

Chinese Chestnut Performance on the Western Fringe of Its Adaptability in the Eastern Great Plains of Kansas

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Abstract. Mature Chinese chestnut trees growing in Riley County, Kansas, on possibly the western fringe of the species range of adaptability in eastern Kansas have produced moderate yields with high quality nuts under a low level of management. After more than three decades of growth, tree health is on the decline due to disease and climatic stress.

Introduction

The Chinese chestnut (*Castanea mollissima* Blume) industry in the United States is in its infancy (Gold et al. 2005). It is just beginning to develop in the Midwest (Hunt et al. 2006, 2009). At the University of Missouri, Horticulture and Agroforestry Research Center (HARC) in New Franklin, Missouri, various studies are being conducted on the management of Chinese chestnut (Garrett 2007, 2008, 2009). New cultivar development is of major importance (Nave 1998, Anagnostakis 1999, and Miller 2003). Early yields from young trees show differences among new cultivars (Hunt et al. 2006). Guidelines for commercial growers have been distributed by Southeastern Iowa Nut Growers Association (Wahl 2002) and HARC. There is one commercial grower in Lawrence, Kansas, plus several home orchards in the state (Reid, pers. comm.).

The objective of this report is to present information on the non-irrigated growth and nut yields of Chinese chestnut trees grown in the challenging climate of eastern Kansas, which we believe to be the western fringe of the species zone of adaptability. The primary objective of the trees planted at

Manhattan, Kansas, was to evaluate them for conservation purposes such as wildlife, windbreak, and landscape plantings. Yield data for mature trees growing in eastern Kansas is not found in the literature. The Asian population in the Manhattan area has collected nuts for human consumption in recent years which indicates a demand for the nuts that could support a cottage industry or limited resource producers in eastern Kansas.

Materials and Methods

Chestnuts collected in 1974 from a planting of 8 trees from accession number 70314 (alternate number BN-8299) from Beltsville, Maryland, which had been growing at the Manhattan Plant Materials Center (PMC) in Manhattan, Kansas, since 1967, were grown out to 1-0 stock by the Kansas Forest Service. One hundred and twelve seedlings were produced, of which 55 were planted in 1975 at the PMC site. The original purpose of the planting was for landscape along the drive leading into the PMC headquarters, where 54 of the seedling trees survived. The trees were planted in two rows on 15 x 20 ft spacing with trees staggered from one another in the adjacent rows for a 0.7 of an acre planting at the rate of 77 trees/acre. The planting has been maintained under a low level of management. The area between the trees was cultivated during the planting's early years, but more recently a combination of mowing and cultivation was employed with less frequency. While occasionally pruned, dead limbs were generally not removed (Figure 1). The planting site's soil is alluvial, fertile, and a well-drained Belvue silt loam (coarse-silty, mixed, mesic Typic Udifluvents). The planting receives no fertilization or supplemental water (which was deemed unnecessary considering the original purpose of the planting) where the average annual precipitation is 34.8 inches, of which two-thirds comes during the growing season. Winters are mild-to-severe and spring and summer drought is common. Data was collected at about 20 and 35 years on tree condition, nut yields, and tree size. The earlier data was for individual trees, while the latter data was representative of the whole planting.



Figure 1. Thirty-five-year-old chestnut tree having multiple stems and overhanging branches.

Results and Observations

Tree quality in 2010 was rated as fair with some disease and no insect problems observed to date. Cankers caused by chestnut blight were assessed with 42% of the trees showing some degree of the disease. Of the trees with cankers, damage was noted in mid-level branches and the lower stems and rated as severe in 39.3%, moderate in 28.6%, slight in 32.1% of the affected trees. At 35 years of age, the planting had a 98% survival rate with variable size trees and only two trees severely stunted. During the 2010 growing season the foliage on all trees was green and of normal size. Mean crown width was 25 ft (N-S direction). Tree height ranged from 19.5 to 36.7 ft with a mean of 28.3 ft. The mean diameter at breast height (DBH) was 12.9 inches and stump girth ranged from 9 to 26.6 inches with a mean of 15.6 inches. Dead limbs were present in 78% of the trees as they were pruned infrequently. This loss was probably due to periods of drought, winter damage, and disease. Tip and branch die-back was noted on over 94% of the trees to the extent of about 1.5 ft on some limbs, with 53% of the damage rated moderate to severe. The greatest damage occurred the sum-

mer of 2010 when the planting was subjected to extremely high winds which had an impact on the 2010 crop.

Nut yields ranged from poor to excellent among trees in the planting, which is typical for planting stock produced from seed (Wahl 2002). Most trees were very good nut bearers at 20 years, but declined during the succeeding 15 years. The mean yield of the trees at 20 to 25 years of age was 3,451 lbs/acre (three-year mean) and at 33 to 35 years of age, 1,574 lbs/acre (three-year mean, Table 1). In southeastern Iowa yields of 1,000 to 2,000 lbs/acre (tree spacing not specified) is considered a conservative estimate of production at maturity (Wahl 2003) and 2,000 lbs/acre in Missouri for 12- to 15-year-old-trees with good moisture conditions at a planting rate of 50 trees per acre (Hunt et al. 2009). Precipitation occurring during the critical period of July, August, and September, could not be correlated with yield (Table 1).

Summary

After more than three decades of tree growth, Chinese chestnuts grown in eastern Kansas have shown that moderate nut yields can be expected in this region. Nuts were

Table 1. Tree height and nut yield at different ages of Chinese chestnut trees grown in eastern Kansas.

Harvest year	Age	Number of trees sampled	Mean ht.	Nut yield/acre ¹	Annual precip. ²	Annual precip. ³ (departure from normal)	July thru August precipitation ³ (departure from normal)
	(yrs)	--	(ft)	(lbs)	(in)	(in)	(in)
Individual Tree Nut Yields: Selected Trees							
1994	20	4	23.0	4570	26.84	-6.98	-3.05
1995	21	3	--	1799	41.77	7.95	1.21
1999	25	5	--	3983	37.36	3.54	-2.62
2000	26	3	25.0	650	22.77	-11.05	-6.92
Mean ⁴	--	--	--	3451	--	--	--
Whole Planting Nut Yields							
2008	33	54	--	1807	43.25	8.45	4.38
2009	34	54	--	1760	38.69	3.89	2.04
2010	35	54	27.6	1155	NA	NA	0.35
Mean ⁴	--	--	--	1574	--	--	--

¹Yield based on a planting rate of 77 trees per acre; ² Official Recording Station, Manhattan, Kansas; ³Kansas Weather Data Library; ⁴Three-year mean.

of high quality and used by the local Asian population for consumption. It appears that tree health is on the decline in recent years due to chestnut blight and periods of drought (Putnam et al. 2008) and lack of supplemental moisture. The experience at Manhattan indicates that the potential to grow Chinese chestnut trees as a nut-producing crop exists as far west as Riley County, Kansas.

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