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Earth-Kind™ Grapes: Low Input Grapes for the Backyard

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Abstract

Earth-Kind™ Grapes research trials were initiated in Texas in 2015 and have since expanded to include seven sites across the state. These research sites represent a wide range of climatic and soils conditions with an aim of identifying well-adapted grapes that are suited for low-input culture. Beyond initial site preparation, no fertilizers are applied and no pesticides are used for the duration of the study. Data collection on vine vigor, nutritional status, yield, fruit composition, and overall health and appearance begins in year three when vines reach bearing age. Data collection is currently underway at four sites and will begin at three more sites in 2020. Observations of nutrient deficiency and incidence of pests and disease have made and will contribute to the overall determination of superior cultivars.

INTRODUCTION

Grapes represent one of few fruit crops that can be successfully grown across the entire state of Texas. However, the availability of well-adapted cultivars is limited, and cultivar selection is the single most important criterion for success. With a wide range of grapes to choose from, homeowners often plant cultivars they recognize, but most require intensive management to be successful. The most well-known grapes used for winemaking (e.g., 'Cabernet Sauvignon', 'Chardonnay', 'Riesling', 'Merlot'), raisins (e.g., 'Thompson Seedless'), table grapes (e.g., 'Flame Seedless', 'Thompson Seedless'), and juice (e.g., 'Concord', 'Niagara') are highly susceptible to a range of fungal diseases as well as the bacterial disease - Pierce's Disease (PD). PD is caused by the bacterium *Xylella fastidiosa* and it is endemic to the U.S. Gulf Coast. PD represents the single greatest limiting factor to grape production in Texas. All European (*Vitis vinifera*) and most hybrid grapes (*Vitis sp*.) are susceptible to PD. However, muscadine grapes (*Vitis rotundifolia*), which are native to Texas, are PD resistant or tolerant.

Due to a different chromosome number (2n = 40), muscadines are largely incompatible with other species of grapes (2n = 38), but they have been greatly improved through breeding. Over one hundred improved muscadine cultivars have been developed including self-fertile cultivars and most recently, seedless cultivars. Muscadines represent a good, disease resistant option for homeowners, but their tolerance of alkaline soils conditions has been largely undocumented. The goal of this research was to identify high quality, disease resistant grapes that can be successfully grown across Texas using Earth-Kind™ trialing methods (Harp et al., 2009). Earth-Kind™ is program started by the Texas A&M AgriLife Extension Service in 1990s to identify adaptable landscape plants through regional trialing, and without the use of pesticides.

METHODS AND MATERIALS

Earth-Kind™ Grapes Trial Sites

Earth-Kind™ Grapes trials have been established in six counties across the state of Texas in areas representing annual precipitation of over 127 cm (>50 in.) to less than 38 cm (<15 in.) (Fig. 1). Soil types across the sites range from acidic and sandy with pH values of 4.5 to alkaline and clay-based with pH values of 8.3. Plot establishment and maintenance is performed by Master Gardener organizations in each county. This gives the Master Gardener volunteers an opportunity to participate in research and learn about grape hands-on growing, while the researcher benefits from the potential to expand the scope and scale of the trials.

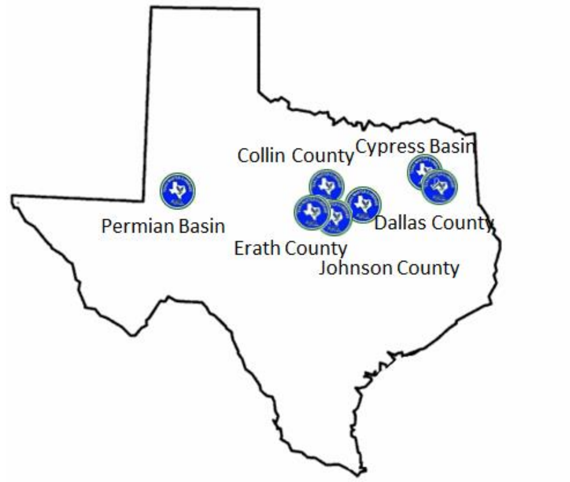

Figure 1. Earth-Kind™ grapes trial locations in 2019.

Plant Material

Nine grape cultivars, representing diverse parentage and plant characteristics, were selected for trialing (Fig. 2). The criteria used to select the grape cultivars included:

1. Pierce's Disease resistant/tolerant
2. Fungal disease resistant/tolerant
3. Self-fertile
4. Not patented
5. Attractive
6. Multiuse

'Champanel': Interspecific hybrid (*V. champinii* x 'Worden') developed by T.V. Munson in 1893. Champanel has medium to large clusters with large black slip-skin berries. Champanel makes excellent jelly and can be used to make a fruity flavored wine (Scheiner, 2019).

'Herbemont': *V. bourquiniana* hybrid developed by Nicholas Herbemont, 1771-1839. Herbemont has medium to large clusters with reddish-brown berries. Herbemont makes a white wine and may be used for jelly typically with purple or black colored grapes added for color.

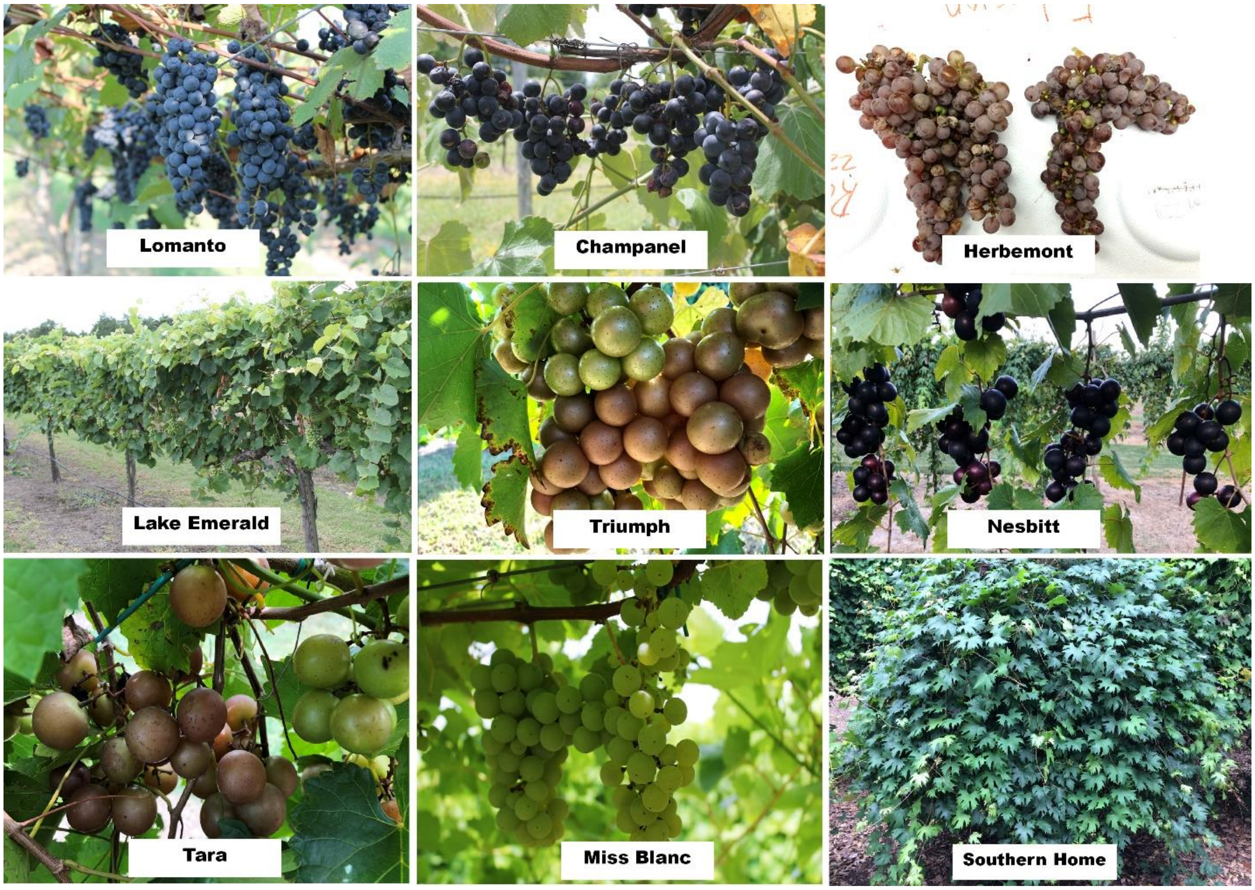

Figure 2. The nine cultivars selected for trialing included muscadines, interspecific hybrid bunch grapes, and one muscadine/bunch grape hybrid.

'Lake Emerald': Interspecific hybrid ('Pixiola' x 'Golden Muscat') released by the University of Florida in 1954. Lake Emerald has large clusters of small green berries that turn yellow with advanced maturity. Lake Emerald was developed as a white wine grape cultivar and takes on a *V. labrusca* flavor when fully mature (Stover 1954).

'Lomanto': Interspecific hybrid ('Salado' x 'Pense') developed by T.V. Munson in 1902. Lomanto has compact clusters of medium-sized black berries. Lomanto makes an exceptionally deep colored red wine and jelly (Scheiner 2019).

'Miss Blanc': Interspecific hybrid 'Galibert 261-12' x ('Extra' x 'Marguerite' seedling) released by Mississippi State University in 1982. Miss Blanc has medium to large clusters of large white- to green-colored berries. Miss Blanc produces an aromatic white wine and may also be used as a juice grape (Overcash et al., 1982).

'Nesbitt': Self-fertile muscadine (*V. rotundifolia*) cultivar released by North Carolina State University in 1985. Nesbitt has large black berries that ripen over a period of three to four weeks and is primarily used for fresh eating and jelly (Goldy et al., 1985).

Southern Home: Complex hybrid ('Summit' x P-9-15) with muscadine and *V. vinifera* parentage. Southern Home was released by the University of Florida in 1994. It produces medium-sized clusters with small (for a muscadine) black berries that have a crisp texture and a muscadine flavor. Southern Home may be used for fresh eating or winemaking, and has very attractive foliage (Mortensen et al., 1994).

'Tara': Self-fertile muscadine (*V. rotundifolia*) cultivar released by the University of Georgia in 1993. Tara has medium to large bronze berries primarily used for fresh eating and jelly (Lane 1993).

'Triumph': Self-fertile muscadine (*V. rotundifolia*) cultivar released by the University of Georgia in 1980. Triumph has medium to large bronze berries with a pinkish hue that are primarily used for fresh eating and jelly (Lane 1989).

Experimental Design

Initial site preparation followed the methods described by Harp et al. (2009). In brief, existing vegetation in the planting row (1.5 m wide strip) was killed and removed prior to planting. A layer of finished compost 7.5 cm (3 in.) deep was tilled into the native soil (Fig. 3).

Figure 3. Prepared trial site immediately before planting and subsequent mulching.

Following planting, organic mulch was applied and subsequently maintained at a depth of 7.5 cm (3 in.) over the course of the study. Irrigation was applied via surface drip with a single emitter placed near the base of each vine. No additional soil amendments or fertilizers were added for the remainder of the study and no pesticides were applied in order to evaluate disease and pest susceptibility.

Vines were spaced at 2.4 m (8 ft.) between vines and 3 m (10 ft.) between rows. The experimental design was a randomized complete block with four, two-vine replications per cultivar. Vine establishment and training were completed during the first two years of the trial and data collection began in year three. The training system used consisted of a simple high-wire system with a single cordon wire position between 1.5 and 1.8 m (5 ft to 6 ft) high. All vines were cordon-spur pruned to approximately 20 buds per meter (3.3 ft) of cordon.

Data Collection

Data collection began in the third year after planting when vines reached bearing age/size. Data was collected on an individual vine basis to characterize vine vigor, nutritional status, yield, fruit composition, and overall health and appearance as follows:

1. **Vine vigor:** dormant pruning weight
2. **Vine health:** visual symptoms of chlorosis, incidence of pests and disease
3. **Phenology:** bud break, bloom, veraison, harvest
4. **Yield components:** cluster number, cluster weight, berry weight
5. **Basic fruit chemistry:** soluble solids and juice pH
6. **Subjective quality assessment:** flavor and preference

RESULTS AND DISCUSSION

Although data collection formally began in year three, all trial sites produced significant quantities of fruit in year two as a result of high vine vigor in most cultivars (Fig. 4).

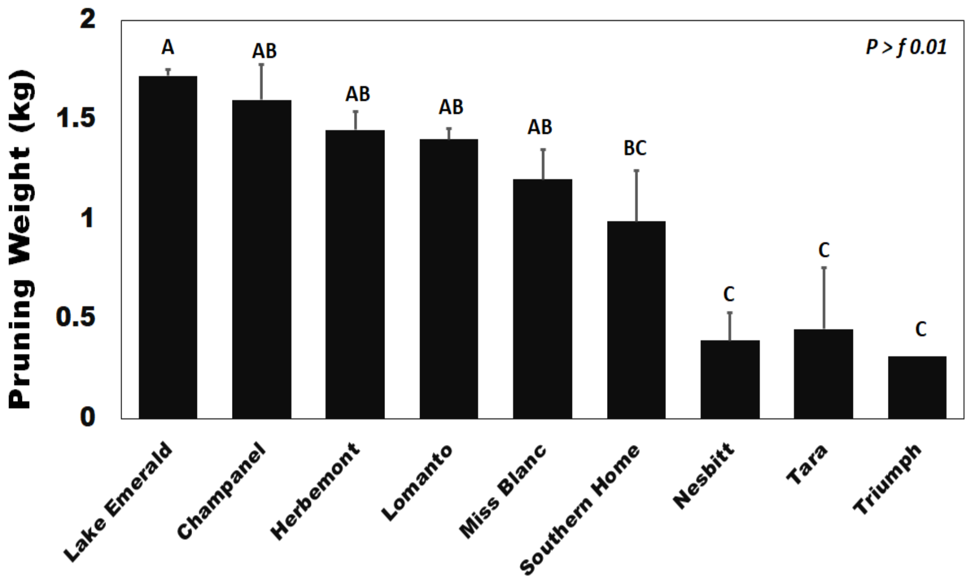

Figure 4. Mean pruning weights of two trial sites in second year after planting. Values are mean ± SE. Means indicated by different letters are significantly different at $p \leq 0.01$, Tukey's HSD.

While site establishment and data collection are still ongoing, the bunch grape cultivars have produced higher pruning weights than the muscadines as a result of greater cane caliper. All bunch grape cultivars under study filled the trellis in their second leaf, but the performance of the muscadines has been more site specific.

On sites with moderately alkaline soils (soil pH > 8.0), shoot tip chlorosis has been consistently observed (Fig. 5). Future data collection will quantify shoot chlorosis through visual ratings and attempt to correlate it with vine vigor and fruit yield.

Figure 5. Iron chlorosis observed in 'Southern Home' and 'Nesbitt' on alkaline soil.

Harvest data has been recorded at three sites (Fig. 6). Total vine yield has been challenging to accurately ascertain in the muscadine cultivars due their asynchronous ripening pattern.

The total number of clusters per vine and mean cluster weight has been used to estimate yields and on average, 'Lake Emerald' has been the most productive cultivar with an estimated vine yield ranging from 4.5 to 8.5 kg/vine across sites (data not shown).

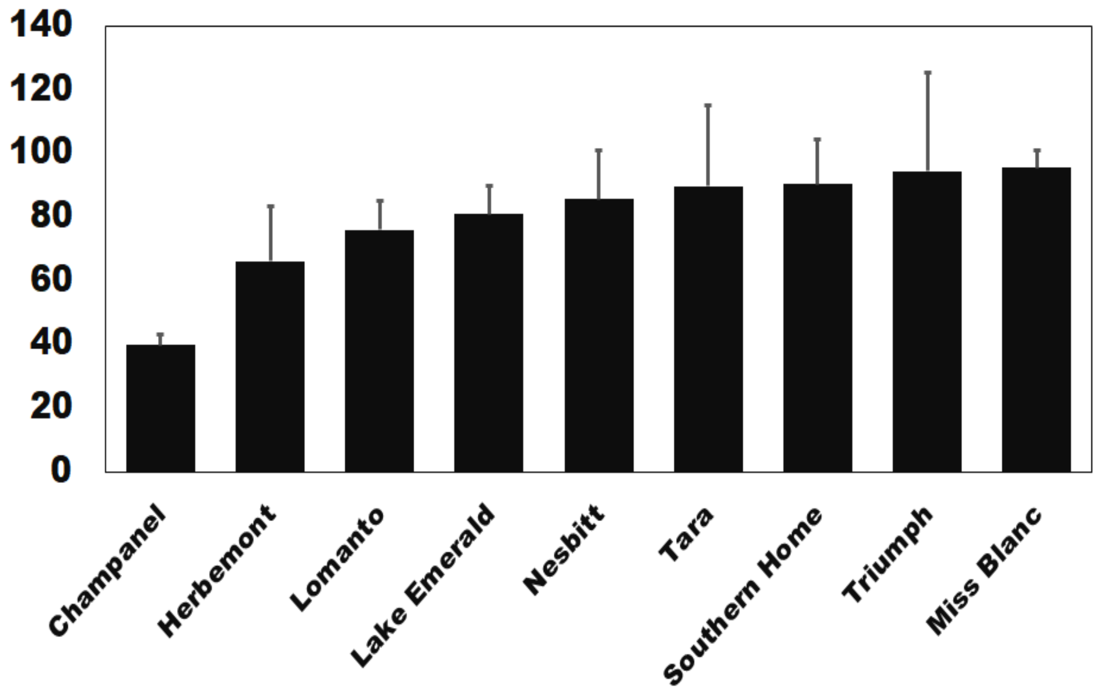

Figure 6. Mean number of clusters per vine in third year after planting for three sites. Values are mean ± SE. Data were not analyzed over sites due to significant cultivar x site interaction.

Observations of the incidence of pest and disease have included variable susceptibility to grape leaffolder moth (*Desmia funeralis*) (Fig. 7), black Rot (*Guignardia bidwelli*) (Fig. 8) and anthracnose (*Elsinoe ampelina*) (Fig. 9). 'Champanel' and 'Lake Emerald' grapes have been infested (≥ 50% of leaves) by leaffolder moth in mid-summer (approximately late July to August) in all sites. Other cultivars are either not infested or only lightly infested. The heavy infestation can result in a rapid increase in exposure of clusters to intense sunlight leading to sunburn, particularly in 'Lake Emerald'.

While controlling this pest can be easily accomplished with insecticides such *Bacillus thuringiensis* (Bt) and carbaryl (Sevin), this may be disadvantageous for the average homeowner.

To date, black rot infections have been observed in 'Lomanto' at two sites. In highly susceptible grape cultivars, black rot can result in total crop loss if left uncontrolled, but the loss observed in Lomanto has been less than 20%. In 2017, anthracnose was observed in Champanel at one site in East Texas. However, fruit loss was estimated to be less than 10%.

Figure 7. Grape leaffolder moth infestation of ‘Champanel’.

Figure 8. Black rot infection in ‘Lomanto’.

Figure 9. Anthracnose infection in ‘Champanel’.

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