as a commercial plum in the South, AU Producer.

My own breeding program for USDA at the Byron Fruit and Tree Nut Lab is designed to be regional in scope. I expect to make my first release (a robust-growing, disease-resistant, high-yielding entrant) into the green-plum market later this year.

W. B. Sherman at Gainesville is investigating low-chill plums for Florida and similar locations.

In summation, future breeding trends seem to be the gathering together of three major attributes which at present exist, but, unfortunately, in separate material. We want good, strong, robust trees. We require resistance to bacterial spot on leaf, twig, and fruit; bacterial canker and black knot; as well as whatever resistance or tolerance to the phony peach rickettsia-like bacterium (RLB) and the related plum leaf scald that can be accumulated. Thirdly, we must demand high fruit quality, adequate fruit size, and, at least eventually, that all cultivars be bluish-purple skinned and yellow or amber fleshed. I have not said anything about rootstocks because that is a subject in itself. We currently grow our trees on peach seedlings and suffer all the insults of peach short-life. But I tell you this, when it all comes together, the South is going to become a plum garden. We have the land, the climate, the water. Now we need the plums.

Pecan Cultivar Review—Southeast[1]

C. E. Arnold and C. P. Andrews[2]

The Southeast is a major pecan producing region in the United States. However, due to humid nature of the region, production of high quality nuts is impeded by severe fungal diseases on many cultivars. This disease problem greatly reduces the number of cultivars acceptable for the Southeast. The Southeast has a definite need for more cultivars which produce high yields consistently, come into bearing at an early age, resist the major pecan diseases, are suitable for high density plantings, and have high nut quality (19, 38). According to Madden, it is 5 to 8 years after a cross is made until the hybrid seedlings produce their first nuts (13). This fact emphasizes the importance of long term support in breeding programs.

Grower demand for improved cultivars suitable for high density planting has increased because of the need to obtain an earlier return on the investment. The desired tree qualities are numerous interior lateral branches, resistance to diseases, vigorous wide-angle branches, late spring bloom, early and uniform nut maturity, and production of good yields after pruning (2, 22, 34, 46). Pecan trees grown in the Southeast appear to be more vigorous but branch less than trees grown in the Southwest (28). Thus, high density plantings may be more difficult to maintain in the Southeast.

Most of the older standard cultivars are not precocious, have little lateral branching and produce most of the crop on the periphery of the tree. Exterior pruning normally results in severe loss of yield for a number of years (16). Currently, mechanical pruning is the only recourse commer-

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cially available to effectively control tree size for close spacing (2). Unfortunately, new cultivars which produce high yields are often characterized by irregular bearings which usually begin after the first large crop (28). Irrigated trees grow more vigorously and produce larger crops, but do not appear to be more precocious than non-irrigated trees (26, 27). Most precocious cultivars are heavy producers (29) and many have good interior branching (26). According to Malstrom, evidence indicates that a precocious, high yielding cultivar which is scab susceptible will normally net more return per acre than a scab-resistant, low yielding cultivar because the price differential between nut grades has not effected grower receipts as much as quantity of nuts produced (30). However, nut quality must be commercially acceptable (38).

Quality of pecans originates in the grove and is influenced by cultivar, cultural practices, and climatic conditions. The most important quality factors in growing, storing, processing and marketing pecan meats include, color, oil content, freshness, stability and freedom from insect damage, mycotoxins and undesirable micro-organisms (8). Percent kernel should average more than 55% to be a superior cultivar (35). Time of harvest is an important factor since nut quality from a November harvest is generally superior to quality from an October or December harvest (11). Early nut maturity is desirable because such trees tend to be more regular in bearing. Nut maturity is often delayed on young trees (36). Adequate pollination is also vital since nuts resulting from self-pollination are commonly smaller in size and not filled as well as nuts developed from cross-pollinated flowers (18).

The best type of nut for shelling is moderately elongated with a symmetrically rounded apex and base. When cracked, the kernel should separate easily from the shell in whole halves without adherence of shell parts (38).

The shell should be thin, but not to such degree that it breaks easily during handling (22, 33). Grower experience has shown that thin shelled cultivars, i.e. Wichita and Schley, are susceptible to shell-split from rapid drying on hot days when harvested in the wet stage (36). Nuts should be suitable for various kinds of harvesting, cleaning and shelling operations. Shells which are too thin will often crack during mechanical harvesting (22).

The kernel should be a bright color and of good edible and storage quality. The consumer associates light colored kernels with high quality and dark kernels with aging and rancidity. Although dark color does not necessarily indicate poor quality and light color does not always represent good quality, until the public is educated to this fact, lightness of kernel color will prevail as a main factor for judging quality. Thus, kernel color must not be neglected in cultivar evaluations (22, 33, 38).

Additional information on pecan cultivar performance in the Southeast is needed, especially for the newer cultivars released during the past 15 years (27). As indicated by Romberg, cultivars are, "something about which pecan growers have always had differing opinions" (34). Below is a brief review of some of the cultivars wihch have been of interest to growers in the Southeast.

Stuart: Stuart, which originated in Jackson County, Mississippi (9), is only a moderate producer, slow to start bearing, and the eating and crackling qualities are not outstanding. However, it has maintained its position as the "standard" for many years (5, 13, 46) and will be economically significant for many more years (37). Stuart has continued to produce acceptable crops for more than 45 years, while certain other cultivars seem to reach

a peak in production at about 30 years old (7). Gossard reported in 1963 that Stuart was highly resistant to scab (6), but it is now susceptible to considerable scab infection (4, 12), emphasizing that no cultivar can be considered permanently resistant to scab. Stuart is generally not recommended for new commercial plantings, but normally it would be unwise to change a mature, producing Stuart grove to another cultivar by topworking (24).

The Stuart tree has strong, upright growth, few lateral branches, and lacks precocity; thus, is not adapted to high density plantings (1, 2, 37). Yields of this cultivar usually increase as shoot length increases. Nut maturity is mid-season (37, 42), and the flowering habit is protogynous (1, 7, 32, 35). Stuart appears to have a high chilling requirement rendering it unacceptable for planting on the southern edge of the pecan belt (37).

Desirable: Desirable with its open canopy spreading growth, few lateral branches, and medium precocity is not suitable for high density plantings (1, 2, 31, 38). However, it is presently the most commonly planted cultivar in the Southeast (1, 38) and will probably remain a major cultivar for many years (24). Desirable has become quite susceptible to scab (1, 12, 24, 47), but will produce good yields of high quality nuts if properly spraved (31, 44, 45, 47). It continues to be an excellent cultivar for conventional spacings (47). Desirable nuts mature mid-season (42). This cultivar is protandrous (1, 32) and is recommended for planting with Kiowa (24) and Elliott (43). It is especially suitable for planting with Kiowa since both cultivars have similar nut size, shape and maturity, and overlap for pollination (24).

Elliott: The Elliott tree is upright and thrifty, but is rather slow to obtain large size (1, 3). It is probably the most disease resistant cultivar grown in the Southeast (3, 12, 24, 35). This small, excellent flavored nut is easy to crack and has bright kernels. Thus, it is liked by commercial shellers (24, 35). Elliott is protogynous and often interplanted with Desirable (43), but lacks precocity. It is well suited for dooryard trees, largely because of its excellent disease resistance, high nut quality, and dark green foliage (1, 3). This cultivar appears to fruit heavily on older trees and yields rather consistently (3, 35). Elliott is not recommended for close spacings due to its lack of precocity.

Curtis: Curtis normally produces good yields of high quality, small, thin shell nuts which mature rather late. Kernels have a characteristic speckling. This cultivar lacks precocity and is not recommended for high density plantings. During the past several years, Curtis has lost much of its resistance to scab. The flowering habit of Curtis is protogynous (35).

Gloria Grande: Gloria Grande has been grown in South Carolina for a number of years but is generally not known throughout the Southeast. It is similar to Stuart except that the nuts are larger, kernel has more moisture, and shells out a higher percentage of halves. Its large size and thick shell make it less vulnerable to bird damage and it is well adapted to mechanical harvesting. Gloria Grande is protogynous and overlaps with Cape Fear for pollination. Although Gloria Grande is not extremely precocious and the percentage kernel is not high, its proven ability to bear large, consistent crops of large nuts after the tree is mature, scab resistance, and strong crotches make it worthwhile for planting in the Southeast (40, 41).

Cape Fear: Cape Fear resembles Stuart but has a slightly smaller nut, brighter kernel, and a higher percent kernel (39). This cultivar has excellent kernel quality including a light color (1, 44, 45). It is protandrous (32) and is a good pollinator for Wichita (43).

Cape Fear is precocious, a heavy producer, and suitable for high density plantings (39, 46, 47). However, reports have indicated that it becomes irregular in bearing and loses quality after about 15 years of age (39). Cape Fear's limb distribution, angle of branching, and scab resistance are good but it is susceptible to fungal leaf scorch and has very dark markings on the shell (39, 47).

Sumner: Sumner is a protogynous cultivar (43), produces good yields, and is precocious enough for high density plantings (44, 46). It has excellent kernel quality, good disease resistance, medium size nuts, and is a relatively consistent producer (44, 45).

Wichita: Wichita is a vigorous growing, moderately upright tree (17) with a medium amount of lateral branching (2, 17). This cultivar is suitable for high density plantings due to its precocity, high yields, high percent kernel, and good nut quality (1, 17, 26). It has protogynous dichogamy (1, 17, 28, 32) and is recommended for interplanting with Cheyenne, Cape Fear and Desirable (14, 43). Wichita produces good yields but is prone to irregular bearing as the tree gets older (29). Nut maturity of this cultivar is early (17, 28). Major disadvantages are severe scab susceptibility, often killing twigs (1, 2, 10, 26, 47), and nut splitting in August and September, sometimes reducing the marketable crop as much as 20% (17, 26).

Cheyenne: Cheyenne is a very promising cultivar for high density plantings in the Souhteast (14, 27, 28). Its desirable traits include compact growth, good lateral branching, scab resistance and uniform shuck opening. In addition, this precocious cultivar produces good yields of excellent flavored nuts with a high percentage of kernels which are bright colored (26, 27, 28, 29, 47). Nuts are medium size (1, 47) and mature mid-season (14, 42). Cheyenne has protandrous dichogamy (1, 14, 24) and is a pollinator for Wichita.

Kiowa: Kiowa is an excellent quality large nut (23) which has good potential for the in-shell market (1, 28, 35, 47). It is precocious (1, 23, 47), high yielding (1, 23, 35), vigorous (1), and protogynous (1, 23, 28, 32). Kiowa is recommended for interplanting with Desirable (23, 24) since they cross-pollinate and have similar nut size, shape and maturity dates. It has relatively good scab resistance (1, 23, 35) but, unless carefully trained, will have a number of narrow limb crotches (1, 24, 47) which often increases limb breakage.

Chickasaw: Chickasaw is a prolific, protogynous cultivar which is very precocious and recommended for high density plantings in the Southeast (1, 19, 24, 25). This cultivar has shown good scab resistance (26, 27, 47), good vigor (1, 19), good lateral branching (1, 2, 19), good nut quality (1, 28, 47), early nut maturity (24, 28, 47), and a large number of nuts per cluster (19). Chickasaw defoliates prematurely apparently due to leaf scorch (24).

Cherokee: Cherokee has very profuse lateral branching (1, 2, 15, 17), good vigor (15), protandrous dichogamy (1, 15, 17, 28), and an exceptionally large number of nuts per cluster (1, 15, 17). However, it is not recommended for planting in the Southeast, even though it is ideally suitable for close spacings (12, 17, 26), because of its extreme susceptibility to scab (1, 2, 10, 26). Cherokee is very precocious (1, 15, 47), prolific (1, 15, 25), early maturing (15, 17, 28), and has a high percent kernel (1, 15, 28). The kernel is sometimes darker than preferred (47) and nut shape is not well suited for shelling (15).

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Red Raspberry Clones Resistant to Root Rot[1]

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Barritt, et al. (1) screened 41 clones of red raspberry for resistance to a root rot incited by *Phytophthora erythroseptica* (2) which is one cause of decline in red raspberry plantings in the Pacific Northwest. This report is an extension of that study and describes the level of resistance of 43 clones, 32 of which have not been studied previously.

In May, 1977, a planting of 99 clones was established in a field with a long history of this particular root rot at the Southwestern Washington Research Unit, Vancouver. Of the 99 clones evaluated, 56 were susceptible Washington State University (WSU) breeding lines and are not included in this summary.

Each hill was evaluated in September, 1979, for disease symptoms and plant growth characteristics. Data for four traits are reported:

1. Root rot rating on a 0-9 scale with 0 being no primocane wilting symptoms and 9 being death of all canes in the hill. Intermediate ratings were based on the proportion of primocanes showing wilting symptoms.
2. Percent infection is the precentage of hills with a root rot rating of 1 or more.
3. Cane number per hill was rated on a 0-9 scale with 9 being the greatest number of canes.
4. Cane height was rated on a 0-9 scale with 9 being the tallest.

The Sumner cultivar was found to have a moderate level of resistance to root rot (1) and, although adapted to the Pacific Northwest, it is not widely

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