

# Ploidy Level of American Persimmon in Kentucky: Could it Impact Production Strategies for Seedless Fruit?

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## Introduction

- The American persimmon (*Diospyros virginiana*) is in the early stages of commercial production (McDaniel, 1973a, 1973b).
- The golden orange fruit are sweet when fully ripened and astringency is reduced (Figure 1); the fruit have great processing potential.
- This tree is a slow growing, moderately sized tree native to the forests of Kentucky; some small commercial orchards can be found in Kentucky.
- The most widely cultivated species is *Diospyros kaki* the Oriental or Japanese persimmon. The *D. Kaki* species has large, light yellow-orange to dark red-orange fruit and does not have the astringency of *D. virginiana*; however, it is not well adapted for the Kentucky climate.
- Persimmons are normally dioecious; that is, trees produce either male or female flowers on separate trees. These self-infertile trees will require cross-pollination with another variety to produce fruit (Figure 1).
- There are two races of American persimmon, a tetraploid (60 chromosome) race is centered in the southern Appalachian mountains and adjacent areas, and a hexaploid (90 chromosome) race occupies the range north and west of the tetraploid range. The ranges overlap in Kentucky (Baldwin and Culp, 1941)
- Most cultivated varieties are thought to be the northern 90 chromosome race; however, there has not been a through examination of ploidy level for commercially available cultivars (Choi et al, 2003; Nissen et al., 2015).
- Since both ranges overlap, pollen from a different race may cause sexual incompatibility resulting in pollination without fertilization. This could result in the desirable production of seedless fruits.

## Objective

- The objective of this study was to determine the existence of the 60 and 90 chromosome races of persimmon in native Kentucky populations and to compare these to established cultivars using flow cytometry.

## Materials and Methods

- Leaf samples from wild American persimmon populations were obtained from trees in Bullitt, Edmonson, and Franklin Counties. Leaf samples from 25 cultivars were obtained from England's Orchard and Nursery in McKee, Kentucky and from trees at the Harold R. Benson Research and Demonstration Farm in Frankfort, Kentucky.
- Ploidy analysis was conducted by Plant Cytometry Services (Berkenhof 37, 6941 ZR, Didam, The Netherlands, <https://plantcytometry.com/>). Briefly, nuclei were isolated from the leaf samples and stained with the DNA specific dye DAPI. The solution with stained nuclei was sent through a flow cytometer (CyFlow Space, Partec GmbH with a UV High power LED 365) and ploidy level determined as compared to standards.



Figure 1. American persimmon fruit (left); Male persimmon flower (center); Female persimmon flower (right).

Table 1. Ploidy Level Determined for American Persimmon Varieties

SELECTION	NOTES	CHROMOSOME #
DOLLYWOOD	D-128 James Claypoole Cross	90
EARLY GOLDEN	Propagated since the 1890, from Illinois	90
ENNIS SEEDLESS	Indiana seedling	60
GARRETSON	Seedling of Early Golden	90
GOLDEN SUPREME	Very old cultivar, unknown background	90
H-118 EARLY JEWEL	James Claypoole Cross	90
HARVESTMOON	Found in Posey County, Indiana by Jeremy Lowe	90
KEENER	Luther Burbank Cross	90
KEENER X	Seedling thought to be 120 chromosomes	90
KORP	Breed By George Slate	90
MEADER	Breed by DR. Corwin Meader of New York	90
MOHLER	Unknown background	90
NC-10	Breed By Douglas Campbell of Southern Ontario	90
PRAIRIE STAR	James Claypoole Cross	90
PRAIRIE SUN	James Claypoole Cross	90
PROK	Breed By George Slate and John Gordon Jr. of upper New York	90
SFES	From Lucky Pittman of Western KY	60
SOUVENIR	Crimea, Ukraine imported in 2006	90
SUGAR BEAR	Seedling from Madison County, Kentucky	60
SUPER SWEET	Breed By George Slate	90
SZUKUS	Breed By George Slate	90
UNION STAR	Found in the Rhodelia, Kentucky	90
WEeping	Seedling from Kentucky	60
WONDERFUL	Cross between Yates X F-100	90
YATES	Found by Ed Yates but was mislabeled AKA Juhl (cv)	90

Table 2. Ploidy Level Determined Trees in Three Counties in Kentucky

COUNTY	GPS COORDINATES	# OF TREES SAMPLED	# OF 60 CHROMOSOME	# OF 90 CHROMOSOME
BULLITT	37.903884, -85.628716	19	6	13
EDMONSON	37.101909, -86.058753	21	21	0
FRANKLIN	38.175547, -84.915906	5	5	0

## Results and Discussion

- Ploidy levels were determined for 25 American persimmon varieties. Only four selected varieties were from the 60 chromosome strain: Ennis Seedless, Weeping, Sugar Bear, and SFES (Table 1).
- There were both 90 chromosome and 60 chromosome American persimmons trees in the populations sampled in the Bullitt County locations, but only 60 chromosome strains were found in Franklin and Edmonson Counties (Table 2)
- As thought previously, most cultivated varieties that were thought to have 90 chromosomes were confirmed to have this chromosome number. However, some varieties were 60 chromosome selections.
- Since many native trees in the forests of Kentucky are of the 60 chromosome strain and grow near commercial plantings of persimmons, pollen from a different race may cause sexual incompatibility and result in pollination without fertilization; and therefore production of desirable seedless fruit for consumption.
- Planting 90 chromosome female varieties with male seedling pollinizer trees of the 60 chromosome strain could be effective in producing seedless fruit in the region; although some nearby Kentucky forests could have 90 chromosome native male trees that could result in seed set of fruit in the commercial (90) varieties.

## Conclusions

- The ploidy levels of most commercially available American persimmon varieties have 90 chromosomes; however, forests in Kentucky have both 60 and 90 chromosome strains.
- Strategies in planting 90 chromosome female varieties with male seedling pollinizer trees of the 60 chromosome strain could be effective in producing seedless fruit in the region, but not in all forested areas.

## Literature Cited

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