

## BLACKBERRY CULTIVATION IN THE WORLD

JOHN R. CLARK<sup>2</sup> & CHAD E. FINN<sup>3</sup>

**ABSTRACT**-Blackberries have now become a common fruit in marketing outlets, particularly in North America and the European Union. Blackberries have enjoyed expansion due to a combination of factors including improved cultivars, expanded marketing efforts and fruit availability, and an overall increase in berry consumption, especially as fresh fruit, in many areas of the world. It is estimated that cultivated blackberries are grown in excess of 25,000 ha worldwide. World production, and cultivation are commented. The rapid expansion of the blackberry industry has been remarkable. New, higher quality, cultivars, modified production practices and new production regions have all combined to make this crop one that consumers expect to be available fresh year-round in their grocery stores. As new cultivars are developed that combine the industry's need for high quality arrivals with increased flavors and expanded dates of harvest, the blackberry industry should expand further.

**Index terms:** blackberry, production, technology,

## CULTURA DA AMORA-PRETA NO MUNDO

**RESUMO**-A amora-preta tornou-se uma fruta comum nos mercados, particularmente na América do Norte e Europa. Ela é bem aceita devido a uma combinação de fatores, tais como variedades melhoradas, mercado em expansão, disponibilidade e por ser uma fruta fresca. É estimado que sua área de plantio é da ordem de 25 mil ha. Devido seu crescimento mundial, é esperado que se torne uma fruta de consumo amplo e ofertada em todos os tipos de mercado de fruta fresca e processada, pela suas qualidades, o que pode levar à expansão de sua área e importância como frutífera comercial.

**Termos para indexação:** Amora-preta, produção, tecnologia.

## INTRODUCTION

Blackberries were once considered only a wild fruit, but cultivation of this domesticated plant has become important in the United States and other countries in the world. The blackberry, in the Rosaceae family, is designated botanically as *Rubus* subgenus *Rubus* Watson., as it is thought to be a blend of a number of *Rubus* species.

Plants in the genus *Rubus*, including blackberries and red raspberries (*R. idaeus* L.), have a perennial root system but have biennial canes. The two cane types are primocanes, or first-year canes, which are usually vegetative, and floricanes, which are the same canes and produce fruit the following season. In red raspberry, primocane- and floricanefruiting cultivars have had substantial commercial value. In blackberry, floricanefruiting has been the basis of all blackberry production and commercial

primocane-fruited cultivars did not exist prior to the release of 'Prime-Jim'® and 'Prime-Jan'® by the University of Arkansas in 2004 (Clark et al., 2005).

Blackberries have now become a common fruit in marketing outlets, particularly in North America and the European Union. Blackberries have enjoyed expansion due to a combination of factors including improved cultivars, expanded marketing efforts and fruit availability, and an overall increase in berry consumption, especially as fresh fruit, in many areas of the world. It is estimated that cultivated blackberries are grown in excess of 25,000 ha worldwide (Strik et al., 2008).

Blackberries are native across much of Eurasia and North America. This presence combined with their tendency to colonize disturbed areas has made them a food source for humans for thousands of years. For most of their history, they were a fruit to be gathered from the wild. It wasn't until the mid

<sup>1</sup>(Trabalho 445-13). Recebido em: 20-09-2013. Aceito para publicação em: 15-12-2013. Palestra II Simpósio Internacional de Fruticultura- Frutas Exóticas, 21 a 25 de outubro de 2013. Jaboticabal-SP.

<sup>2</sup>University of Arkansas, Fayetteville, AR USA. E-mail: jrclark@clark.edu

<sup>3</sup>USDA-ARS, Horticultural Crops Laboratory, Corvallis, OR USA

to late 1800s that people started to select for better or, more typically in the early stages, novel characteristics in plants that were brought into cultivation. Fresh fruit production began to be more common for local sales in the 1900s.

### World Production

The greatest recent expansion in fresh blackberry production has been in North America, for consumption in the U.S. and Europe. This expansion has been driven by factors including a stable blackberry supply in most or all months of the year made up of cultivars that allow shipping to distant markets. While the fresh blackberry industry expanded rapidly in California in the 1990s, it expanded greatest in Mexico in the 2000s. The Pacific Northwest, while primarily a processed industry, had a significant expansion of their fresh market during the same time. While Chile had become a major supplier of fresh berries for off season consumption in the late 1980s and the 1990s for the northern hemisphere, the cost of air freighting fruit from Chile was high and led to a search for new production areas. As a result Chile went from a major fresh red raspberry and blackberry producer in the 1990s and early 2000s to almost no fresh production for export to North America by the mid 2000s. In a similar time frame, Mexican production rapidly increased. Additionally, production in the last 10 years has increased in Guatemala along with several countries in Europe with limited industry development in Australia.

This expansion has also occurred as consumers in many areas of the world have developed increased interest in berries for health benefits, of which blackberries offer substantial antioxidant levels. Thus, blackberries complemented other berries in the expanded consumer interest. The most exciting production area for blackberries that has developed in recent years is Central Mexico, in the states of Michoacan and Jalisco. In the 1980s, cultural manipulations were developed to allow floricanefruiting blackberries to be forced into fruiting without a dormancy period. This production system is cultivar dependent and was first developed on the thorny cultivar Brazos (developed by Texas A & M University, USA), which had an estimated chilling requirement of approximately 300 h. Production of 'Brazos' was the basis of the development of the Mexican blackberry industry in the 1990s. In 1990, the Brazilian cultivar Tupy was brought to Mexico (developed by EMBRAPA, Pelotas, Brazil) and was estimated to have similar chilling requirement as that of 'Brazos'. Although initial efforts to manage 'Tupy' with the same practices used on 'Brazos'

were not fully successful, adjustments were tried and fine-tuned to provide for dependable production of 'Tupy'. The substantially increased quality of 'Tupy' over 'Brazos' led to expanded market development and tremendous expansion in production area. Fruit production in Mexico spans the months of October to June using these specialized management methods. It is estimated that 'Tupy' is produced on 6,500-8,000 Ha in Central Mexico as of 2013. This production has provided for a dependable fruit supply during the "off" season in the US and Europe.

With the expansion of blackberry marketing in the winter and spring in the US and Europe, US domestic production for fresh market was encouraged to increase. Acreage expanded further in the western states, particularly California, and production for commercial shipping began in the South. Georgia, North Carolina, Arkansas, and Texas initiated acres for retail-market sales. Current production in the US is at an all time high with the development of these additional areas. Fig. 1 provides a view of shipping to terminal markets in the USA for 2000-2010. This figure includes data for only California for the US, but with increases in other states in the US, particularly from 2005 onward, one can examine a strong upward trend in production. The production in the US is dwarfed by that of Mexico, however. Therefore, although not all production for shipping is included, one can see that blackberries shipped increased from just above 4,500 kg in 2000 to approximately 54,545 kg in 2010. Some expansion of production in Europe occurred also, scattered in several countries including the UK, Spain, and Italy.

The Pacific Northwest in the US, with over 3,500 ha, and Serbia in Europe, with over 5,000 ha, have remained as the leading producers in the world for the processed market. Chile over the past five years has changed from largely a producer of fruit for the fresh market to one that is mostly for processing. While the tonnage of Mexican fruit going to processing is much less than the tonnage used for the fresh market, with the tremendous expansion of the industry, there now is a processing industry where there was not one in the past. While the fresh blackberry industry has rapidly expanded, the processing industry has remained relatively stagnant with only a small increase in acreage worldwide.

Production practices and cultivars that bring a higher quality, year round product to the consumer, and that are profitable for growers, packers, and processors have been an integral part of this fresh market expansion. Traditional, open-field, floricanefruiting production has been, and continues to predominate, in worldwide production even in the more moderate

climates such as California. However, after high tunnel production systems that were developed in Europe for a number of horticultural crops began to move to the US, they were found to be very useful for blackberry production. The recent expansion of fall-fruiting blackberries, particularly in California in 2011 and 2012 (of the variety Prime-Ark® 45) is virtually all grown under high tunnels. Precipitation, most typically in the fall, is detrimental to the quality of fall ripening fruit and greatly reduces shipping ability and shelf life (particularly when tried in Oregon). With tunnels, producers in mild climates can have excellent fruit nearly until winter although they typically shut down when cheaper fruit begins to arrive from Mexico in the fall.

The development of Mexican blackberry production has involved development of unique production practices that when combined with the mild, high elevation environment of central Mexico and use of the cultivar Tupy, allows for year round production of fruit. Individual blackberry fields can be manipulated to flower and ripen fruit at nearly any time of the year. The primocanes are grown and trained using typical management practices but then they are defoliated and treated with growth regulators to bring the canes into bloom. In addition, the just-fruiting floricanes can be pruned to induce a second flower bud break. Mexican production is usually tailored so there is little production in the main production season of the US as this is the hotter and rainier season and as the crop has more competition from US-produced fruit.

While we have mentioned 'Tupy', which is so integral to the Mexican production system, improved cultivars in general have helped propel the expansion of the fruit industry. The USDA-ARS variety 'Chester Thornless' is probably the most widely grown fresh market blackberry in the world outside of Mexico. Renowned for its productivity, firmness, and retention of its black color during shipping, it has recently begun to fall from favor due to its only fair fruit flavor and the fact that there are now competitive cultivars with better fruit quality. In the erect types developed at the University of Arkansas, 'Cherokee' served as a mainstay of the industry until the 1990s but was replaced by the thornless 'Navaho' which in turn is being complemented by the thornless 'Ouachita' (Clark and Moore, 2005) followed by 'Natchez' (Clark and Moore, 2008) in 2007 and 'Osage' in 2012. While the western trailing types have generally been too soft for shipping, 'Siskiyou', released in the 1990s and more recently 'Obsidian' are exceptions that are very early ripening, filling a unique niche, and are just firm enough to ship. The

trailing 'Onyx' and 'Newberry', which is a 'Boysen'-type blackberry, are poised to be important regional fresh market cultivars for the west coast of the US.

Primocane fruiting, one of the most innovative developments in blackberry breeding, has several advantages including: 1) potential of two crops on the same plant in the same year (floricane followed by primocane) 2) later-season (autumn or fall) fruiting, 3) the possibility of scheduling fruit production based with primocane management, 4) reduction in pruning costs by mowing of canes (primocane crop only), 5) avoidance of winter injury, and 6) production of fruit in an extended geographic area (such as low- or non-chill environments). The value of primocane fruiting depends primarily on the growing environment and fruit marketing opportunities. A very important period in which availability of blackberry fruit is limited in the U.S. is September to November, the period when most of the summer production in the U.S. is complete, but before substantial Mexican imports begin. This is also a time of higher fruit prices and potential grower profitability (Carvalho et al., 2010). Primocane-fruiting is beginning to play a role in filling this market window. Winter injury is a major concern in the mid-western to northern U.S., and prevents reliable fruiting of blackberries. Since canes of primocane types do not need to overwinter, the opportunity exists to grow blackberries in areas where they are usually winter killed. In areas with inadequate chilling for floricane-fruiting blackberries, primocane production has potential as the need for chilling is eliminated. This might be particularly valuable in Mexico where chemical manipulations of plants are required on floricane-fruiting cultivars.

The University of Arkansas recently released the first commercially viable, primocane fruiting blackberry, 'APF-45' (marketed as Prime-Ark 45®) (Clark and Perkins-Veazie, 2011). While it is too early to tell the impact of this cultivar, it has begun to make an impact in the US market for August to October fruit sales. The industry will be growing more primocane fruiting types in the future. Primocane-fruiting red raspberries served a critical role in the expansion of the raspberry industry. The primocane habit allowed growers to grow the crop in areas of low or no chill and also more fully manipulate cropping time. This has resulted in red raspberries being grown in a short-term perennial production system where yield, fruit size, and fruit quality were maximized. As improved cultivars of primocane-fruiting blackberries are developed, it is expected they will have the same sort of impact on fresh production (Clark et al., 2012).

### Highlights of Production

Blackberry plantings are usually established by plants. Plants are often produced by tissue culture, and this type of plant provides for the healthiest planting material with less risk of virus infection. Plants are also produced from layering, stem cuttings and root cuttings, depending on type or variety. Plants are normally spaced 0.6 to 1.3 m apart on rows spaced 3-4 apart. Figures 2 thru 1 provide some illustrations of blackberry plantings and fruits.

Blackberry harvest usually occurs the year after planting, allowing for quick return of the investment in planting. Yields can be as high on one-year-old plantings as mature plantings in erect types.

Blackberry culture differs depending on type and where grown. The trailing type blackberry common in Oregon requires tying to the trellis and management is much different from erect types. The erect varieties also use a trellis, but after the first year of growth do not normally require tying to the trellis.

Fruits are used for fresh market sales or processing. Most varieties ripen in the summer months, ranging from June to August depending on location and variety, plus the primocane-fruiting varieties

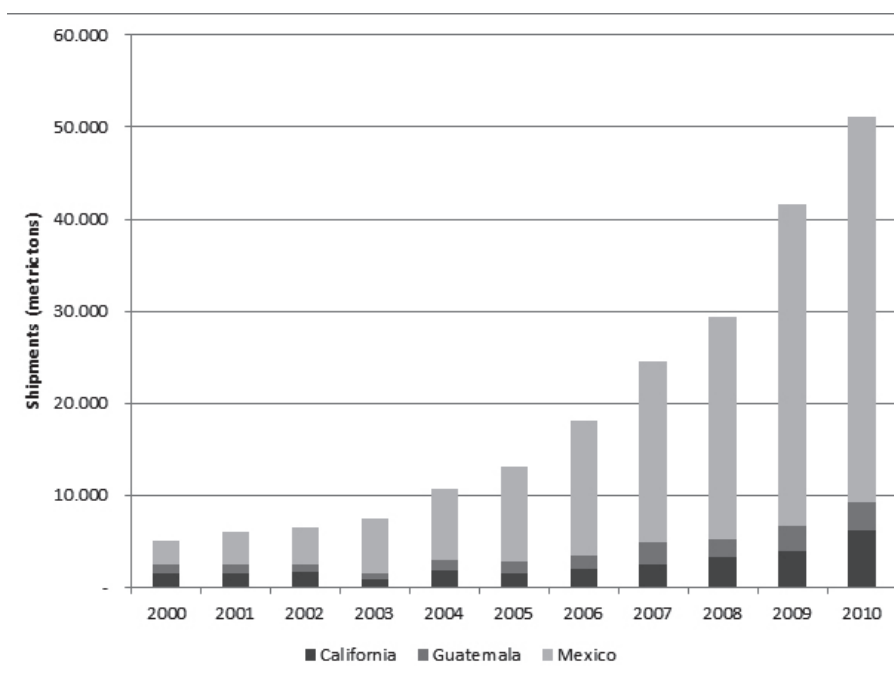
extend until the end of the growing season also. The erect types tend to be the firmest and allow shipping and storage for retail markets. The trailing types are more often processed. Products from processing types are frozen, canned, yogurt, jellies and jams.

Yields vary depending on variety and production system. Generally, yields extend from 8,000 to 20,000 kg/ha. Prices in the US are usually highest for fresh market fruit but vary from season to season based on production levels and if blackberries from Mexico are present in the market, and when this occurs the US price can be reduced. Local markets provide outlets also for blackberries, marketed on the farm, pick-your-own, or at farmers markets, and these markets can be very profitable particularly in areas with large urban populations.

The following websites are valuable for viewing major guidelines of production:

Erect blackberry production: <http://www.ces.ncsu.edu/depts/hort/hil/pdf/ag-401.pdf>; <http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2008/08BrambleguideMay22.pdf>.

Trailing blackberry production: <http://berrygrape.org/blackberry-production-in-oregon/>



**FIGURE 1-** Growth in U.S. fresh market shipments 2000-2010 by major production regions. These are not total shipments because not all regions report to USDA including the southern USA, however, data are indicative of the trend. (source USDA Agricultural Marketing Service).



**FIGURE 2-** Newly established Ouachita erect blackberries on black plastic mulch; upper picture just planted, lower picture after growth has begun.



**FIGURE 3-** First year complete-season growth of Ouachita tied to the trellis for fruiting the next season (upper photo). Natchez canes tied to trellis after one year's growth.



**FIGURE 4-** Erect primocanes on a mature Ouachita plant at tipping height of about 1.2 m. Floricanes that grew the year prior are blooming with fruit ripe about 50 days after bloom.



**FIGURE 5-** Natchez fruit.



**FIGURE 6** -The primocane-fruiting trait expressed on canes, where the canes terminate in a flower rather than remaining vegetative as floricanes-fruiting types grow.



**FIGURE 7** - A commercial planting of Prime-Ark 45® in California grown under a high tunnel. Plants begin fruiting in August, this picture taken in mid October.





**FIGURE 8** -Comparison of fruit of Prime-Jim ® fruit grown in moderate summer and fall temperatures in Oregon (upper photo) and in Arkansas (lower photo). Temperatures during bud, flower and fruit development above 32-35C are detrimental to quality fruit production and areas similar to this are not recommended for primocane-fruiting varieties.



FIGURE 9-Fruit of Prime-Ark 45® (above) in clam-shell packaging for marketing in retail markets in the US. Lower photo is of Tupy blackberries grown in Mexico for US marketing.



**FIGURE 10-** Trailing blackberry with leaves (upper photo), and dormant plants tied to the trellis (lower).



**FIGURE 11-** Large planting of ‘Marion’ trailing blackberry in Oregon for processing.

## CONCLUSIONS

The rapid expansion of the blackberry industry has been remarkable. New, higher quality, cultivars, modified production practices and new production regions have all combined to make this crop one that consumers expect to be available fresh year-round in their grocery stores. As new cultivars are developed that combine the industry’s need for high quality arrivals with increased flavors and expanded dates of harvest, the blackberry industry should expand further.

## REFERENCES

CARVALHO, T.; THOMSEN, M.R.; CLARK, J.R. Commercial fresh blackberry shipping market growth and price trends in the United States. **Fruit News**, New York, v.10, n.2, p.8-10, 2010.

CLARK, J.R.; J. N. MOORE. ‘Natchez’ thornless blackberry. **HortScience**, Alexandria, v.43, p.1897-1899, 2008.

CLARK, J.R.; J. N. MOORE. ‘Ouachita’ thornless blackberry. **HortScience**, Alexandria, v.40, p.258-260, 2005.

CLARK, J.R.; PERKINS-VEAZIE, P. Prime-Ark® 45 primocane-fruited blackberry. **HortScience**, Alexandria, v.46, p.670-673, 2011.

CLARK, J.R.; MOORE, J.N.; LOPEZ-MEDINA, J.; PERKINS-VEAZIE, P.; FINN, C.E. ‘Prime Jan’ (APF-8) and ‘Prime-Jim’ (APF-12) primocane-fruited blackberries. **HortScience**, Alexandria, v.40, p.852-855, 2005.

CLARK, J.R.; STRIK, B.; THOMPSON, A.E.; FINN, C.E. Progress and challenges in primocane-fruited blackberry breeding and cultural management. **Acta Horticulturae**, The Hague, v.926, p.387-392, 2012.

STRIK, B.C.; CLARK, J.R.; FINN, C.E.; BAÑADOS, M.P. Worldwide production of blackberries. **Acta Horticulturae**, The Hague, v.777, p.209-218, 2008.