stn., St. Paul, MN.

Johnson, Paul S. 1977. Predicting oak stump spouting and sprout development in the Missouri Ozarks. USDA For. Serv. Res.Pap. NC-149, 11 p., North Cent. For. Exp. Stn., St. Paul, MN.

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