HortScience 27(5):473. 1992.

Fruit Set of Pecan Requires a Low Percentage of Live Pollen in Controlled Pollination

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Additional index words. Carya illinoinensis

Pollen dose used in controlled crosses can influence plant characteristics of F_1 and subsequent generations. A high pollen dose yielded zucchini *(Cucurbita pepo* L.) seed that tended to germinate more rapidly than seed from a low pollen dose (Davis et al., 1987). Zucchini plants resulting from a high pollen dose produced larger fruit and more seed, and they were considered superior to plants derived from low pollen doses. Presumably, a high pollen dose creates competition among microgametophytes (Mulcahy and Mulcahy, 1987), and correlation between microgametophyte and sporophytic performance is believed to be a result of significant gene overlap expressed in both stages of the plant life cycle (Tanksley et al., 1981). The objective of this research was to evaluate the influence of pollen dose on fruit set of pecan *[Carya illinoinensis* (Wangenh.) K. Koch] and early seedling performance.

'Western Schley' and 'Wichita' were chosen as the female and male parents, respectively. Pollen doses were constructed by mixing current-season and dead pollen at various ratios. Pollen was collected 13 May 1987 from 'Wichita' trees and maintained at room temperature for 3 years. This pollen was assumed to be dead based on an earlier report (Yates and Sparks, 1989). Live pollen was collected during the current season (3 May 1990) from 'Wichita' trees. Dead pollen was added to current-season pollen to achieve 100%, 50%, 20%, 5%, and 0% mixtures of current-season pollen by weight.

Before floral receptivity, 50 to 75 pollination bags were placed over female flower clusters (Smith and Romberg, 1940) on each of six 'Western Schley' trees in El Paso, Texas. When flowers were receptive, pollen was injected into pollination bags and onto receptive stigmas 13 May 1990. In addition to the five pollen dose treatments, unpollinated controls were included on each tree to include about five flower clusters. At least five flower clusters per tree were pollinated with each pollen dose treatment. On average, there were 3.3 flowers per cluster, and 7.9 flower clusters were pollinated with each treatment on each tree. Fruit set on each cluster was recorded 6, 21, 36, 73, and 122 days after pollination. Fruit drop virtually ceased after 73 days; therefore, data from day 122 were deleted. Mature nuts were harvested, weighed, and stratified. Nuts were planted 9 Jan. 1991, and seedling height was evaluated 2 Apr. 1991. Data were analyzed as a randomized block design and the F statistic was evaluated for statistical significance at $P = 0.05$. Independently, five flower clusters (20 flowers) of 'Western Schley' were similarly pollinated with 'Wichita' pollen. Flowers were immediately harvested after pollination, and stigmas were removed from the subtending flower parts and placed into 1.0 ml of fixing solution of formalyn, alcohol, and water (FAA) and agitated to facilitate pollen grain removal. Pollen washes freely from receptive stigmas (personal observation) if immediately fixed in FAA (50% ethanol, 10% formalyn, 5% acetic acid, and 35% water). Four 2-µl samples of fixing solution containing the washed pollen grains were placed on a microscope slide, and pollen grains were counted in each droplet. Pollen counts were extrapolated to estimate total pollen grains in fixing solution and therefore the number of grains that had affected each stigma.

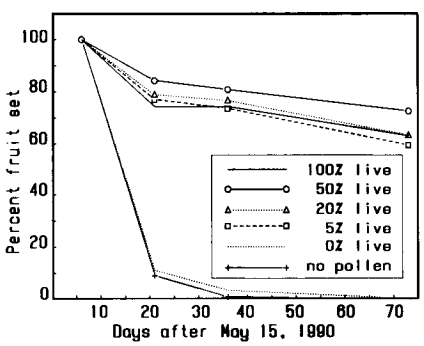

Fig. 1. Percent fruit set of 'Western Schley' pecans pollinated with various percentages of live (current-season) 'Wichita' pollen.

Fruit set after 73 days was not significantly affected by reducing the portion of current-season pollen in the mix from 100% to 5% (Fig. 1). Romberg and Smith (1950) reported excessive pollen used in pollination can result in heavy fruit drop, but the actual pollen dose applied to receptive stigmas was not reported. As expected, pollination with dead pollen resulted in fruit abortion (Fig. 1), which corresponded to the abortion of flowers that remained unpollinated (Smith and Romberg, 1940; Sparks and Madden, 1985). Also, seed weight of mature pecans and seedling height were similar among pollination treatments in which live pollen was included (data not provided). Apparently, a sufficient number of live pollen affected the stigma to eliminate differences associated with pollen competition even when the pollen dose was comprised of only 5% current-season pollen.

Pollen impaction counts ranged from 1100 to 17,400 grains per stigma and averaged >6000 grains among the 20 flowers evaluated. This variability is likely due to spatial arrangement of flowers on the cluster, orientation of syringe in relationship to the flowers, and the quantity of pollen injected into each pollination bag.

These data suggest that a limited supply of fresh or live pollen can be "stretched" by diluting with up to at least 95% dead pollen without significant reduction of fruit set or early seedling performance.

Literature Cited

Davis, L.E., A.G. Stephenson, and J.A. Winsor. 1987. Pollen competition improves performance and reproductive output of the common zucchini squash under field conditions. J. Amer. Soc. Hort. Sci. 112:712-716.

Mulcahy, D.L. and G.B. Mulcahy. 1987. The effects of pollen competition. Amer. Scientist 75:44-50.

Smith, C.L. and L.D. Romberg. 1940. Stigma receptivity and pollen shedding in some pecan varieties. J. Agr. Res. 60:551-564.

Sparks, D. and G.D. Madden. 1985. Pistillate flower and fruit abortion as a function of cultivar, time, and pollination. J. Amer. Soc. Hort. Sci. 110:219-223.

Tanksley, S.D., D. Zamir, and C.M. Rick. 1981. Evidence for extensive overlap of sporophytic and gametophytic gene expression in *Lycopersicum esculentum.* Science 23:453-455.

Yates, I.E. and D. Sparks. 1989. Hydration and temperature influence in vitro germination of pecan pollen. J. Amer. Soc. Hort. Sci. 114:599-605.

Received for publication 6 June 1991. Accepted for publication 9 Oct. 1991. 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.

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