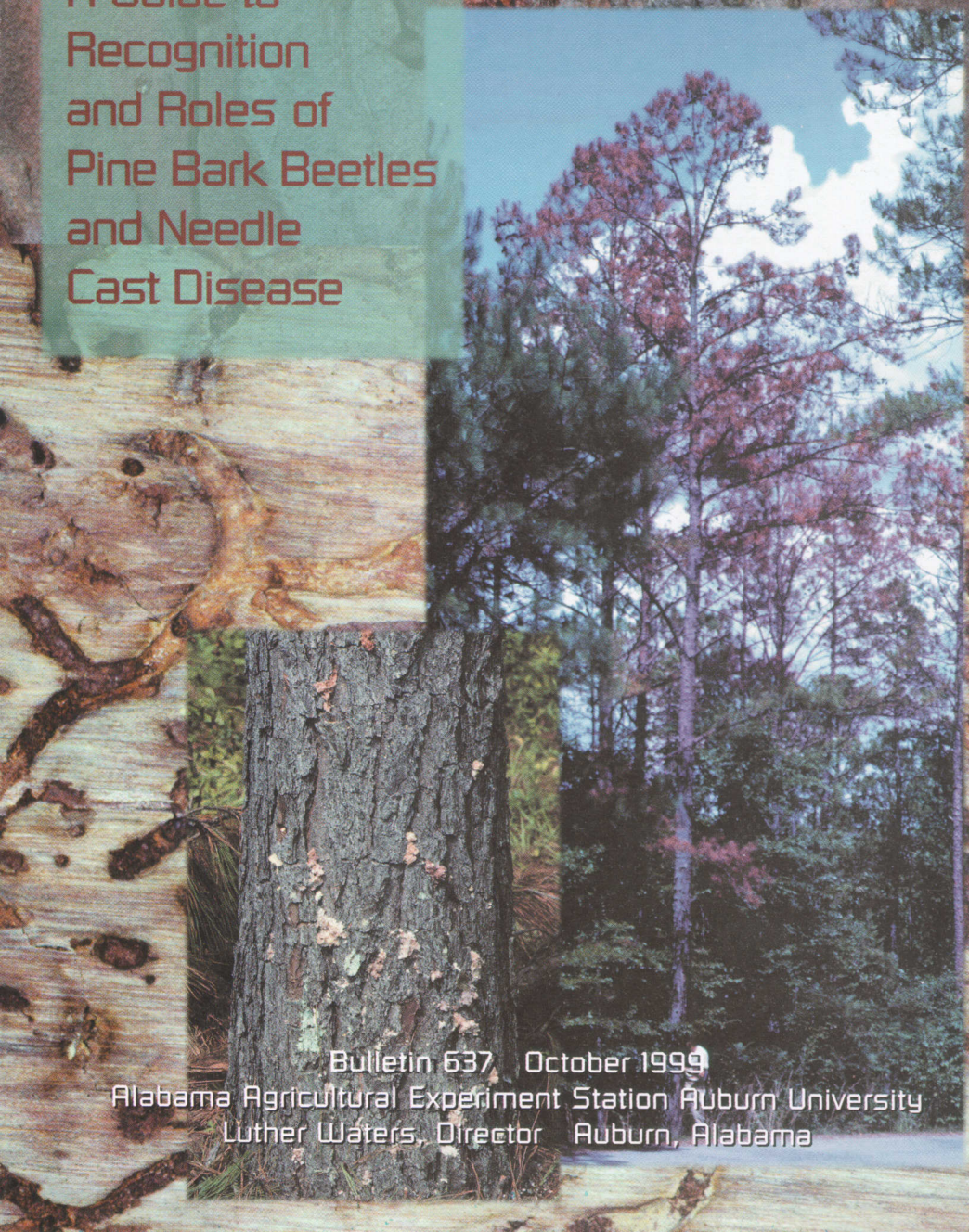
Red-Topped Pines in the Urban Forest

A Guide to Recognition and Roles of Pine Bark Beetles and Needle Cast Disease



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A Guide to Recognition and Roles of Pine Bark Beetles and Needle Cast Disease

L.L. Hyche[1]

Introduction

Among pines, condition of the crown, especially color of foliage, generally reflects the overall health and condition of the tree. A full, dark green crown is characteristic of a normal, healthy tree; a fading, yellowing crown commonly indicates a decline in tree vitality; and a red or straw-brown crown (red-topped) (Photo 1) usually, but not always, means that the tree is dead.

Any one of several things, or a combination thereof, may cause or contribute to development of red crowns among pines, e.g., old-age decline, mechanical injury, lightning, prolonged drought, insects, or disease. The most common and serious causes with which homeowners, arborists, and urban foresters have to contend are pine bark beetles and needle cast, a

[1] Associate Professor, Department of Entomology

disease of pine needles. Successful attacks by either of these agents produce similar red crowns, but result in different consequences for the trees. As a general rule, bark beetle-infested pines with red crowns are dead, or will die, as result of beetle activity. In the case of red-top caused by needle cast disease, only the needles are dead; trees are alive and, in time, will usually recover. Consequently, correct identification of the cause is important in determining a course of action. Results of research at the Alabama Agricultural Experiment Station provide information and clues for determining the identity and importance of these two common causes of red-top among pines in the urban forest.

Bark Beetles

The principal bark beetles (Family Scolytidae) commonly associated with red-topped pines in Alabama are the *Dendroctonus* beetles (*D. terebrans*, black turpentine beetle, and *D. frontalis*, southern pine beetle) and the *Ips* engraver beetles (*I. calligraphus*, sixspined ips; *I. grandicollis*, eastern fivespined ips; and *I. avulsus*, small southern pine engraver). These beetles commonly attack most native pines, and species of both *Dendroctonus* and *Ips* may be found developing in the same tree. Adults of the two genera can be easily differentiated by differences in external structure. In *Dendroctonus* (Photo 2A), the head of the adult is visible when viewed from above, and the elytra (wing covers) curve down smoothly over the rear end. In *Ips* (Photo 2B), the head is not visible from above, and the wing covers slant down abruptly at the rear, and each cover bears tooth-like spines along the outer edge. The immatures (larvae, pupae) of both bark beetle groups are much alike in form, structure, and appearance (Photo 3), and are not easily separated by casual observation.

The general mode of development is much the same for both *Dendroctonus* and *Ips*. Attacking adults bore through the outer bark into the phloem (inner bark) and construct galleries, or tunnels, in which the females lay eggs. Larvae, which are legless grubs, feed, develop, and pupate in the inner bark region. Subsequently, new-brood adults bore exit holes through the outer bark and emerge to start a new cycle. Adults are present outside the tree for only a brief period and are not often seen. Most of the life cycle is completed under the bark; thus, developing stages also are not visible. However, there are distinct, characteristic signs present on and in infested trees that reveal beetle presence and aid in identification of the species.

Photo 1. Pines with red tops typical of dead trees. These pines were killed by bark beetles.

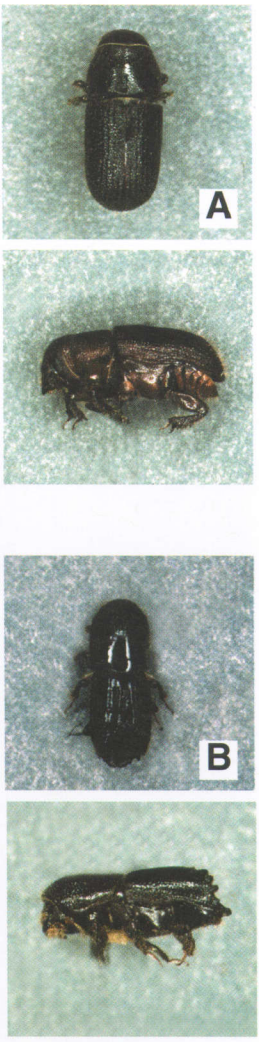
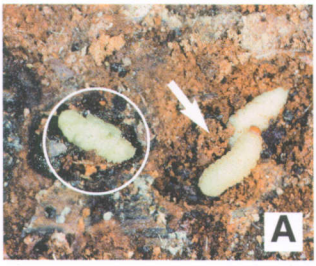


Photo 2. Dorsal and lateral views of (A) typical *Dendroctonus* and (B) *Ips* beetle adults. The *Dendroctonus* shown is the black turpentine beetle (actual length, 5/16 inch). The *Ips* specimen is the sixspined *ips* (actual length, 1/4 inch).



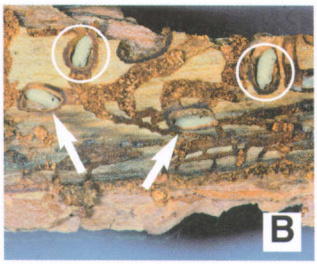


Photo 3. Larvae (arrows) and pupae (circles) of (A) *Dendroctonus* (black turpentine beetle), and (B) *Ips* engraver beetles (sixspined *ips*).

Photo 4. Base of loblolly pine with large resin pitch tubes, a typical sign of black turpentine beetle attack.

Photo 5. (A) Closeup of fresh and (B) older black turpentine beetle pitch tubes. (C) Black turpentine beetle adults in the inner bark; beetles are about 5/16 inch long.

Black Turpentine Beetle

The black turpentine beetle (Photo 2) typically attacks the lower 6-foot portion of the trunk (Photo 4). Resin accumulates on the bark at each beetle entrance hole to form a large (up to walnut size) lump referred to as a pitch tube. Fresh pitch tubes are soft and white, becoming reddish to gray from wood borings and age (Photo 5A, B).

Once in the inner bark, adults construct a broad tunnel (Photo 5C) in which the female lays eggs. Larvae feed in a group and consume patches of inner bark. When attacks are numerous enough to result in girdling of the stem, the tree dies and the crown turns red or straw-brown. If girdling is not complete, trees may survive and crowns remain green. However, in such cases, trees weakened by black turpentine beetle may be attacked and killed by other bark beetles.

Completion of the life cycle of the black turpentine beetle requires 2 1/2 to 3 months. If infestations are detected early, this beetle can be controlled and tree mortality prevented (see Prevention and Control).

Southern Pine Beetle

The southern pine beetle (Photo 6) is perhaps the most notorious bark beetle associated with red-top in pines. Attacks occur throughout much of the trunk, usually extending from 2 to 3 feet above ground level upward to the beginning of the crown. Pitch tubes form at each point of beetle entrance. Southern pine beetle pitch tubes (Photo 7A) are small, 1/4 to 3/8 inch in diameter, and often numerous. Adults (one pair to each entrance hole) enter the inner bark and construct narrow tunnels in which females oviposit. Tunnels (Photo 7B) are typically S-shaped and wind across the grain of the wood. Larvae feed and construct short individual tunnels in the inner bark; pupation takes place at the end of larval tunnels. New adults emerge through individual holes cut through the outer bark, leaving the bark with many "shotholes" (Photo 7C). The life cycle is completed in about 30 days.

Southern pine beetle adults introduce a blue-stain fungus (Photo 7D) which invades the sapwood of infested trees. Girdling by the beetle and action of the fungus cause tree mortality. Within about 2 weeks following initial attack, green needles begin to fade and turn yellow. By the end of the beetle cycle (about 30 days), crowns are usually fully red, and the new-brood beetles often have already vacated the trees. Pines successfully attacked by

Photo 6. Southern pine beetle adult (actual length about 1/8 inch).

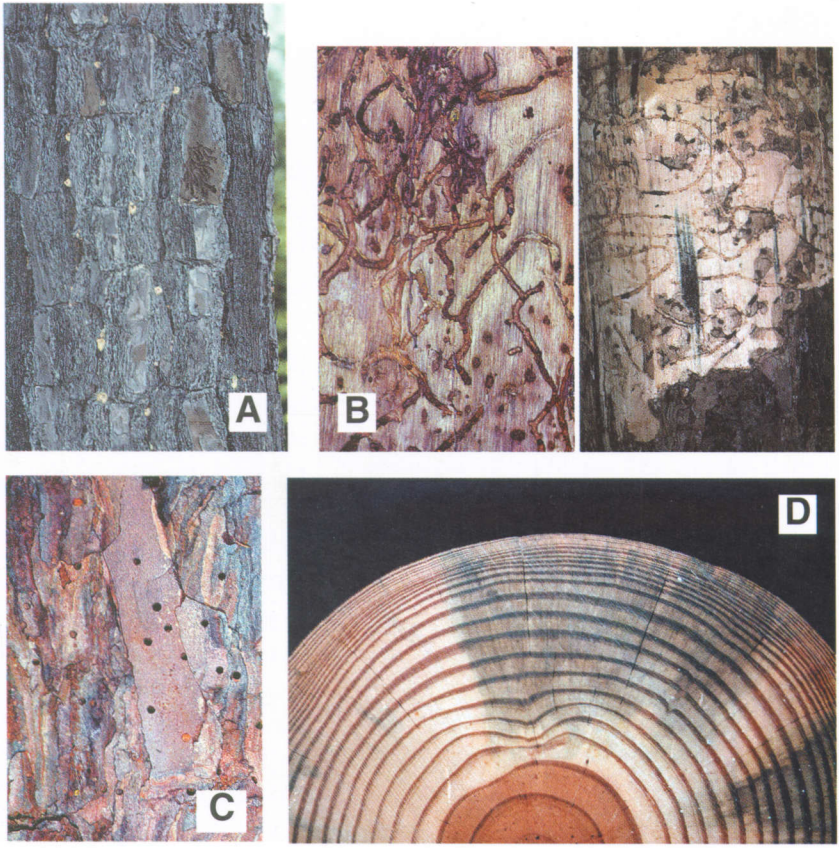


Photo 7. (A) Typical southern pine beetle pitch tubes at points of beetle entrance. (B) Crisscrossing, "S-shaped" tunnels made by adults in the inner bark (L.); the pattern is typical of southern pine beetle and is also visible on the sapwood (R.). (C) Exit "shotholes" of new-brood adults. (D) Blue stain in wood of beetle-killed trees; the fungus was introduced by the attacking beetles.

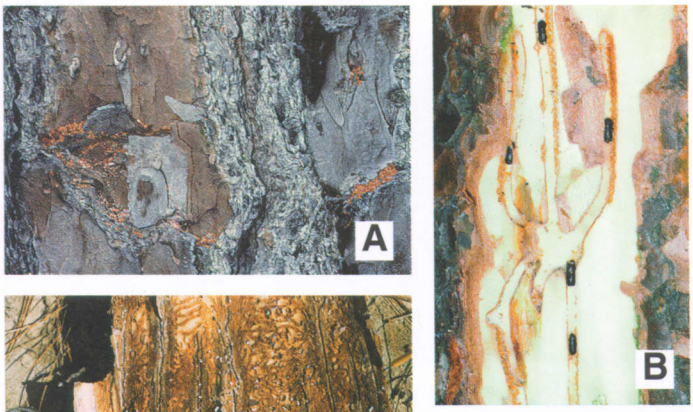


Photo 8. (A) Boring dust in crevices of the bark, a common sign of *Ips* attack. (B) *Ips* adults and tunnels in the inner bark; typically, adult tunnels are straight and run parallel with grain of the wood – note egg niches in the edge of the tunnel. (C) *Ips* larval tunnels in the inner bark.

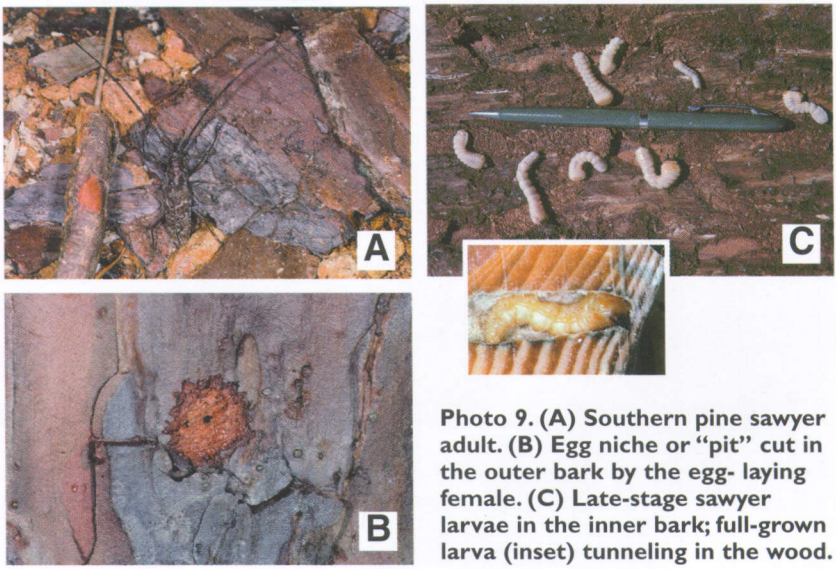


Photo 9. (A) Southern pine sawyer adult. (B) Egg niche or "pit" cut in the outer bark by the egg- laying female. (C) Late-stage sawyer larvae in the inner bark; full-grown larva (inset) tunneling in the wood.

Photo 10. (A) Ambrosia beetle adult (about 1/4 inch long). (B) Powdery wood dust accumulated at base of the tree; a typical sign indicating presence of ambrosia beetles and/or pinhole borers.

southern pine beetle cannot be saved; however, measures can be taken to reduce the chance of spread of beetles to uninfested trees (see Prevention and Control).

Ips Engraver Beetles

Ips engraver beetles are among the most common bark beetles found in red-topped pines, but typically, are purely secondary invaders. They attack and develop in freshly cut, newly killed, and/or dying trees; however, they are capable of contributing to the death of weak, low-vigor trees. *Ips* are often found in trees infested with black turpentine beetle and/or southern pine beetle.

Three species occur in Alabama. External structure (Photo 2) for all is typically that of *Ips*, but size and number of spines on the rear of each wing cover vary by species: the sixspined ips is about 1/4 inch long with six spines per wing cover; the eastern fivespined ips is about 3/16 inch long with five spines; the small southern pine engraver is about 1/8 inch long and has four spines on each wing cover.

The *Ips* male initiates the attack and is subsequently joined in the inner bark by one to several females. Trees attacked by *Ips* are weak and low in vigor; consequently, pitch tubes seldom form at entrance holes. However, reddish-brown boring dust collects in bark crevices (Photo 8A) below entrance points and provides external sign of *Ips* beetle activity. In the inner bark, females construct long narrow individual galleries that run with the grain of the wood. Several galleries may lead away from a single entrance point resulting in a pattern described as I-, Y-, or H-shaped (Photo 8B). Females lay eggs in niches along the sides of the galleries. Larvae construct individual tunnels in the inner bark (Photo 8C) and pupate at the end of tunnels. New adults emerge through the bark leaving

Photo 11. (A) "Red-topped" pine with needle cast disease; photographed 2 February–note that some needles are still showing green. (B) Same pine in April, completely brown. (C) Same pine in August, recovered.

numerous holes. The length of the development period varies: 18 to 22 days for the small southern pine engraver, 22 to 30 days for the fivespined ips, and 28 to 35 days for the sixspined ips. *Ips,* like southern pine beetle, introduce blue stain into trees they attack.

Other Insects Associated with Red-Topped Pines

Dying, freshly cut, and recently killed pines are attractive to many species of insects that have nothing to do with the death of the trees. These insects are there simply because such trees provide them with preferred food and ideal breeding sites. Characteristically, these insects are not found in living trees; thus, their presence is an indication of tree mortality. Among the most common of these associated with dead/dying pines in Alabama are southern pine sawyer, ambrosia beetles, and pinhole borers. Each of these arrives rather promptly at "dead" trees, sometimes even before symptoms of decline are noticed, and each provides readily visible evidence of its presence.

The southern pine sawyer is a common longhorned ("longhorned" refers to the long antennae of the adults) wood borer regularly found at dead, dying, and/or bark beetle-infested trees. The adult (Photo 9A) is 1 to 1 1/4 inches in length and mottled gray-brown in color. Antennae of males are 2 to 3 times longer than the body; those of females are about as long as or slightly longer than the body. Adult coloration blends with that of pine bark; consequently, beetles are easily overlooked. However, females, in preparation for oviposition, excavate crater-like egg niches in the outer bark (Photo 9B), and thereby, provide readily visible evidence of sawyer presence.

Eggs are placed in the inner bark at the bottom of the niche. Larvae, called roundheaded borers, feed in the inner bark until nearly full-grown, then bore into the wood where they pupate. Full-grown larvae (Photo 9C) are about 1 1/2 inches long. Sawyer larvae tunneling in the wood (Photo 9C – inset) produce a rasping sound that is clearly audible outside the tree or log.

Ambrosia beetles and pinhole borers constitute a group of several species of small (1/16 to 1/4 inch-long), cylindrical, reddish-brown or brown beetles (Photo 10A), with similar wood-boring habits. Attacking adults bore through the outer bark directly into sapwood and heartwood. In the process, fine, white, powdery wood dust is pushed out and accumulates in bark crevices of the lower trunk and on the ground at the base of the tree (Photo 10B). This is a sure sign of the presence of these beetles, and a good indication that the pine is dead.

Needle Cast

The term "needle cast" refers to a fungus-caused disease of needles. Among Alabama's native pines, loblolly, slash, Virginia, and shortleaf seem to be most often attacked. Diseased needles die and crowns of severely infected trees become "red-topped" (Photo 11A, B), a condition characteristic of beetle-killed trees. However, in the case of needle cast, only the needles are dead and, with no other problems present, the tree will usually survive.

Crowns of infected trees usually begin to show conspicuous browning in winter (December to January); however, close inspection of these crowns will often reveal some live needles (Photo 11A). As the disease progresses, crowns may become completely brown (Photo 11B). During spring, dead needles fall, new needles develop and, in time, crowns become green again (Photo 11C).

Needle cast may be caused by any one of several fungal species capable of infecting southern pines. Specific identification of the fungus and descriptions of the disease will require the services of a plant pathologist, and are beyond the objectives of this article. However, there are signs associated with red-topped pines that, by their presence or absence, can aid the non-specialist in determining the specific cause and whether the tree is dead or alive. In the case of a red-top caused by needle cast, some of the best signs implicating the disease are signs that are absent, i.e., absence of any sign of bark beetles, sawyers, ambrosia beetles, pinhole borers, or injury such as lightning strike. Elimination of insects or injury leaves needle cast disease as a possible cause.

Prevention and Control

Pine bark beetles prefer and develop best in injured or weak, stressed trees, which often describes many of the pines growing in the urban environment. Chances of having bark beetle problems can be reduced by maintaining uninjured, healthy, growing trees. Steps to control black turpentine beetle or to prevent the spread of southern pine beetle and *Ips* to uninfested neighboring trees are often necessary. Recommendations on control and management of pine bark beetles in the urban landscape can be obtained from Extension entomology specialists.

Control of needle cast in urban forest trees is not usually necessary; infected trees, if healthy otherwise, usually survive. Positive identification of needle cast fungi, and information on life history and control can be obtained from Extension plant pathology specialists.

Summary

Among southern pines, a red crown is typically associated with tree mortality and is commonly considered to mean that the tree is dead.

Successful attacks by pine bark beetles and severe infections of needle cast both produce red crowns characteristic of dead pines. Crowns of beetle-infested trees are red because the trees are dead or dying. Crowns of needle cast-infected trees, however, are red because the needles are dead; the trees are alive, and will usually recover.

In cities and thickly settled urban and suburban areas, removal of trees may involve considerable expense. Removal of red-topped trees on the assumption that all are dead may result in the needless cutting of living trees. Among the red-crowned pines commonly encountered in Alabama's urban forest landscape, readily visible signs and symptoms are present that can be used to determine if trees are dead or alive, infested with bark beetles, or infected with needle cast disease. A little time spent on tree inspection may save both trees and money.

Alabama's Agricultural Experiment Station
AUBURN UNIVERSITY

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Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
★ Alabama A&M University
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Research and Extension Center, Belle Mina.
2. Sand Mountain Research and Extension Center, Crossville.
3. North Alabama Horticulture Station, Cullman.
4. Upper Coastal Plain Research Station, Winfield.
5. Chilton Area Horticulture Station, Clanton.
6. Piedmont Research Station, Camp Hill.
7. Prattville Experiment Field, Prattville.
8. Black Belt Research and Extension Center, Marion Junction.
9. Lower Coastal Plain Research Station, Camden.
10. Monroeville Experiment Field, Monroeville.
11. Wiregrass Research and Extension Center, Headland.
12. Brewton Experiment Field, Brewton.
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