Reason for 1991 Delayed Pecan Shuck Opening Remains Elusive

Ray E. Worley¹ and Ben Mullinix²

University of Georgia, Coastal Plain Experiment Station, Tifton, GA 31793-0748

Additional index words. *Carya illinoensis*

In 1991, many reports of a delayed shuck-opening malady on 'Stuart' pecans [*Carya illinoensis* (Wangenh.) K. Koch] in the Albany, Ga., area were received regarding apparently well-managed orchards. This is not the late-season shuck necrosis malady attributed to stress (Sparks et al., 1995) and fungi (Reilly, 1994). Drought stress causes shucks to become flaccid and to eventually dry tightly stuck to the shell (Worley, 1982). For the malady described, the shuck remained green and turgid and kernels remained extremely moist with a dark brown seedcoat. Normal shucks would have been dehiscent, and nuts would be dry and ready for harvest.

A light crop load and low insect and disease pressure in 1990 induced an extremely large crop set in 1991. Abundant rain through the sizing stage made the nuts large, but a drought beginning in mid-August forced many growers to irrigate. Rainfall was 168, 193, 91, 13, 20, and 5 mm for June through November, respectively. The historical norms for these months are 115, 144, 128, 92, 55, and 58 mm, respectively. Mean air temperatures from June through November were 25, 27, 26, 24, 19, and 12C, respectively, with no hard freezes before harvest; historical means for these months are 26, 27, 27, 25, 20, and 15C, respectively.

The degree of the malady varied among trees in a research orchard at Tifton. We attempted to determine if the extent of the malady could be associated with pruning, fertilizer treatments, or any of the usual measured characteristics. The orchard was drip-irrigated, insects were controlled, and foliage condition was excellent at harvest (6 Nov. 1991).

Nuts were harvested from individual trees. Nuts free of shucks were considered "marketable." The moist nuts with unopened shucks

were termed "in-shuck" nuts; in a crack test of a 454-g composite sample of these culls, after drying, 17.5% were edible. A ratio (I : O) of the in-shuck and out-of-shuck nuts, based on weight, was calculated. Nut size, percentage of kernel, and kernel grade were determined from a 50-nut sample of the marketable nuts from each tree.

Tests comparing selective limb-pruning intensity, pruning height, N application radii, and K applied annually or only when leaf K dropped below five thresholds (Worley, 1987, 1989, 1990, 1991, 1994) did not influence total yield of in-shuck nuts or the I : O ratio. In a test of N application rates (Worley, 1990), trees receiving the lowest N rates had the lowest out-of-shuck yield (marketable nuts); however, weight of in-shuck nuts was not affected (Table 1). The I : O ratio for the two lowest N thresholds was almost double that of higher thresholds.

A stepwise multiple regression (SAS, 1989) used in-shuck yield and I : O ratio as dependent variables and leaf N, P, K, Ca, Mg, Mn, Fe, Cu, Zn; tree vigor and color ratings; tree circumference; shoot terminal growth; cumulative yield; nutlet count in August; trunk circumference growth; nuts per kilogram; percentage of 13/16, 14/16, 15/16, and 16/16 size nuts; percentage of fancy, standard, and amber kernels; cumulative terminal growth; yield of marketable nuts; previous year's cumulative yield; and previous year's cumulative terminal growth as independent variables for 88 large 'Stuart' trees. No single variable accounted for >8% of the variation in in-shuck yield, and

the nine variables in the regression equation were associated with only 42% of the variation. For the I : O ratio, the yield of the marketable nuts accounted for 49% and no other variable accounted for >4% of the variation. Trees with a high yield of marketable nuts had a lower I : O ratio than those with lower yields. Since leaf N did not enter either equation, the differences in the I : O ratio found in the N study (Table 1) were probably associated with the differences in yield.

The nuts had few sprouts, but the moist appearance of the kernels of nuts in the shucks suggests a presprouting condition. A similar shuck-opening problem in 1973 was related to high N rates (Worley, unpublished). Stress from excessive crop load was obviously not related to the delayed shuck opening. The problem was not serious in 1992 through 1994.

Literature Cited

- Reilly, C.C. 1994. Fungi involved in fungal leaf scorch and the shuck disease complex of pecans. Proc. Southeastern Pecan Growers Assn. 87:129-142.
- SAS Institute. 1989. SAS/STAT user's guide, version 6, 4th ed., vol. 2. SAS Inst., Cary, N.C.
- Sparks, D., W. Reed, I.E. Yates, M.W. Smith, and T.G. Stevenson. 1995. Fruiting stress induces shuck decline and premature germination in pecan. J. Amer. Soc. Hort. Sci. 120:43-53.
- Worley, R.E. 1982. Tree yield and nut characteristics of pecan with drip irrigation under humid conditions. J. Amer. Soc. Hort. Sci. 107:30-34.
- Worley, R.E. 1987. Effect of pruning old non-crowded pecan trees to three heights. Proc. Southeastern Pecan Growers Assn. 80:123-127.
- Worley, R.E. 1989. Can we reduce the area covered by nitrogen application. Proc. Southeastern Pecan Growers Assn. 82:171-174.
- Worley, R.E. 1990. Long-term performance of pecan trees when nitrogen application is based on prescribed threshold concentrations in leaf tissue. J. Amer. Soc. Hort. Sci. 115:745-749.
- Worley, R.E. 1991. Selective limb pruning intensity influences mature pecan tree and nut characteristics. HortScience 26:126-129.
- Worley, R.E. 1994. Long-term performance of pecan trees when potassium is based on prescribed threshold concentrations in leaf tissue. J. Amer. Soc. Hort. Sci. 119:434-438.

Table 1. Effect of N application, based on leaf analysis, on pecans shaken from the tree in-shuck and out-of-shuck and the in-shuck : out-of-shuck (I : O) ratio, 1991.

N applied (kg·ha ⁻¹)	Leaf N limit (%)	Yield		I : O ratio
		Out-of-shuck (kg/tree ²)	In-shuck (kg/tree)	
112	<2.25	51 a	24 a	0.51 b
112	<2.50	51 a	27 a	0.54 b
112	<2.75	83 b	19 a	0.23 a
112	<3.00	62 a	22 a	0.36 a
224 ³	---	79 b	20 a	0.27 a

²Mean separation by Proc. GLM, PDIF (t test) option at $P \leq 0.05$.

³Applied annually.

Received for publication 23 Jan. 1995. Accepted for publication 15 May 1995. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

¹Professor of Horticulture.

²Agricultural Research Statistician.