



## Selecting Blackberry Cultivars for Utah

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### Introduction

Historically, Utah has not been a significant blackberry producer. This is likely due to harsh winters and frequent late spring frosts which result in significant blackberry cane damage and crop loss. However, the delicate fruit have a short shelf life that makes shipping the fruit from distant markets difficult, presenting opportunities for local sales. With careful cultivar selection and good management, blackberries can be successfully grown in Utah and can be a profitable fresh-market crop. For 6 years, 21 blackberry cultivars were compared at the USU Kaysville Research Farm in order to identify cultivars that might be suited to local production. Characteristics evaluated were winter survival, yield, and fruit quality suitable for direct-market sales.

### Blackberry Biology

#### Floricanes-fruiting

Blackberry plants have a perennial root system with biennial canes, meaning the root systems can live for many years, while the individual canes live only 2 years. Floricanes-fruiting blackberries produce vegetative canes in the first year called primocanes. In the second-year those same canes (now called floricanes) produce flowers and fruit. After fruiting, the floricanes die but are replaced by new primocanes that grew during the year. Typical harvest in Northern Utah begins in mid to late July, peaking in early August.

#### Primocane-fruiting

There are several blackberry cultivars that can produce fruit on first year canes (primocane fruiting). These start fruiting in late August and continue until fall freezes occur. Since canes do not have to overwinter, winter hardiness is not a concern. However, fall freezes may halt production before full yield potential is reached.

#### Growth Habit

Blackberries are classified by growth habit into three categories: trailing, semi-erect, and erect. Trailing types

produce long thin canes that will grow along the ground unless supported by an appropriate trellis. These plants do not spread by suckers, instead the canes are replaced by new growth arising from a single crown. Semi-erect blackberries have primocanes that initially grow erect, but then branch and the side branches droop down to the ground. When the shoot tips come in contact with the ground, the plants will tip layer (root down and form a new plant) which is an important consideration in trellising and management. Semi-erect types typically produce heavier yields than the erect and trailing types. Erect blackberries are mostly self-supporting plants but still benefit from trellising. They spread by root suckers, making them capable of completely filling in a row over time. They produce long canes that need to be headed back to encourage side branching.

Blackberries often suffer from some cold injury in Northern Utah, which typically results in loss of floricanes buds, or dieback of the entire cane (Figure 1). As a general rule, the trailing types of blackberries are most cold sensitive, and the semi-erect types are the most cold hardy. Although Utah winter conditions rarely cause permanent damage to the plant, floricanes damage reduces or eliminates potential yields.



*Figure 1. Winter injured floricanes with new primocanes emerging.*

## Kaysville Cultivar Trial

Blackberry plants from 21 different cultivars and advanced selections were established in 2006. Plants were spaced 5 feet within the row and rows were spaced 10 feet apart. Irrigation was provided using both drip and overhead systems. Half of the replications were placed on a vertical trellis; the other half were placed on a rotating cross-arm trellis. Primocanes were selected and tied to the trellis periodically throughout the growing season. The rotating cross-arm was set near the ground in December each year. All floricanes were pruned the winter following fruiting.

In the 2008-2012 growing seasons, plots were evaluated for winter injury, yield, fruit size, and production season. Once each week, a subsample of fruit was taken and weighed to determine average fruit size. Ripe fruit was harvested three times per week from mid-July until the first fall freeze. Consumer taste tests were carried out in 2011 and 2012.

## Results

### WINTER INJURY

Based on a visual assessment of the percent of surviving buds, winter injury was compared each spring. One particularly hard winter was noted in the study, 2010-2011. Temperatures dropped from 50°F to -0.4°F in 48 hours on November 24-25, without any prior acclimating temperatures. See Table 1 for winter survival of each cultivar over 6 years. 'Illini Hardy' (average 93% survival), 'Apache' (88% survival), and 'Chester' (83% survival), consistently had the highest rate of winter bud survival. By contrast, 'Marion' (19% survival), and 'Kiowa' (16% survival), had the poorest rates of bud survival. There was no significant difference in bud survival rates between the vertical trellis and the swing trellis reps. Note that winter injury is not reported for 'Prime Jim' and 'Prime Jan' (Primocane-fruiting) since canes are removed to the ground each fall.

### YIELD

The cultivars with the largest fruit size included 'Kiowa', 'Triple Crown', and 'Apache'. The cultivars 'Navaho' and 'Chester' had the smallest fruit size. Yields were closely correlated with winter survival. 'Triple Crown' consistently had the highest yields, followed by 'Doyle's' and 'Hull'. The trailing types ORUS 1939-4, 'Metolius', and 'Marion' consistently had the lowest yields.

Another way to evaluate yield is to look at how reliably the cultivar will produce a crop each year. Since yield varies considerably between years, a reliability index (75%) was calculated. This represents the minimum

yields that could be expected in 75% of the years. Yield reliability is shown as a black line on the bar graphs (Figure 2). In general, only the semi-erect types had yield reliability at acceptable levels for Utah cultivation (ranging from 0.3 to 1.0 pounds per plant depending on cultivar). Trailing types had yield reliability indexes less than zero, indicating that total crop failure would result more than 25% of the time.

**Table 1. Average winter survival over 6 years: 2007-2012, and average fruit size (gram/fruit) over 5 years: 2008-2012.**

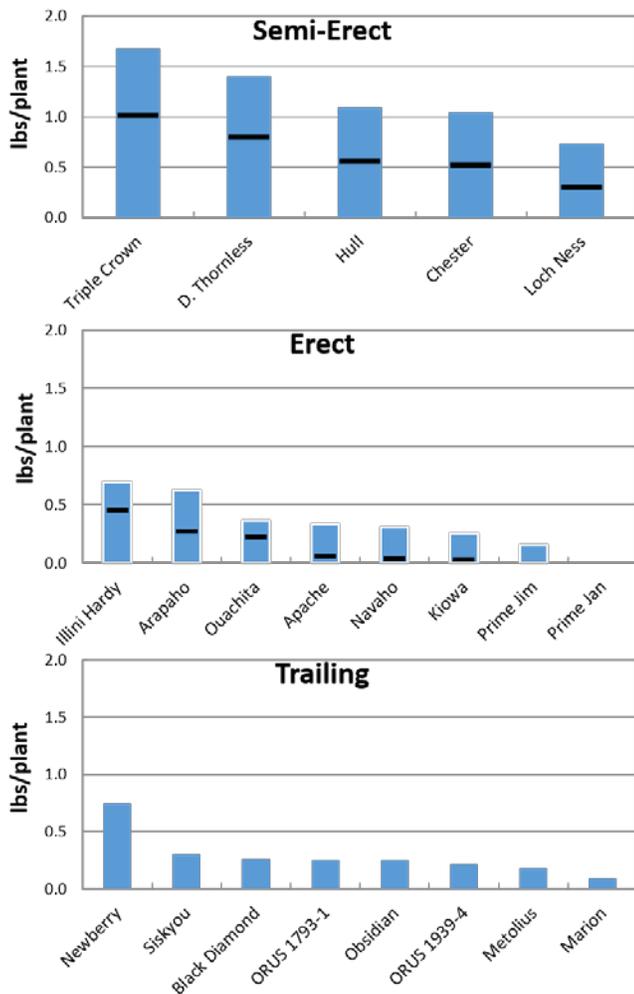
	<u>% Survival</u>	<u>grams/fruit</u>
Illini Hardy	92.2	3.1
Apache	87.7	5.4
Chester	84.7	2.9
Navaho	78.5	2.9
Triple Crown	76.9	5.7
Arapaho	75.0	4.3
Hull	66.2	4.2
Ouachita	56.7	4.8
Doyle's	58.3	3.1
Newberry	57.5	4.3
Loch Ness	61.3	3.3
Siskyou	52.5	4.0
Black Diamond	32.0	3.5
Obsidian	25.1	4.1
ORUS 1793-1	27.0	4.6
ORUS 1939-4	26.5	3.3
Metolius	25.5	3.9
Marion	14.0	3.2
Kiowa	17.3	6.7
Prime Jim	--	4.3
Prime Jan	--	4.4

### CONSUMER PREFERENCE

In order to gauge consumer preference, some cultivars were evaluated in taste tests at the USU Botanical Center farmers market in Kaysville in 2011 and 2012. Cultivars were placed in clamshells with a numbered piggybank behind each cultivar. Market patrons were given 10 pennies and instructed to put one or more pennies in the piggybanks adjacent to their favorite cultivars. Due to differences in ripening, not all cultivars were available for all tastings. There were six cultivars that were included in all three tastings, and a seventh cultivar present at two of the three tastings. These cultivars are compared in Table 2. The top four cultivars in tastings over two years based on relative order of preference were: 'Apache', 'Arapaho', 'Triple Crown', and 'Chester'. 'Arapaho' was not available for tasting on 8-Sep-2011.

**Table 2. Taste preferences ranking based on overall votes for each tasting date. Rank was calculated based on highest to lowest total “votes” (number of pennies) for taste preference with rank 1 receiving the most votes.**

	8/18/11	9/8/11	8/9/12	Avg.
Apache	3	1	1	1.7
Arapaho	2		2	2.0
Triple Cr.	1	3	3	2.3
Chester	5	2	5	4.0
Doyle's	7	5	4	5.3
Loch Ness	6	4	8	6.0
Illini Hardy	8	6	7	7.0



**Figure 2. Average yield with yield reliability index (75%, represented by black line) of 21 cultivars at the Kaysville Research Farm. Values are average of five seasons (2008-2012). Yield reliability index was below 0 for all trailing type cultivars so no line appears in the graph.**

## Cultivar Descriptions

### SEMI-ERECT TYPES:

**‘Triple Crown’** - (Thornless) This is a long-time favorite among Utah blackberry growers for its productivity, vigor and flavor. Often considered the standard for comparison among blackberries, it produces large berries mid-season and has heavy yields. It was susceptible to moderate winter damage but was a favorite among taste test consumers. Developed by the USDA Agricultural Research Service.

**‘Doyle’s Thornless’** - (Thornless) Heavy producer, but fruit size was among the smallest. Produces mid-season with moderate winter survival. Not a favorite among consumers.

**‘Hull’** - (Thornless) Good winter survival rate, produces medium sized fruit mid-to-late season. No taste test data on this variety. It was introduced in 1981 from Illinois Agricultural Experiment station. Fruit are oblong and color well in the heat.

**‘Chester’** - (Thornless) Exceptional winter survival. Can fruit quite late in the season and will produce high yields with mild fall weather, but may freeze out before full yield potential is reached. Fruit size was the smallest of the cultivars tested, and the fruit was not favored by consumers. Developed by the USDA Agricultural Research Service.

**‘Loch Ness’** - (Thornless) This moderate yielding plant produces medium sized fruits mid-season. Winter survival is fair. This was not a favorite among taste testers.

### ERECT TYPES:

All erect types, except Illini Hardy were released from the University of Arkansas breeding program.

**‘Illini Hardy’** - (Very thorny) Developed by the University of Illinois for northern growers. Best rate of winter survival of all the cultivars in the trial. This plant produces small fruit late in the season with heavy yields. Good for areas with late frosts and/or unpredictable springs. Least favorite among taste tested cultivars.

**‘Arapaho’** - (Thornless) produces medium to large fruit mid to late season (ripens before ‘Apache’ and ‘Navaho’). It was among the more winter hardy, and the highest yielding of the erect types. This was a taste test favorite among consumers.

**‘Ouachita’** - (Thornless) This cultivar produces large fruit late in the season, with moderate yields and good postharvest storability. ‘Ouachita’ scored low in consumer taste tests.

**‘Apache’** - (Thornless) A favorite among consumers. Produces moderate yields of large fruits in mid-season. Most winter hardy of the erect types.

**‘Navaho’** - (Thornless) Produces below-average yields, with fruit size among the smallest tested. It had very good winter survival. Fruit was not included in taste tests.

**‘Kiowa’** - (Thorny) Least winter hardy variety of all cultivars tested with an average of 16% cane survival. It was low yielding but had extremely large fruit. No taste test data available.

**PRIMOCANE-FRUITING TYPES (erect):**

**‘Prime Jim’** - (Thorny) Developed at the University of Arkansas. Plants bear fruit on first year canes. This cultivar produces larger fruit than ‘Prime Jan’ slightly earlier in the season. This cultivar also produced heavier yields than ‘Prime Jan’. No winter damage assessment was taken. No taste test data are available.

**‘Prime Jan’** - (Thorny) Plants bear fruit on first year canes, eliminating problems associated with winter cane survival. Plants produced moderate harvests late season. Fruits were moderately sized. No taste test data are available. Released from the University of Arkansas.

**TRAILING TYPES:**

All trailing types were developed in Corvallis, Oregon, by the USDA – Agricultural Research Service.

**‘Newberry’** - (Thorny) Moderate winter survival. This plant produces medium-to-large fruit early in the season. It had the best winter survival and the highest yields among trailing types, and had moderate scores in taste tests.

**‘Siskyou’** - (Thorny) A favorite among consumers participating in the taste tests, it produced large fruit, and was the earliest bearing cultivar in the planting. Yields were inconsistent from year to year due to winter damage.

**‘Obsidian’** - (Thorny) Produces medium-sized fruit mid-season. It has poor winter survival and very inconsistent yields. No taste test data available.

**‘Marion’** - (Thorny) This cultivar is widely used for commercial production and is typically used in processing. It is not well-suited to the climate in northern Utah.

**‘Black Diamond’** - (Thornless.), **‘Metolius’** - (Thorny.), **ORUS 1793** - (Thorny.), and **ORUS 1939** - (Thorny.) were not sufficiently winter hardy for northern Utah.



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