Worldwide Blackberry Production

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ADDITIONAL INDEX WORDS. Rubus, cultivars, area planted, statistics, production systems, erect, semi-erect, trailing, primocane-fruiting blackberry

SUMMARY A survey of worldwide blackberry (Rubus spp.) production was conducted in 2005. Results indicated there were an estimated 20,035 ha of blackberries planted and commercially cultivated worldwide, a 45% increase from 1995. Wild blackberries still make a significant contribution to worldwide production, with 8000 ha and 13,460 Mg harvested in 2004. There were 7692 ha of commercially cultivated blackberries in Europe, 7159 ha in North America, 1640 ha in Central America, 1597 ha in South America, 297 ha in Oceania, and 100 ha in Africa. Worldwide production of cultivated blackberries was 140,292 Mg in 2005. Of the blackberry area worldwide, 50% was planted to semierect cultivars, 25% to erect, and 25% to trailing types. ‘Thornfree’, ‘Loch Ness’, and ‘Chester Thornless’ were the most important semierect types, and ‘Brazos’ and ‘Marion’ the most common erect and trailing types, respectively. In general, erect and semierect cultivars are grown for fresh market and trailing cultivars for processing. Fresh fruit are usually picked into the final container in the field, whereas 75% of trailing blackberries for processing are picked by machine. Common production problems are reported. Production systems for field-grown blackberry differ with type grown and region. For example, in Mexico, production systems are modified to extend the production season for ‘Tupy’ and other erect-type cultivars from mid-October to June. Organic blackberry production is expected to increase from the 2528 ha planted in 2005. An estimated 315 ha of blackberries were grown under tunnels, mainly to protect against adverse weather and target high-priced markets. Based on this survey, there may be 27,032 ha of commercial blackberries planted worldwide in 2015, not including production from harvested wild plants.

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Blackberries have long been a favorite wild fruit, as many species are native to several countries worldwide and are picked for personal or commercial use. Natural hybrids of wild species provided several of the first named cultivars including, for example, ‘Eldorado’ (Rubus allegheniensis × R. frondosus) introduced in the mid-1850s in the United States (Hall, 1990; Moore, 1984).

Blackberries are often classified according to their cane architecture into three types: erect, semierect, and trailing (Strik, 1992). Erect-caned cultivars include the thorny ‘Brazos’, ‘Tupy’, and ‘Cherokee’; and the thornless ‘Navaho’ and ‘Arapaho’. Semierect cultivars include ‘Chester Thornless’, ‘Thornfree’, ‘Loch Ness’, and ‘Caçanska Bestrna’. Trailing cultivars include ‘Marion’, ‘Silvan’, and ‘Thornless Evergreen’ and the blackberry-raspberry hybrids ‘Boysen’ and ‘Logan’. The new primocane-fruiting cultivars ‘Prime-Jan’ and ‘Prime-Jim’ (Univ. of Ark., Fayetteville) are erect, thorny types. Erect blackberries produce primocanes from buds at the base of floricanes at the crown or from buds on roots, whereas trailing and semierect types only produce new primocanes from buds on the crown. With the exception of the primocane-fruiting erect types, primocanes are vegetative the first year and fruit the second year on the entire length of the florican.

In 1990, results of a survey conducted in North America reported 3180 ha of blackberries in the northwestern United States (Strik, 1992) and 1205 ha in the eastern United States (Clark, 1992), for a total of 4385 ha. In 1990, most of the blackberry production in the eastern United States was pick-your-own or prepicked for on-farm or local sales, and less than 2% was processed (Clark, 1992). In contrast, over 90% and 50% of the trailing blackberry crop in Oregon and California, respectively, was processed in 1990. Over 80% of the production from the 55 ha of erect and semierect blackberries in northwestern United States was marketed fresh in 1990 (Strik, 1992).

In the 1990s, blackberries were not found on grocery store shelves in...
the eastern United States and only rarely in the western United States (Clark, 2005). Late in the 1990s, ‘Chester Thornless’ became a major shipping blackberry, as it was found to have good fruit firmness. ‘Navaho’ was found to have excellent shelf life and could be shipped. These and other cultivars contributed to a major shift in the production outlook for shipping of blackberries from that of a local-marketed crop to one shipped for retail marketing (Clark, 2005).

In the mid- to late 1990s, shipping of blackberries from Chile, Guatemala, and Mexico into the United States provided fresh blackberries during the “off-season” autumn, winter, and spring months, increased consumer awareness of this berry crop, and consequently increased sales of U.S.-produced fruit in season also. Production of blackberries was apparently on the increase worldwide; however, there was relatively little factual information on area planted, cultivars grown, and most common production systems. This review is based on a survey of worldwide blackberry production conducted in 2005. To our knowledge, no prior survey had been done on worldwide blackberry production; we were thus surprised at some of our findings, particularly the large area planted in Serbia and the high production in China. Included in the many questions asked in our survey were an estimate of area planted in 1995 (Fig. 1). Worldwide blackberry production was 140,292 Mg (Table 1). In the following sections, we will provide more information on blackberry area and production systems in the major producing regions of the world. We include little information on production in countries with less than 100 ha planted (Table 2).

EUROPE. There were 7692 ha of commercially cultivated blackberries in Europe in 2005. Serbia accounted for 69% (5300 ha) of Europe’s blackberry area and had the greatest area in the world (Fig. 1). Serbia produced 25,000 Mg, the fourth highest production in the world (Fig. 2), with 90% of their production processed and exported.

Hungary was the next largest producer in Europe with 1600 ha or 21% of the total area and 12,000 Mg, most of which was processed and exported. Countries in Europe with 100 ha or more were the United Kingdom, Romania, and Poland (100 ha each), Germany (110 ha), and Croatia (180 ha). In the United Kingdom and Germany, most of their production was for fresh, domestic use. Area in Poland has doubled in the last 10 years; 500 Mg were produced with 80% processed and most of this was exported as was most of their fresh production.

NORTH AMERICA. There were 7159 ha of commercially cultivated blackberries in North America in 2005 with the United States accounting for 67% of the area planted (4818 ha), the second highest in the world. The area planted in Europe increased 28% from 1995 to 2005. The United States had the highest production in the world with 31,841 Mg (Fig. 2).

Sixty-five percent of the blackberries cultivated in the United States were in Oregon (Table 3). Area in this state increased 25% from 1995 to 2005. Over 95% of the total production of 22,848 Mg was processed with the remaining marketed fresh, all for domestic use. Most of the blackberries were trailing types, Oregon particularly the cultivars ‘Marion’ (61%), ‘Boysen’ (15%),

Table 1. Worldwide area and production of blackberries, 2005.

<table>
<thead>
<tr>
<th>Region</th>
<th>Area planted (ha)*</th>
<th>Production (Mg)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>7,692</td>
<td>43,000</td>
</tr>
<tr>
<td>North America</td>
<td>7,159</td>
<td>59,123</td>
</tr>
<tr>
<td>Central America</td>
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<td>South America</td>
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<tr>
<td>Asia</td>
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<td>26,350</td>
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<tr>
<td>Oceania</td>
<td>297</td>
<td>3,650</td>
</tr>
<tr>
<td>Africa</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>World total</td>
<td>20,035</td>
<td>140,292</td>
</tr>
</tbody>
</table>

*1 ha = 2.4711 acres, 1 Mg = 1.1023 ton.

USA: Alabama (Bobby Boozer, Auburn Univ.); Arkansas (John Clark, Univ. of Arkansas); California (Rick Harrison, Driscoll Strawberry Assoc., Inc.; Mark Bolda and Ed Perry, Univ. of California); Delaware (Darryl Swartz, Univ. of Maryland); Florida (Jeff Williamson, Univ. of Florida); Illinois (Bob Marvin, Univ. of Illinois); Iowa (Gail Nonnecke, Iowa State Univ.); Indiana (Bruce Bordelon, Purdue Univ.); Georgia (Gerard Krewer, Univ. of Georgia); Kansas (Sorkel Kadir, Kansas State Univ.); Kentucky (John Strang, Univ. of Kentucky); Louisiana (John Pyznar, Louisiana State Univ.); Maryland (Harry Swartz, Univ. of Maryland); Massachusetts (Sonia Schloemoh, Univ. of Massachusetts); Michigan (Eric Hanson, Michigan State Univ.).

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Table 2. Countries, by region, that reported from 1 to 99 ha of planted blackberries in 2005 (countries with greater area are reported in the text).

<table>
<thead>
<tr>
<th>Region/country</th>
<th>Area planted (ha)</th>
<th>% Change 1995–2005</th>
<th>% Change 2005–2010</th>
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<tbody>
<tr>
<td>Europe</td>
<td></td>
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<tr>
<td>Austria</td>
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<td>Belgium</td>
<td>5</td>
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</tr>
<tr>
<td>France</td>
<td>30</td>
<td>200</td>
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</tr>
<tr>
<td>Ireland</td>
<td>10</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Italy</td>
<td>26</td>
<td>28</td>
<td>92</td>
</tr>
<tr>
<td>Spain</td>
<td>55</td>
<td>450</td>
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</tr>
<tr>
<td>Switzerland</td>
<td>35</td>
<td>0</td>
<td>0</td>
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<tr>
<td>The Netherlands</td>
<td>21</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>North America</td>
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</tr>
<tr>
<td>Canada</td>
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<td>36</td>
<td>67</td>
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<tr>
<td>Central America</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Guatemala</td>
<td>90</td>
<td>–63</td>
<td>33</td>
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<tr>
<td>South America</td>
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<td></td>
<td></td>
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<tr>
<td>Argentina</td>
<td>35</td>
<td>106</td>
<td>49</td>
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<tr>
<td>Peru</td>
<td>2</td>
<td>1900</td>
<td>650</td>
</tr>
<tr>
<td>Uruguay</td>
<td>9</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Venezuela</td>
<td>1</td>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>Oceania</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>38</td>
<td>90</td>
<td>32</td>
</tr>
</tbody>
</table>

*1 ha = 2.4711 acres.

‘Thornless Evergreen’ (11%), and ‘Silvan’ (7%). An estimated 125 ha of semierect types were present in Oregon, mainly ‘Chester Thornless’ grown primarily for late-season fresh market from early August through October. Only 1% of the blackberries in Oregon were erect types, mainly ‘Cherokee’ and ‘Navaho’, hand-picked for fresh market in July.

The next largest blackberry producing state in the United States was California with 2359 Mg in 2005. The fruiting season is from mid-May through August. Over half of the area was planted to semierect cultivars. The production of ‘Boysen’ for processing in the central valley of California has declined steadily, as predicted (Strik, 1992), to only 40 ha. Most of the blackberry production in California was now located on the north-central coast, near Watsonville, and has a fresh-market focus.

Texas reported 275 ha and 726 Mg in 2005. Only erect blackberries are planted, with ‘Kiowa’, ‘Brazos’, and ‘Rosborough’ accounting for 85% of the area. Only 10% of the production is processed, with 40% sold on-farm and 50% marketed to domestic, U.S. markets in the months of May–July. Arkansas had 243 ha, a 60% increase in planted area from 1995. A broad range of erect cultivars are being grown, including ‘Arapaho’, ‘Navaho’, ‘Ouachita’, ‘Apache’, ‘Chickasaw’, and ‘Kiowa’. Eighty percent of this production is marketed fresh, and the rest is sold on-farm from 20 May to 20 July. The area in Georgia has tripled in the last 10 years to 127 ha. Erect types are mainly grown with ‘Arapaho’ and ‘Navaho’ accounting for 60% of the area planted.

In the United States, other than the aforementioned five states, four states reported 50–100 ha planted. An additional 26 states reported from 2 to 50 ha of blackberries. Of note is Washington, which had less than 50 ha in 1995; this area had doubled by 2005 and is projected to grow to 140 ha by 2015.

Mexico accounted for 32% of the planted area in North America in 2005 with 2300 ha, a very large increase from 230 ha in 1995. Most of the blackberries are planted in the state of Michoacan, but there is also some production in the state of Jalisco and a new planting of semierect types in state of Chihuahua. The predominant type of blackberry grown was erect, particularly ‘Brazos’ and ‘Tupy’ with relatively little (5%) semierect types, mainly proprietary
cultivars. Most of the Mexican production targets fresh export markets to the United States. In 2004, Mexico exported 7480 Mg to the United States, more than double their export volume in 2002.

Central America. There were 1640 ha of commercially cultivated blackberries in Central America in 2005 with 1590 Mg produced. The two countries that reported commercial production were Costa Rica and Guatemala. There were 1550 ha of blackberries (mainly ‘Brazos’ and R. glaucus) in Costa Rica located predominantly in the Provinces of Cartago and San José. Most grow R. glaucus like a shrub without a trellis in organic production systems. Of the 1500 Mg produced in 2004, <15% was exported. Presently, most is used for local processed and fresh consumption.

The blackberry production area in Guatemala declined 63% from 1995 to 90 ha in 2005 but is expected to increase 33% in the next 10 years, provided this country can compete with Mexican production. Guatemala is the main country in Central America that ships fresh blackberries to the United States.

South America. There were 1597 ha of commercially cultivated blackberries in South America in 2005 with 6380 Mg produced. Ecuador accounted for about half of the planted area with 850 ha. ‘Brazos’ and R. glaucus are the main types planted in organic production systems with average yields of 15 and 2.5 Mg·ha⁻¹, respectively. There was an estimated 30% growth in planted area from 1995 to 2005, but little growth is projected for the next 10 years. Only 15% of their estimated 1290 Mg of production are exported for fresh market, mainly due to the soft fruit of R. glaucus and the Mediterranean fruit fly (Ceratitis spp. and Anastrepha spp.).
Chile had 450 ha of commercial blackberries in 2005 with a total production of 3879 Mg. The area planted increased 50% from 1995 to 2005. In 2004, Chile exported 9679 Mg of processed fruit (55% to 65% was harvested from introduced wild species) and 190 Mg of fresh fruit. Their fruiting season is from November to March using trailing, erect, and semierect cultivars and wild species. Production systems for cultivated types are similar to those reported for the United States.

Brazil had 250 ha and 780 Mg of production with only 15% exported. All of their area is planted with erect blackberries, mainly ‘Tupy’ and ‘Guarani’. Most of the production is processed for domestic use.

No other countries in South America reported more than 100 ha of area planted.

**Asia.** China accounted for all of the reported production in Asia with 1550 ha and 26,350 Mg in 2005. Over 90% of the area was planted with semierect blackberry, mainly seedlings of ‘Hull Thornless’ and ‘Chester Thornless’. The remaining area was planted with ‘Shawnee’ and the trailing cultivars ‘Boysen’, ‘Marion’, and ‘Siskiyou’. Most of the production in China is processed with 70% of processed fruit, and 10% of the fresh production exported. Most blackberries were planted in the Jiangsu Province, but the newest regions, in the Liaoning, Shandong, and Hebei provinces, are projected to grow most in the next 10 years when China is expected to have 2200 ha.

**oceania.** Most of the blackberry area in Oceania is planted in New Zealand, which had 259 ha and 3350 Mg in 2005. The fruiting season in New Zealand is from November through April with almost all of their blackberry production consisting of trailing types, mainly ‘Boysen’. Almost all of their production is processed with 55% of that exported.

**Africa.** South Africa was the only country in 2005 reporting commercial blackberry production with 100 ha. About 60% of their area was planted to ‘Young’ trailing blackberry that was all processed and 60% exported. ‘Hull Thornless’, ‘Loch Ness’, ‘Choctaw’, and ‘Arapaho’ were grown also, with 50% of their production being marketed fresh. However, it was not cost-effective to export fresh fruit from South Africa to Europe. They reported problems with plant importation due to phyto-sanitary restrictions and the need for cultivars that are firmer for long-distance shipping. They will try to produce the new primocane-fruiting types in South Africa.

**Cultivars**

Wild or feral blackberries still make a significant contribution to worldwide production and although accurate data are hard to obtain, survey respondents estimated that 3600 ha of wild blackberry (R. glaucus) in Ecuador, 2400 ha in Romania (R. armeniacus, R. laciniatus), 2000 ha in Chile (derived from introduced R. ulmifolius), a small area of unknown size in Mexico, and 100 ha R. glaucus in Venezuela were harvested in 2005. The 8000 ha of wild blackberries harvested in 2005 had a total reported production of 13,460 Mg. About one-third of worldwide blackberry production (5800 Mg) was processed and exported in Chile. In some regions, like northwestern North America, fruit harvested from wild blackberries, even though for personal use, may negatively impact sales of commercially grown fruit.

Respondents reported the cultivars grown on 15,412 ha of the 20,035 ha of blackberries grown worldwide. On this reported area, 50% of the area was planted to semierect cultivars, 25% to erect, and 25% to trailing types.

In general, erect and semierect cultivars are grown predominantly for fresh market; these types produce fruit that is more firm, has a longer shelf life, and is better suited to shipping. Trailling types, however, are mainly used for processing. These cultivars, like Marion, are known for having highly flavored, aromatic fruit, with small seeds. Fruit of most trailing cultivars available today are not firm enough for long-distance shipping. Still, there are a few cultivars of trailing blackberry that are relatively new and are suited for fresh market; ‘Siskiyou’ and ‘Obsidian’ are examples.

The first cultivars of primocane-fruiting blackberry to be released were ‘Prime-Jan’ and ‘Prime-Jim’ in 2004. In 2005, primocane-fruiting blackberry were not yet commercially grown, although test plantings had been established in Arkansas and Oregon.

**Trailing.** ‘Marion’ is the most important trailing blackberry grown, accounting for 51% of the worldwide area of trailing types; more than 90% of the worldwide ‘Marion’ area is located in Oregon. ‘Boysen’ accounted for 24%, ‘Thornless Evergreen’ 9%, and ‘Silvan’ 5% of the worldwide area of trailing blackberry. However, in 2004 and 2005, plant sales of the new thornless ‘Black Diamond’ were greater than all other predominant cultivars being ‘Thornfree’, ‘Dirksen Thornless’, and ‘Smoothstem’ that are harvested in July and August. ‘Loch Ness’ accounted for 75% of the blackberry area in Hungary and is the main cultivar in Germany and Romania. In Oregon, ‘Chester Thornless’ and other semierect cultivars are primarily for the late-season, early-August through October, fresh market with an average yield of 30 Mg ha$^{-1}$.

The only other cultivar grown on more than 5% of the worldwide semierect area was ‘Čačanska Bestrna’, a newer cultivar from the Investigation, Production, and Trade Center of Pomology and Floriculture in Skiernikowice, Poland, accounted for 80% of the area planted in Poland. Typical yields are 5 to 8 Mg ha$^{-1}$.

**Erect.** ‘Brazos’ was by far the most common erect blackberry grown worldwide in 2005 accounting for 46% of the erect area. However, ‘Brazos’ is being rapidly replaced by ‘Tupy’ in Mexico. Other cultivars accounting for 5% or more of the erect area planted worldwide were ‘Tupy’ (18%), ‘Navaho’ (9%), ‘Kiowa’ (5%), and ‘Cherokee’ (5%). These cultivars are all hand-picked mainly for the fresh market. In Texas, ‘Kiowa’ now accounts for over one-third of the area planted; the superior fruit quality of this cultivar coupled with its extended harvest season, has doubled retail sales of blackberries there.

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cultivars. The fruiting season for this type of blackberry ranges from late June through August, depending on cultivar.

Production systems

Blackberry plantings generally have a life of 5–20 years, depending on the production region, type of blackberry grown, and productivity. Plantings are established in the spring using plants propagated by tissue culture or root cuttings, depending on type of blackberry grown. Plantings may be established with bare-root or potted plants.

Semi-erect. The planting density for semi-erect blackberries varies with production region and cultivar. In Serbia, plants are generally established at an in-row spacing of 1.0–1.5 m with 2.5–3.0 m between rows. In the United States, plants are typically 1.5–1.8 m apart in rows that are 3.0–3.6 m apart. In most fields in China, the planting density is very high with 0.3–0.4 m between plants and 1.0 m between rows.

In almost all regions, primocanes are tipped during the growing season, at 1.5–1.6 m high to encourage branching. In the winter, the dead floricanes are removed and the branches of the new canes are pruned to about 0.5 m in length or left unpruned. Canes are either trained on a multiple wire trellis with a nondivided canopy or are trained to a “double T” system. In most regions, plantings are irrigated using drip, overhead, or microjet systems. However, in China fields are commonly flood irrigated.

Average yield is 8–45 Mg·ha⁻¹ with all fruit hand-picked every 3–5 d for fresh market. The fruiting season, in the northern hemisphere, ranges from July to October, depending on cultivar and production region. Excess fruit are processed, usually as a seedless puree.

Erect. In most production regions, plants are established 0.8–1.2 m apart in rows 3 m apart. During the growing season, primocanes are tipped at a height of 0.9–1.2 m, depending on production region, to encourage branching. After fruit harvest or in winter, dead floricanes are removed by pruning. In some production regions, like Oregon, dead floricanes are left in the planting to save labor costs; they will eventually break off and fall into the row middles. In Texas, growers often do not prune out dead floricanes in winter, and see increased problems with anthracnose (Elisine veneta). In winter, the primocane branches are usually shortened to ≈0.5 m by hand. However, in Oregon, use of a machine to hedge plantings in winter results in variable branch length.

Erect blackberries are grown without a trellis in some regions; however, the use of a trellis is becoming very common as planting area increases. Reasons to trellis include the reduction in cane breakage due to wind along with keeping all fruiting canes upright within the row to limit yield loss at fruit maturation. Usually a simple two- or four-wire trellis is used, but canes are usually not tied to the wire. In Georgia, U.S., hydrogen cyanamide (Dormex; SKW Trostberg AG, Trostberg, Germany) is applied in some years to improve budbreak. Drip irrigation systems are most common.

Fruit are harvested by hand, primarily for fresh market, every 3–5 d. The fruiting season of erect floricanefruiting cultivars is about 4 weeks long, from May to August, depending on production region. Yields range from 3 Mg·ha⁻¹ (Texas) to 11 Mg·ha⁻¹ (Orc.).

In Mexico, the area planted to blackberry has increased 10-fold since 1995 and growth continues to be strong. Specialized production systems have been developed through on-farm research by growers and private companies to extend the season for ‘Brazos’, ‘Tupy’, and other erect cultivars. About 5–7 months after primocane emergence, a chemical defoliant (a combination of urea or ammonium sulfate, copper sulfate, and mineral oil) is applied two to three times. The plants are then pruned by topping canes and shortening laterals to about 0.3 m. Gibberellic acid (GA) and thidiazuron (TDZ) are used about 3 weeks after defoliation to improve flowering and promote budbreak. Fruit harvest begins ≈90–100 d after defoliation. After the first crop is finished, many growers prune again, removing the portion of the cane that fruited, and repeat the defoliation process to obtain multiple crops. Growers then mow the canes to ground level to repeat the cycle. Often plants are grown in tunnels to protect fruit from adverse weather conditions. Using these methods, the Mexican fruiting season extends from mid-October to early May for the export market and from May through June for local markets.

Primocane-fruiting blackberries can be double-cropped (florican in early summer plus primocane in late-summer through autumn) or single-cropped (primocane only). These blackberries were too new to be grown to any significant extent commercially in 2005. It appears that primocane-fruiting blackberries must be tipped during the growing season for maximum fruit production (Strik et al., 2007). Primocane-fruiting blackberries show great promise for improving the availability of fresh market blackberries worldwide using off-season production systems.

Trailing. Trailing types are typically grown in every-year production systems at an in-row spacing of 0.9–1.8 m with 3 m between rows. Most are grown on a trellis with the canes wrapped around two wires (top at 1.7 m second at 1.2 m).

Trailing blackberries can be grown in every-year (EY) or alternate-year (AY) production systems. In EY production, new primocanes are trained along the ground, under the canopy, while the floricanes are on the wire producing the current season crop. After fruit harvest, the dead floricanes are removed and the primocanes trained onto the trellis wires in August or February. Most growers in Oregon train primocanes in February, leaving canes more protected from cold, potentially injurious temperatures as compared with August-training where canes are more exposed to cold injury on the trellis.

In AY production systems, plants fruit every other year. In the “on-year” floricanes produce a crop and primocanes are not managed. In October, the dead floricanes and the primocanes are pruned off at the crown. The following “off-year” primocanes are trained to the trellis as they grow. The yield of an AY field is about 85% of an EY field over a 2-year period (Eleveld et al., 2001). Research has demonstrated that primocanes following an off-year in an AY system are more cold-hardy than...
R. glaucus. C within 2 h of
An estimated 315 ha
211
monitored to ensure high quality. In
wooden stands and are not allowed
clamshells. Flats are usually supported
the final container, often clear plastic
market is hand harvested directly into
Harvest
range from 8 to 15 Mg

-1

ha

-1

EY production systems.

are machine-harvested on more
75% of the area in the United
market are machine-harvested on more
row irrigation is very common.
Overs systems. Over 60% of the trailing black-
area is thought to be
last 10 years to 1550 ha. Much of this
blackberries has increased 55% in the
10 years to 1550 ha. Much of this
area is thought to be R. glaucus. The
average farm size is 2.5 ha. Most
growers are using organic production
but have trouble getting suf-
cient quantities of approved organic
fertilizers. Weeds and native grasses
that grow around plants are kept
short using machetes or mowers. In
this tropical region, fruiting can occur
season long; however, peak fruit-
ing seasons occur from September
to December and January to May.
Typical yield is 1.5 Mg·ha-1.

In Romania and Chile, fruit are
harvested from wild or feral plants in
fence rows, for example, with fruit
brought to processing companies in
small quantities at a time.

Harvest
In general, most fruit for fresh
market is hand harvested directly into
the final container, often clear plastic
clamshells. Flats are usually supported
on specially constructed wire or
wooden stands and are not allowed
to contact the ground. Pickers are
monitored to ensure high quality. In
ideal situations, fruit are harvested in
the early morning, after the dew is off
the berries and temperatures are
cooler, for best quality.

Field-heat is often removed
using forced-air cooling to lower fruit
temperature to 0–1 °C within 2 h
picking. Relative humidity within
the refrigerated rooms is maintained at
85% to 95%, although free moisture
on the berries or in the containers
must be kept to a minimum. Fresh-
market berries are not washed before
shipment to enhance shelf life and
reduce fruit rot.

In Hungary, semi-erect black-
berries (1600 ha) are harvested by hand for
the processing market. Most of the
trailing blackberry production world-
wide for processing is harvested by
machine. Growers begin machine har-
vest when the primary fruit are fully
mature. Fruit are gently shaken from
the plants using self-propelled, over-
the-row machines. Frequency of harvest
is about every 5 d depending on cultivar
temperature, and harvest is typically
at night when fruit are more easily
removed. Machine-harvested fruit are
more uniform in maturity, having
higher aroma, flavor, and percent solu-
ble solids than hand-harvested fruit.

In addition to the possible insect
contaminants, thorns can be a serious
contaminant in thorny cultivars that
are machine harvested. Research has
helped growers minimize this risk by
using machine harvesters equipped
with brushes in winter to remove
potential contaminants (Strik and
Bueller, 2002). Plant breeders consider
the development of high-quality,
thornless trailing blackberry cultivars
a high priority and have recently
released several thornless cultivars
for processing, including the popular
new trailing ‘Black Diamond’ (Finn
et al., 2005).

Blackberries are processed as
individually quick frozen (IQF), bulk
frozen, puree (with or without seeds,
depending on cultivar), freeze-dried,
canned, or juice/concentrate.

Changes in production systems
In the United States, the major
changes over the last 10 years include
a trend toward higher-density plant-
ings and increased use of machine
harvest for processed markets. In
New Zealand, growers have adopted
Eurogap and ISO 22,000 and other
standards, use more foliar fertiliza-
tion, sweep cane prunings into the
row to provide a mulch, and packing
lines now have a water bath. Organic
and tunnel production systems are
becoming more common worldwide.

Organic production. There
were 2528 ha of organic blackberry
production reported in the world in
2005: 1550 ha in Costa Rica, 893 ha
in South America (most in Ecuador),
73 ha in North America (most in the
United States), and 11 ha in Europe.
Most production regions expected an
increase in organic area in the next
10 years.

Tunnels. An estimated 315 ha
of blackberries grown under tunnels
were reported worldwide, with tun-
nels mostly being used to protect
against adverse weather (150 ha in
Mexico; 20 ha in Oregon; and 12 ha
in Washington). Tunnels or green-
houses to advance or delay the fruit-
season in addition to protection
against the elements were used in
Spain (50 ha), The Netherlands and
Italy (20 ha each), Romania (10 ha),
and South Africa (10 ha). Essentially,
all of the blackberries grown in The
Netherlands are in either a tunnel, a
greenhouse, or are covered with plas-
tic (less expensive structure) to pro-
tect fruit from rain. The use of tunnels
is expected to increase, particularly in
Mexico, Oregon, and Washington.

Although tunnels may cost over
USD 25,000 per hectare, growers
report advantages including protec-
tion against rain and heat, relative
freedom from insects and some dis-
eases, and the ability to manipulate
microclimate and thus plant growth
target high-priced markets.
Research on tunnel production of
blackberries began in Belgium and
The Netherlands in the early 1980s.
Tunnels can be used to delay the
fruiting season, simply by protecting
the crop against adverse weather or to
advance the season by placing plastic
over the tunnel at the end of the
dormant period to advance growth.
The season can be further advanced
3–4 weeks by heating the tunnel
starting in late winter. Often, yield
in the tunnel is higher than in the
open field, as less fruit are lost to
disease, winter cold damage is
reduced, and the entire crop can be
harvested (Bal and Meesters, 1995).
Blackberries produced in tunnels have
been reported to have a better shelf
life than open field-grown fruit (Bal and Meesters, 1995; L. Giongo, personal communication). Off-season production in winter can be accomplished by growing blackberries in containers (10 L most commonly) and bringing plants into a heated greenhouse after chilling has been satisfied. Yields are generally lower than for field-grown plants in this production system.

Production problems

Most blackberries are grown using a combination of cultivation and herbicides for weed management and pesticides for disease and insect control.

Cultural. Although semierect blackberries are considered relatively cold-hardy, cold injury is still considered the most important production problem in Serbia, Romania, and Poland, and in Oregon for their most important trailing cultivar, Marion. Damage from low winter temperatures can occur in Arkansas, in some years. In China, in all production regions except Nanjing Province, canes are buried in winter to avoid cold injury. Other cultural production problems mentioned included: managing weeds (almost all production regions), rainfall at harvest (Arkansas, Georgia, Costa Rica), white drupelets, thought to be due to UV (ultraviolet) light damage (United States), and color reversion from black to red (Brazil, Mexico, and some cultivars in some regions in United States).

Diseases. Disease problems were listed as prevalent in all production areas; specifically mentioned were downy mildew [Peroxospora sparsa or P. rubi (Germany, Mexico, New Zealand, Oregon, California)]; powdery mildew [Sphaerotheca macularis (Mexico)]; fruit rot [Botrytis cinerea (Chile, Mexico, New Zealand, Germany, Poland, Romania, Serbia, southeastern United States)] particularly in years with rain occurring during bloom or fruit development; raspberry bushy dwarf virus (New Zealand, Romania, Oregon); cane blight [Leptosphaeria coniothyrium (Georgia)]; crown gall [Agrobacterium tumefaciens (Brazil, Germany)]; anthracnose [Elsinoe veneta (Mexico, United States)]; rosette or double blossom on thorny, erect cultivars [Cercosporella rubi (Arkansas, Georgia, Texas)]; yellow rust [Pheumidium violaceum (Serbia, Romania, Oregon on ‘Thornless Evergreen’ only)]; orange rust [Arthrinomyces peckianus (eastern United States)]; cane and leaf rust [Kuehneola uredinis (western United States)]; unknown rust (Costa Rica); cane and leaf spot [Septoria rubi (western United States)]; orange felt or orange cane blotch [Cephalteuros virens (Georgia)]; and purple blotch [Septocysta ruborunum (trailing types in Oregon; semierect types in Serbia and Romania)].

Insects. The importance of insect pests in blackberry production varies by region. Insect problems mentioned included: raspberry bud moth [Heterocrossa rubobagia (New Zealand)], fruit fly [Ceratitis spp. and Anastrepha spp. (Brazil, Ecuador)], two-spotted spider mite [Tetranychus urticae (Chile, Mexico)], red berry mite [Acalitus esigi (Germany, Hungary, Oregon, California)], aphids [Amphorophora rubi (Romania)], rednecked cane borer [Agrius ruficollis (Arkansas, Texas)], raspberry crown borer [Pennistia marginata (United States)], thrips [Frankliniella spp. (Mexico, Arkansas)], stink bugs [Euschistus spp. (United States)], crickets [Oecanthus spp. (Mexico)], leaf rollers including the orange tortrix (Argyrotettia franciscana) and the oblique banded (Christineura rosaceana) in New Zealand, the United States, and an unknown Lepidopteran (Costa Rica, Mexico).

Birds were mentioned as a problem in Costa Rica, New Zealand, Venezuela, and Texas.

Economic and regulatory concerns

Various economic concerns were raised for blackberry production. Many regions mentioned increasing cost of labor (Chile, New Zealand, Romania, United States). In addition, competition from other production regions and the adverse impact on grower price for fruit was mentioned by several (Chile, Costa Rica, United States). Variability in price growers are paid for fruit as a result of fluctuating supply in years with cold damage (Oregon and Serbia) and low cost to the grower for fruit (Mexico, United States) were also mentioned. The cost of compliance for local environmental legislation is an issue in New Zealand.

Regulatory concerns included impacts of legislation, border security, or immigration reform on the availability of labor in the United States; groundwater issues (New Zealand); chemical or pesticide residues on exported fruit (China, Mexico); ability to meet Eurogap requirements for organic certification (Costa Rica); and requirements for showing traceability or source of fruit in processed markets (Chile).

Limits to expansion. Many areas producing blackberries have some limitations to expansion of the area planted including: lack of and cost of labor (Texas), encroachment of urban area (New Zealand), lack of suitable land and high cost of land (New Zealand), lack of organization, technical support, certified plants, and commercial infrastructure (Costa Rica, Venezuela), lack of processors to handle any increase in production (Brazil, Venezuela), need for fresh market cultivars with better flavor (many regions) or those that are better adapted to the local area (Georgia), and the need for more cold-hardy cultivars with good quality to ensure stability of market (Germany, Hungary, Romania, Serbia). Issues related to markets included: relative lack of consumer awareness of blackberries (South America) and needing markets to expand (China, Mexico, United States).

Despite the above-mentioned limitations, blackberry production is expected to increase in many regions. Projections for the greatest growth in the next 10 years (Fig. 1) are in Romania (90%), Poland (200%), Mexico (117%), China (76%, mainly in trailing cultivars for processing), Hungary (50%), China (42%), and the United States (20%).

Research and breeding programs. In the United States, large public breeding and research programs in blackberry exist at Oregon State University and the U.S. Department of Agriculture, Agricultural Research Service (USDA-ARS), Corvallis, Ore. In the southern United States, research is done on postharvest fruit quality (USDA-ARS, Lane, Okla.), and at the University of Arkansas (Fayetteville) there is a strong breeding program as well as research on various cultural and...
disease issues. There is no public breeding program for blackberries in California and little public research. Two private breeding companies based in California, Driscoll Strawberry Associates, and Plant Sciences, in Watsonville, have blackberry breeding programs.

There is a new breeding program for blackberry in Mexico (University Michoacan de San Nicolas de Hidalgo) but no production/physiology research. Some private companies, based elsewhere, breed for cultivars adapted to the Mexican climate.

There was an active breeding program along with supporting pathology and horticulture research programs conducted by New Zealand HortResearch, in 2005. In South America, there was very little blackberry research reported other than the breeding program at the Embrapa Clima Temperado Research Center in Pelotas, Brazil, and cultivar trials in Chile. In Europe, breeding programs were reported in Poland, Hungary, Romania, Scotland (N. Jennings), and Serbia and production trials or research in Germany, Romania, Poland, and Italy. Asia has no blackberry breeding programs, but cultivars from other regions are undergoing trials in China.

**Conclusion**

Worldwide blackberry area increased from 13,958 ha in 1995 to 20,036 ha in 2005, a 44% increase. Most of this growth occurred in Mexico, the United States, China, and Costa Rica. Projections for the greatest growth in the next 10 years are in Romania, Poland, Mexico, Chile, Hungary, China, and the United States. On the basis of this survey, there may be 27,032 ha of commercial blackberries worldwide, not including production from harvested wild plants, in 2015.

**Literature cited**


