

# The Blueberry Industry of North America

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**Additional index words.** *Vaccinium corymbosum*, *V. ashei*, *V. angustifolium*, highbush blueberry, lowbush blueberry, rabbiteye blueberry, mechanical harvest, blueberry cultivars, blueberry pests, blueberry utilization, blueberry marketing, blueberry research

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**Summary.** Expansion of blueberry culture in North America has occurred during the past decade and is projected to continue into the next century. Thirty-six U.S. states and six Canadian provinces report some blueberry production. The area planted to blueberries has increased by 19% in 10 years, with the largest increase (47%) in cultivated types and only 11% in wild blueberries. It is projected that the total area will increase by an additional 14% by the year 2000. New cultivars are proving of value and are affecting the composition of plantings. Greater interest is being given to mechanical harvesting, and new cultural and pest control innovations are being employed to enhance the economics of production. The expansion of blueberry production is being undergirded by expanded programs in problem-solving research.

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The culture of blueberries in North America is of relatively recent origin. The lowbush species *Vaccinium angustifolium* Ait. and *V. myrtilloides* Michx. are believed to be the first blueberries to be managed because native North Americans are thought to have burned wild stands to enhance production, and European settlers began tending wild stands in the 19th century (Eck and Childers, 1966). Rabbiteye blueberries (*V. ashei* Reade) were first cultivated near the end of the 19th century (Mowry and Camp, 1928), while highbush (*V. corymbosum* L.) culture is a 20th century phenomenon, started by the pioneering research of F.V. Coville and Elizabeth White in the early 1900s (Eck and Childers, 1966).

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Initially, the expansion of cultivated blueberry acreage was slow. By 1930, 10 years after the first improved cultivar introductions from Coville's highbush breeding program, there were <80 ha of highbush under cultivation. Plantings increased steadily, however, and by 1965 there were nearly 8100 ha in production. From 1950 to 1965 alone, the area planted to highbush blueberries quadrupled (Eck and Childers, 1966). Similar expansion trends have occurred with rabbiteye blueberries, but more recently and to a smaller scale, because improvement of this species did not begin until the 1940s.

Today, blueberries are a major fruit crop in North America. To characterize the rapidly changing complexion of the North American blueberry industry and to document its present status, I conducted a survey in 1992. Questionnaires were sent to researchers/extension persons in all 50 states in the United States and nine Canadian provinces. Responses were received from 44 U.S. states and six Canadian provinces. Blueberries are not grown, or are very minor crops, in the nonresponding states (California, Hawaii, Montana, Nevada, Rhode Island, and Wyoming) and provinces (Alberta, Manitoba, and Saskatchewan); therefore, the data collected can be considered essentially complete for the North American blueberry industry.

## Production characteristics

Thirty-six U.S. states and six Canadian provinces reported some blueberry production (Table 1), although it was very minor in several reporting states. States reporting >450 ha of highbush were Michigan (6890), New Jersey (3320), North Carolina (1375), Oregon (670), Arkansas (520), Washington (490), and New York (490). In Canada, the leading provinces in highbush area are British Columbia (1820) and Ontario (275), with lesser amounts in Quebec and Nova Scotia. Major rabbiteye-producing states are Georgia (1620), Florida (580), Texas (520), and Mississippi (445), with lesser amounts in Alabama, Louisiana, North Carolina, South Carolina, Arkansas, Tennessee, and Virginia. Wild lowbush

production is centered in Maine (24,300 ha), Quebec (12,230), Nova Scotia (11,410), and New Brunswick (3240), with lesser area harvested in Newfoundland, New Hampshire, and Massachusetts. Production of a fourth type of blueberry, southern highbush, is still in its infancy, with substantial plantings only in Florida, but testing is underway in several southern states.

Table 1. *Production and marketing characteristics of the North American blueberry industry.*

State or Province	Area (ha)			Avg. yield (t·ha <sup>-1</sup> )	Market outlet (%)		
	1982	1992	2000 (est.)		Processed	Fresh	PYO
Alabama <sup>z</sup>	50	200	300	8.9	15	75	10
Arkansas	350	520	710	8.9	10	80	10
Connecticut	60	80	80	6.7	3	27	70
Delaware	35	30	30	---	0	10	90
Florida <sup>z</sup>	400	850	2,030	3.4	30	60	10
Georgia <sup>z</sup>	1,200	1,670	2,220	5.6	62	33	5
Idaho	0	40	60	6.7	0	25	75
Illinois	60	80	120	5.6	0	60	40
Indiana	260	300	300	3.9	30	30	40
Iowa	0	2	4	10.0	0	0	100
Kansas	2	3	3	3.9	0	0	100
Kentucky	20	20	30	4.5	0	20	80
Louisiana <sup>z</sup>	20	160	320	3.5	40	40	20
Maine <sup>y</sup>	22,300	24,300	26,330	1.9	99	1	0
Maryland	40	70	80	4.5	0	10	90
Massachusetts	200	300	300	13.4	5	65	30
Michigan	4,900	6,890	8,100	4.5	60	35	5
Minnesota	0	30	80	2.2	5	10	85
Mississippi <sup>z</sup>	40	450	810	8.9	60	30	10
Missouri	20	120	130	6.7	10	30	60
New Hampshire <sup>x</sup>	900	660	560	2.5	70	30	0
New Jersey	3,000	3,320	3,240	4.5	30	65	5
New York	300	490	570	6.7	5	50	45
North Carolina <sup>w</sup>	1,600	1,580	1,620	2.8	33	63	4
Ohio	70	110	130	5.0	10	35	55
Oklahoma	40	80	120	6.7	10	30	60
Oregon	250	670	1,010	10.6	55	40	5
Pennsylvania	160	200	200	7.8	0	40	60
South Carolina <sup>z</sup>	70	160	250	8.9	0	10	90
Tennessee <sup>y</sup>	40	70	90	5.6	0	20	80
Texas <sup>z</sup>	80	530	810	11.2	25	50	25
Vermont	---	40	40	---	0	25	75
Virginia <sup>u</sup>	60	85	150	5.6	0	10	90
Washington	320	490	1,090	6.1	40	50	10
West Virginia	0	4	4	---	---	---	---
Wisconsin	0	2	4	2.8	0	5	95
Canada							
British Columbia	970	1,820	2,430	7.8	65	30	5
New Brunswick <sup>y</sup>	2,430	3,240	3,640	2.2	90	5	5
Newfoundland <sup>y</sup>	?	810	810	---	---	---	---
Nova Scotia <sup>y</sup>	9,790	11,410	13,040	2.2	98	2	0
Ontario	60	275	340	5.0	0	25	75
Quebec <sup>y</sup>	12,160	12,230	12,310	1.1	95	5	0

<sup>z</sup>Rabbiteye and southern highbush.

<sup>y</sup>Lowbush (wild).

<sup>x</sup>15% highbush, 85% lowbush.

<sup>w</sup>87% highbush, 13% rabbiteye.

<sup>v</sup>33% highbush, 67% rabbiteye.

<sup>u</sup>67% highbush, 33% rabbiteye.

Table 2. *Area planted to blueberries in North America in 1982 and 1992 and projected for 2000.*

Blueberry type	Area (ha)			Change (%)	
	1982	1992	2000	1982-1992	1992-2000
Northern highbush	12,700	17,540	20,830	+38	+19
Rabbiteye	1,950	3,900	5,220	+100	+34
Southern highbush	160	390	1,840	+144	+372
Cultivated total	14,810	21,830	27,890	+47	+28
Wild (lowbush) total	47,450	52,550	56,600	+11	+8
Total, all types	62,260	74,380	84,490	+19	+14

During the past decade, area planted to blueberries in North America has increased by 19%, from 62,260 to 74,380 ha (Table 2). Cultivated types showed a greater percentage increase (47%) than wild (14%). Among the cultivated types, southern highbush and rabbiteye more than doubled in area planted, indicating a rapid expansion of blueberry production in southern United States.

Projections of production area for the year 2000 indicate continued growth of the blueberry industry (Table 2). Total area of all types is expected to increase by 14%—to 84,490 ha—with a 28% increase in cultivated types and 8% in wild lowbush. The greatest percentage increase will be in southern highbush (372%), but the area planted to this type will still be the least of all types.

Average yields per hectare vary greatly from state to state (Table 1). Many of the highest-reported per-hectare yields are from states with predominantly young plantings just reaching maximum production. Also states with mostly small, intensively managed plantings generally achieve a higher average per-hectare yield than states with extensive production on large plantations. States growing rabbiteye cultivars usually achieve higher per-hectare yields than states with highbush cultivars. Over all regions, highbush yields averaged 5.7 t·ha<sup>-1</sup>, rabbiteye 7.2 t·ha<sup>-1</sup>, and lowbush 1.9 t·ha<sup>-1</sup>.

## Market outlet

Market outlets vary greatly from state to state (Table 1). Generally, states with small areas planted to blueberries market through pick-your-own (PYO) and local markets, while states with large production ship fresh fruit or process. Overall, in North America, 81% of the fruit is processed, 15% sold fresh, and only

4% is PYO (Table 3). By type of blueberry, cultivated is almost equally divided between processed (43%) and fresh (45%), with 12% sold PYO.

Most fruit from wild stands is processed (97%).

## Method of harvest

The increase in area planted to blueberries in the past decade has resulted in a concomitant increase in mechanical harvesting. At present, 60% of the total blueberry area is hand-harvested and 40% machine-harvested (Table 4). Interestingly, this percentage is similar for both cultivated and wild blueberries. Percentage of cultivated area harvested by machine is closely related to the size of the industry in the different states. Most of the larger-producing states (Michigan, Florida, Georgia, and Oregon) report that 50% or more of berries are machine-harvested. In contrast, New Jersey, the second-leading state in cultivated production, reported that only 20% are machine-harvested. Most states with <500 ha report little or no machine-harvest. Machine-harvest of wild blueberries varies among regions. Maine, the leading state in lowbush production, reports 95% hand-harvest, while Quebec reports 95% machine-harvest. Nova Scotia, another leading lowbush province, reported 40% hand- and 60% machine-harvest.

Respondents were asked if they foresaw a change in method of harvest in the future. Almost all in the larger-producing states forecast an increase in machine harvesting. Only the states with little expected production increase in the future do not foresee an increase in mechanical harvest.

The market outlet for fruit based on type of harvest is very different for cultivated and wild blueberries (Table 4). For cultivated, 82% of hand-harvested fruit is used fresh and 77% of machine-harvested fruit is processed. For wild blueberries, 97% of hand-harvested fruit is processed and essentially 100% of machine-harvested berries are processed.

## Cultivars

Respondents were asked to list the five most-popular cultivars in their state, the percentage of area planted to each, and whether the cultivar was increasing, decreasing, or remaining stable in popularity. A total of 25 highbush, 10 rabbiteye, and two southern highbush cultivars were listed in the survey. Area planted to each was calculated and the leading cultivars of each type are shown in Table 5.

The most popular highbush by far is 'Bluecrop', with 35% of the highbush area. It

*“Projections of production area for the year 2000 indicate continued growth of the blueberry industry.”*

Table 3. *Utilization of blueberries produced in North America, 1992.*

Blueberry type	Processed		Fresh		PYO	
	ha	Percent	ha	Percent	ha	Percent
Cultivated	9,400	43	9,830	45	2,620	12
Wild	50,970	97	1,570	3	10	---
Total	60,370	81	11,400	15	2,630	4

is noteworthy also that the future trend for 'Bluecrop' plantings is increasing or steady. In contrast, the second most-planted highbush, 'Jersey', is in decline. 'Bluecrop' was listed on more surveys than any other cultivar, indicating wide adaptability. The third- and fourth-ranked cultivars were listed only by single states ('Weymouth' in New Jersey and 'Croatan' in North Carolina). 'Elliott' is increasing in popularity, as is the new cultivar 'Duke'.

'Tifblue' is the most widely planted rabbiteye, with 40% of the rabbiteye area. 'Climax', in second place, and 'Brightwell', in third, both show increasing popularity. The once-popular 'Woodard' is now in decline. Of the southern highbush listed, 'Sharpblue' is the most-planted, followed closely by 'O'Neal'. Both are increasing in popularity in southern U.S. areas.

Respondents were also asked to list new cultivars that show promise in their states. New cultivars listed as promising (number of respondents listing in parentheses) were: Highbush—'Duke' (11), 'Bluejay' (7), 'Nelson' (7), 'Toro' (5), 'Patriot' (5), 'Elliott' (4), 'Northblue' (3), 'Spartan' (3), 'Sierra' (2), 'St. Cloud' (1), and 'Northsky' (1); Rabbiteye—'Briteblue' (4), 'Brightwell' (3), 'Powderblue' (2), and 'Centurian' (1); Southern highbush—'Georgiagem' (3), 'Cooper' (3), 'Gulfcoast' (2), 'Blueridge' (2), 'Cape Fear' (1), 'Reveille' (1), and 'Bladen' (1).

Several significant changes have occurred in the cultivar situation in the past 10 years. Among changes listed by respondents are: Southern highbush increasing in southern region, new half-high cultivars being planted in the upper Midwest, switch to cultivars that can be machine-harvested, shift to hardy cultivars ('Patriot', 'Blueray', and 'Northland') in New England, shift to earlier-ripening rabbiteye cultivars, and general increase in planting 'Bluecrop', 'Duke', and 'Elliott', with decreased interest in 'Collins' and 'Coville'.

Major genetic limitations of cultivars perceived by respondents included (in order of frequency of listing): lack of cold hardiness; susceptibility to spring frosts; lack of adaptation to high soil pH; lack of upland and heavy soil adaptation; lack of adaptation to machine-harvest; drought susceptibility; early bloom of rabbiteye and southern highbush; poor fruit quality; susceptibility to cane blight, phytophthora root rot, phomopsis rot, viruses, fusarium canker, mummyberry, and necrotic ring-spot; poor fruit set; and lack of early ripening rabbiteye cultivars with good quality.

## Cultural modifications and problems

Within the past decade, a number of significant changes have been made in blue-

Table 4. *Utilization of North American blueberries according to system of harvest, 1992.*

Blueberry type	Hand-harvested (ha)			Machine-harvested (ha)		
	Processed	Fresh	Total	Processed	Fresh	Total
Cultivated	2,410	10,960	13,370	6,520	1,940	8,460
Wild	30,580	950	31,530	21,020	0	21,020
Total	32,990	11,910	44,900	27,540	1,940	29,480

berry culture. Many of these changes have been necessitated by the expansion of blueberries into nontraditional soils and sites, including upland mineral soils with higher-than-optimum pH and heavier soils. In such situations, soils and culture have been modified to allow successful plant establishment and growth. These procedures include pre-plant soil modification (pH adjustment, incorporation of organic matter, and drainage), use of organic mulches, planting on raised beds for drainage, more-precise water management, and better soil pH management.

Improved irrigation management is being practiced in all areas. The use of trickle irrigation has expanded in most areas, and more attention is being given to irrigation scheduling. There is increased use of fertigation and soil acidification through drip irrigation. A few states report a recent shift from trickle irrigation to overhead sprinklers to enable frost protection.

The move to more machine-harvest has resulted in changes in plant spacing and pruning to accommodate machines. More-precise

*"Within the past decade, a number of significant changes have been made in blueberry culture."*

Table 5. *Major blueberry cultivars in North America, 1992.*

Cultivar	Area		Trend <sup>z</sup>		
	ha	Percent <sup>y</sup>	Increasing	Steady	Decreasing
Highbush					
Bluecrop	6,170	35	10	12	2
Jersey	3,030	17	0	2	6
Weymouth	990	6	0	0	1
Croatan	950	5	0	1	0
Blueray	740	4	2	13	2
Elliott	700	4	5	2	0
Rubel	550	3	0	0	1
Berkeley	420	2	2	4	4
Bluetta	340	2	0	0	2
Patriot	210	1	7	1	1
Earliblue	190	1	1	1	5
Duke	170	1	1	0	0
Rabbiteye					
Tifblue	1,580	40	2	4	2
Climax	810	21	4	2	2
Brightwell	280	7	5	0	0
Premier	190	5	3	4	0
Woodard	160	4	0	1	4
Southern highbush					
Sharpblue	210	18	1	0	0
O'Neal	65	16	1	0	0

<sup>z</sup>Number of respondents indicating the trend for the cultivar.

<sup>y</sup>Percent of total area within each species type.

Table 6. *Areas of active blueberry research by states and provinces in North America, 1992.*

State or Province	Breeding	Cultivar testing	Physiology	Culture	Processing	Disease control	Insect control	Weed control	Marketing	Handling/storage	Research effort in past 10 years
Alabama		x		x			x	x		x	Increased by 100%
Alaska	x			x				x			<i>V. uliginosum</i> —increased greatly
Arkansas	x	x	x	x		x		x			Increased 20%
Florida	x	x	x	x		x	x	x		x	Increased 50%
Georgia	x	x	x	x				x			No change
Idaho		x	x	x							Increased—none 10 years ago
Illinois		x		x							Increased 25%
Indiana		x									No change
Kentucky		x		x							Increased 10%
Louisiana		x	x	x				x			Increased 90%
Maine		x	x	x	x	x	x	x		x	Increased 350%
Maryland								x			Variable
Massachusetts			x			x	x		x	x	Increased slightly
Michigan	x	x	x	x		x		x		x	About the same
Minnesota	x	x		x		x		x	x		About the same
Mississippi	x	x	x	x	x	x	x			x	Increased to 2 SY
Missouri	x	x	x	x		x					Increased substantially
New Hampshire		x		x		x	x	x			No change
New Jersey	x	x		x	x	x	x	x		x	Increased 50%
New York		x		x				x			Increased (0–0.15 FTE)
North Carolina	x	x	x	x		x	x	x		x	Increased 50%
Ohio		x									Increased some
Oklahoma		x		x							Same
Oregon		x	x	x		x	x	x		x	Increased 50%
Pennsylvania		x	x	x							Increased
South Carolina		x									Decreased
Tennessee		x		x							No change
Texas		x		x				x		x	Increased
Virginia		x	x	x							Increased slightly
Washington		x			x	x	x	x	x	x	Same
Canada											
British Columbia	x		x	x	x	x	x	x	x	x	About the same
New Brunswick		x		x			x				Decreased
Nova Scotia		x	x	x	x	x	x	x	x	x	Increased on low-bush; decreased 80% on highbush
Ontario		x		x					x		Highbush same, lowbush decreased
Quebec		x		x	x			x	x	x	Increased slightly

pruning is being practiced in all areas to improve yields. Mechanized topping after harvest is being used in North Carolina to reduce hand-pruning costs.

High-density plantings are being investigated in some states to increase yields. In some cases, increased plant density is being used with netting for bird control. The loss of all effective chemical bird repellents has created a major problem in many areas, especially in small plantings, and exclusion with nets is receiving renewed attention.

Other recent cultural changes include increased use of leaf analysis, increased use of herbicides, use of gibberellic acid to improve fruit set, improved winter protection techniques in the upper Midwest, more use of tissue-culture-produced plants, and a change from burn prune to mow prune of lowbush in Maine.

Many cultural problems still exist in all blueberry areas. These include (in order of frequency of listing): soil pH management, water management (both from standpoint of

drought and drainage), winter cold damage, use of poorly adapted soils and sites, weed control, spring frosts (rabbiteye), poor understanding of pruning requirements, pollination/fruit set problems, costs of mulching, availability of labor, controlling plant size in rabbiteye, and lack of plant cover in lowbush fields.

## Pests

Pest problems vary greatly among blueberry areas in North America. Some pests are common in wide geographic regions, while others are very limited in occurrence. Thirteen disease and 19 insect pests were listed in the major pest section of the survey form, but many appeared only once.

Diseases listed as major problems were (followed by frequency of listing): Mummyberry (10), stem blight (7), anthracnose (7), botrytis rot (7), phomopsis canker (5), viruses (5), phytophthora root rot (4), godronia canker (4), fusisporium canker (2), stem canker (2), and stunt (1).

Major insect pests reported were: Blueberry maggot (9), cranberry fruitworm (3), root weevil (2), spanworm (2), and fall web worms (2). Insects receiving only one mention were: Gall midge, thrips, citrus root weevil, scale, winter moth, stem borer, Japanese beetle, green June beetle, leaf rollers, aphids, leafhoppers, and bud mites.

Among other types of pests, birds were mentioned most (18), followed by weeds (9), voles (5), and mice (2).

Interestingly, 12 respondents reported no pests on blueberries in their areas. Many of these were from states in which blueberries have been recently introduced and plantings are small.

## Research programs

Blueberry research has increased to parallel the increase in blueberry production in North America. The increase in problem-solving research is a major factor in stimulating commercial developments in blueberry production in all regions. In many cases, pioneering research has led to the establishment of state blueberry industries, and the future health of blueberry industries in all areas is very dependent on research-generated technology.

A total of 35 states and provinces currently are conducting blueberry research (Table 6). Of these, 23 reported that their blueberry research effort had increased in the past 10 years, some very substantially. Ten states reported that the research effort has remained stable, and only two states reported a decrease in research. (Nova Scotia reported

a decrease for highbush but an increase for lowbush, while in Ontario lowbush research has decreased while highbush remains stable.)

Among 10 areas of blueberry research, cultivar testing is the most common, being listed by 32 of the 35 reporting states and provinces (Table 6). Other research areas receiving attention are (with frequency of listing): Culture (29), weed control (21), physiology (15), disease control (15), handling/storage (14), insect control (13), breeding (11), processing (7), and marketing (6).

Research within a state is conducted, of course, on the type of blueberry grown in that state. A few states in which two or more types of blueberries are grown conduct dual research programs. Florida, for example, conducts breeding programs on both rabbiteye and southern highbush, and North Carolina is breeding highbush and southern highbush.

There is great interest in all regions in the development of new cultivars, as evidenced by the high involvement in cultivar testing. New cultivars are perceived by most as providing the best solutions to many of the cultural problems that exist, such as cold hardiness, soil adaptability, and disease and insect resistance. Of the 11 breeding programs currently extant, six are involved with highbush improvement and four with rabbiteye. The Minnesota program is developing half-high cultivars for the upper Midwest by hybridizing highbush and lowbush. An interesting breeding program has recently been initiated in Alaska to improve the native species, *V. uliginosum*.

## Conclusions and future prospects

The blueberry industry of North America has experienced phenomenal growth in the past half-century, and is expected to continue to increase. A major factor in industry growth is the still-evolving movement of producing blueberries in nontraditional states and expansion onto nontraditional soils and sites. The industry is rapidly expanding into new areas as research overcomes production barriers.

Production problems continue to exist in both traditional and nontraditional production regions. However, renewed and expanded research and better attention to plantation management by growers promises to overcome obstacles to production.

The most critical problem that the blueberry industry of the future may face is the market utilization of the increased volume of production. If projections made in this survey are accurate, there will be 27,890 ha of cultivated and 56,600 ha of wild blueberries in production by the year 2000. This represents an expected increase in hectareage of 28% for

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cultivated and 8% for wild, for an overall hectareage increase of 14% as compared to 1992. The North American Blueberry Council (Holbein, 1992) reported that production in 1992 was 72,500 tons for cultivated and 68,586 tons for wild, giving a total production of 141,086 tons. Projected increases in hectareage by the year 2000 would result in production of 92,800 tons of cultivated and 74,073 tons of wild, for a total blueberry production of 166,873 tons in 2000. These figures are close to the production estimates made by Holbein (1992) for the year 2000.

These projections for future production levels are based solely on anticipated increases in hectareage, and do not take into account possible yield increases that may result from cultural and cultivar improvements in the future. Thus, actual production by 2000 may exceed present estimates. To say the least, barring unexpected catastrophes in the blueberry industry, there will be a much larger volume of fruit to be used.

Past history shows that blueberry marketing/use has kept pace with increased production. Organizations such as the North

American Blueberry Council largely can be credited with increasing markets, and they will continue to play a vital role in the growth of the industry. Many opportunities exist for increasing world consumption of blueberries, including increased international marketing, increased per-capita consumption (blueberries are among the lowest of all fruits in the United States at present), and new blueberry products. The recent publicity on the health-giving properties of blueberries should enhance consumer interest and increase consumption.

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