SMALL FRUIT PRODUCTION IN COLORADO

Options for the Front Range

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EXTREME & UNUSUAL WINTER IMPACTS TO FRUIT

Our experience in Douglas County
November 50-70° F single-day drop
  ° after Indian summer
  ° only light frosts previously
  ° Plants & trees not hardened off
Wide-spread damage—even to normally hardy varieties
Reports of 20-year old trees dying
4 YEAR-OLD PLUM KILLED LAST WINTER

PLUM DAMAGED LAST WINTER
Peach—Partial Survival in Protected Area
Stone Fruits—Heavy damage & die off
  - All Peaches died
  - Most Apricots died
  - Heavy die-off & damage in Plums
  - Moderate damage in Tart Cherries (no deaths)

Pears—Relatively unscarthed

Apples—Light-moderate damage w/ some die-offs
Small Fruits—Damage Assessment

- Grape vines—most died-back (Frontenac vines lived)
- Raspberry canes—most died-back
  - Floricane fruiting:
    - Boyne, Royalty many lived
    - Prelude, Nova a few lived
  - Primocane fruiting raspberries-no data (canes pruned in winter as standard cultural practice)
- Black Raspberries—most died-back (Minnesota wild-collected had some canes survive)
- Blackberries—all died back (usual)
- Strawberries (Monterey)—all survived
Blueberries—significant damage & die-offs
Currant & Gooseberry no to minimal damage
Serviceberry—no damage
Seaberry—minimal damage
Elderberry—minimal damage
Bush cherry—no damage
Haskap—no damage
Northern hybrid Hazelnuts no damage
Oregon Hazels—Doris died, Halles Giant lived
Plants in High Tunnels suffered minimal damage

- Peaches: no damage, but some slow to leaf
- Apricots: no damage
- Sweet Cherries: no damage
- Brambles: some cane damage (normal)
- Apple: no damage
BEST YEAR YET FOR PEACHES IN HIGH TUNNEL...
MOST TREES HAVE FRUIT!
SOME SLOW TO LEAF-OUT

Peaches in High Tunnel May 14, 2015
Low Cost Protection Options
Protected Growing Raised Beds
Protected Growing Raised Beds
Protected Growing

- May Cover with:
  - Agribon non-woven fabric
  - Plastic
  - Shade cloth
  - Hail cloth
  - Bird netting
  - Insect screening
  - Hardware cloth/ chicken wire

- Supplemental heat possible
- Misting possible
Notable Initial Performance
Douglas County Research Orchards

Good
- Apple
- Raspberry
- Strawberry
- Primocane fruiting
  Blackberry
- Bush Cherry
- Tart Cherry
- Seaberry
- Currant
- Gooseberry
- Aronia
- Haskap

Poor
- Pawpaw
- Groundcover raspberry
- Medlar
- Shipova
- Hardy Kiwi
- Cranberry
- Lingonberry
- Mulberry
- Quince
- Persimmon
- English Walnut
- Almond
Grapes

- Can work on Front Range
- Select Varieties:
  - Cold hardy
  - Early to mid-season ripening
  - Later bloom is best
- Table Grapes
- Wine/ Juice Grapes
Seedless Table Grapes

HIMROD

RELIANC

Have harvested up to 15 lbs./ vine Reliance in past years
# Other Suitable Grapes

<table>
<thead>
<tr>
<th>TABLE</th>
<th>NATIVES</th>
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<tbody>
<tr>
<td>® Canadice <em>(seedless)</em></td>
<td>® Concord</td>
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<tr>
<td>® Swenson red</td>
<td>® Niagara</td>
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<tr>
<td>® Swenson white</td>
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<tr>
<td>® Experimenting with</td>
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</tr>
<tr>
<td>• Vanessa <em>(seedless)</em></td>
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<tr>
<td>• Trollhaugen</td>
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<tr>
<td>• Glenora Black</td>
<td></td>
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<tr>
<td>• Somerset</td>
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</table>
Wine Grapes

MARECHAL FOCH

FRONTENAC

Harvested 3-4 lbs./vine 2012
Partially shaded edible landscape
<table>
<thead>
<tr>
<th>Late Bud Break</th>
<th>Early Bud Break</th>
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<tbody>
<tr>
<td>Brianna (w)</td>
<td>LaCrescent (w)</td>
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<tr>
<td>LaCrosse (w)</td>
<td>Edelweiss (w)</td>
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<tr>
<td>Vignoles (w)</td>
<td>Marquette (r)</td>
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<tr>
<td>Frontenac (r)</td>
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</tr>
<tr>
<td>Frontenac Gris (w)</td>
<td></td>
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<tr>
<td>Prairie Star (w)</td>
<td></td>
</tr>
<tr>
<td>Espirit (w)</td>
<td></td>
</tr>
</tbody>
</table>

From: Colorado Front Range
Grape-growing Parameters
CSU publication
Hardy Wine Grape Varieties for Front Range

LATE BUD BREAK
E-M HARVEST

- Seyval (w)
- Traminette (w)
- Vidal blanc (w)
- Cayuga white (w)
- Leon Millot (r)
- St Croix (r)
- Corot noir (r)
- Chancellor (r)

EARLY BUD BREAK
E-M HARVEST

- Marechal Foch (r)
- GR7 (r)
- DeChaunac (r)

From: Colorado Front Range
Grape-growing Parameters
CSU publication
Hardy Wine Grape Varieties for Front Range

LATE BUD BREAK
M-L HARVEST

- Chambourcin (r)
- Noiret (r)
- Norton/Cynthiana (r)

- Vinifera grapes not recommended for Front Range

From: Colorado Front Range
Grape-growing Parameters
CSU publication
Raspberry & Blackberry
Maine study – Primocane raspberry yield:
- 5000 lbs/ ac outside
- 14,000 lbs/ ac high tunnels
- due mainly to season extension

Cornell University Greenhouse Raspberry Production Guide
Earlier Floricane harvest possible
- Primocane varieties most applicable
- Produced well into October
  - Quality diminished after hard frosts
  - Floating row cover would mitigate frost

‘Caroline’ raspberry late January

Black Raspberry in High Tunnel
- Outdoor Blackberry fruit ruined by frost by early October 2013
- HT Blackberries still green and flowering in November
  - HT October light frost damage could be mitigated by row covers or heater
- Some leaves & canes green mid-winter after -20° F lows (esp. low or protected by leaves)
  - V little bit dink
Brambles Outside

- Black Raspberries
- Summer Bearing Rasp.
- Fall Bearing Rasp.
- Blackberries
Black Raspberries

- MOST OVERWINTERED WELL 2012-2013 AND 2013-2014
<table>
<thead>
<tr>
<th>Surviving Cultivars</th>
<th>Non-Surviving Cultivars</th>
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<tbody>
<tr>
<td>Wild Minnesota</td>
<td>Huron</td>
</tr>
<tr>
<td>Jewel</td>
<td>Black Hawk</td>
</tr>
<tr>
<td>Bristol</td>
<td>Allen (never got established)</td>
</tr>
<tr>
<td>Mac Black</td>
<td>Niwot (re-planting)</td>
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<tr>
<td>Pequot</td>
<td></td>
</tr>
<tr>
<td>Logan</td>
<td></td>
</tr>
<tr>
<td>Munger</td>
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</table>
## 2014 Black Raspberry Trial Results

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield per Plant (lbs.)</th>
<th>Berry Size</th>
<th>Sweetness (1 = high 5 = low)</th>
<th>Flavor Robustness (1-5)</th>
<th>Peak Season</th>
<th>Ease of Picking (1-3)</th>
</tr>
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<tbody>
<tr>
<td>Minnesota Wild Collected</td>
<td>1.3</td>
<td>S</td>
<td>3-4</td>
<td>2</td>
<td>July 14-29</td>
<td>3</td>
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<tr>
<td>Cumberland</td>
<td>0.8</td>
<td>S-M</td>
<td>2</td>
<td>2</td>
<td>July 14-29</td>
<td>3</td>
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<tr>
<td>Bristol</td>
<td>2.6</td>
<td>M-L</td>
<td>1</td>
<td>2</td>
<td>July 14-Aug 11</td>
<td>1-2</td>
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<td>XL</td>
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<td>Mac Black</td>
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• Niwot plants too young to ripen fruit in 2013
• Niwot developed by Pete Tallman, Longmont, CO
• Ohio Treasure also available
Blackberries

**Primocane**
- Prime Ark 45
- Prime Jim
- Prime Jan
- Prime Ark Freedom

**Floricane**
- Triple Crown
- Loch Ness
- Tayberry
- Illini Hardy
- Black Hull
- Chester
- Metolious (did not survive)

Primocane fruiting blackberries 2013
Primocane Bramble Management

- Usually managed for single fall crop in CO
- Bear on top 1/3 of 1st year canes in late Aug., Sept.+
- Mow canes off winter or spring

Mowing last season’s BB primocanes during winter
All primocane BBs rushed by fall frosts
Prime Jan earliest
Prime Jim middle
Prime Ark 45 latest (very few berries ripened in 2013 or 14)
Prime Ark Freedom-Thornless-season unknown
Primocane Blackberries

🎯 All primocane BBs large & flavorful
🎯 Canes have never survived winter in Franktown or Castle Rock
🎯 Row covers might keep alive over winter
Triple Crown & Loch Ness

- Trailing
- Floricane Fruiting
- Large fruit
- Loch Ness tart & insipid
- Triple Crown sweet & delicious
- Triple Crown thornless

Triple Crown berries 2014
Canes survive in high tunnel

Could Protect Canes outside with by:

- laying canes down & mulching
- row covers

Triple Crown in High Tunnel
All mature primocane varieties grow and fruit at Franktown & Castle Rock
Primocane Raspberry Characteristics

- Fall Gold: More flavorful & firmer than Anne, light yields
- Anne: Yellow, soft, light yields
- Jacklyn: Excellent flavor, fruit sticks to torus, slightly frost tender, moderate yields
- Himbo Top: Sunscald problems
- Caroline*: Exc. Flavor, highest vitamin C, high yield
- Polana*: A little more tart, 20% higher yield in Boulder**

*Best all around choices for Front Range Growing, based on current experience.
**Joel Reich, personal communication
Primocane Raspberry Characteristics

- Autumn Britten*: Exc. Flavor, high yields
- Autumn Bliss*: Exc. Flavor, 50% of harvest in 1st couple weeks, minimizes loss to early frost, high yields
- Prelude (No data yet)
- Joan J (No data yet)
- Heritage: Good berry but 2-3 weeks later than others, risking frost, high yields, somewhat soft
- Plainsman: From Cheyenne Research Station (no data yet)

*Best all around choices for Front Range Growing, based on current experience.
Spotted Wing Drosophylla
Affects berries & soft fruits on the plant
Compromises fruit quality
Don’t appear until mid-summer
  - July 21st first signs
  - Aug. 5th heavy activity
Found orchard hygiene reduced incidence drastically
  - Pick early & often
  - Collect & remove bad fruit
Floricane Raspberries

Red Mammoth
Boyne**
Latham
Nova*
Octavia
Chilicotin
K816
Lauren
Royalty (purple)**
Taylor
Prelude*
Encore
Killarney

Temperature hit 0°F mid-April 2013
Temperature dropped 50-70°F after Indian summer 2014
Very few canes survived to fruit in 2013 & 2015

**Many canes of this variety survived winter of 2014-15 (perhaps 30-50%)
*A few canes of this variety survived winter of 2014-15
Fruits of Our Labor
Day Neutral Strawberries with Commercial Potential

Varieties:

- Monterey
- Mara Des Bois
- Evie 2
- Albion
- Seascape
- Portola
- San Andreas

Strawberries grown at Hidden Mesa
Monterey & San Andreas

- Monterey:
  - Vigorous
  - High yielding
  - Very Large berries
  - Firm
  - Sweetness developed at end of ripening cycle
  - Berries can develop woody core after hard frosts

- San Andreas similar to Monterey

Monterey & other varieties grown in high tunnel at Hidden Mesa Orchard
Monterey Strawberries
Spring 2015

Spread from only a few plants. Overwintered beautifully with no protection.
Mara Des Bois (DN)

- Extremely sweet & aromatic
- Unique flavor
- Medium - Small berries
- Softer than Monterey - melts in mouth
- Consistent producer

Mara Des Bois at Hidden Mesa
These DN Varieties are all large and somewhat similar:

- Evie 2
- Albion
- Seascape
- Portola

Strawberries grown at Hidden Mesa
Cavendish (June Bearing)

- Very sweet
- Unique flavor
- Very vigorous vegetative growth
$330M industry in Europe & Scandinavia
- Food/drink
- Nutraceuticals
- Cosmetics

Nitrogen fixing

Hardy to -40°F

Super-fruit
- Vitamins A, C, & E
- Beneficial oils
- Minerals
Seaberry

- Aka Sea Buckthorn
- Thorny
- Many Commercial Varieties
- Mechanical harvest methods being developed
- Easy to establish
- Very fast growing
Haskap (Edible Blue Honeysuckle)

- Hardy to -40°F
- Blossoms hardy to 15-17°F (tolerates spring frost)
- Native from N. Japan to Siberia + Canada
Very early blooming
- Russian earlier than Japanese
- Bear earlier than Strawberries

Honeysuckle family—beautiful in the landscape

Japanese delicacy—potential export market

Protect from bird predation
Haskap

® Improved Commercial varieties from Univ. of Saskatchewan
  ° Russian origin
  ° Blooms earlier
  ° 2 available in USA

® Improved varieties from Oregon State Univ.
  ° Japanese origin
    ° Blooms slightly later
  ° Not yet released

® Honeyberry: selected wild blue honeysuckle
  ° Generally
    ° Lower yield
    ° Smaller fruit
    ° Not as flavorful
Hardy Bush Cherry

- Univ. of Saskatchewan
- ¾ pie & ¼ Mongolian bush cherry
- Hardy to -50°F
- 4-7’ bush
- Complex tart flavor
- Deep red fruit & juice
- 18-22 brix
- 5 years to mature
- Lit. says yield up to 25lbs/ bush
- 3 released in USA

Carmine Jewell
Cherries from Edible Landscape
Carmine Jewel in edible landscape

Yielded about 5 lbs./bush in 4th year w/ ½ day sun & landscape competition

Black aphids—not problematic
Carmine Jewel in Bloom
Hardy Bush Cherries
Mechanically Harvestable
Tree-Type Tart (Pie) Cherries

- Normally very reliable in Front Range Climate (not in 2014-15 winter)
- Susceptible to bird damage
- High yield potential

Evans Bali tart cherry tree in edible landscape in Castle Rock
Saskatoon (aka Serviceberry, Juneberry)

- Colorado Native
- Selected & Improved varieties
- 6-12’ bush or tree
- Mechanically harvestable
- Highly nutritious
- Many products & uses
- Viable industry in Canada
- Similar in appearance to blueberry
**Gooseberry & Currant**

- Very cold tolerant
- Shade tolerant
- Espalier options
- Row crop culture
- Mechanically harvestable
- High nutrition
- Various colors & flavors
- Some fresh & many process market uses

Various colored gooseberries & hybrids from Hidden Mesa
Fruiting Gooseberry at Lowell Ranch

Picked 7 lbs. off 3 bushes in shaded edible landscape 2012
Various Red Gooseberries from Hidden Mesa
Currant
Elderberry

- European (Sambucus nigra)
- American (Sambucus canadensis)
- Highly nutritious
- Process market
- Yields:
  - 12-15 lbs/ plant
  - 4-12 tons/ ac in New York (more w/ S. nigra)
  - Mechanical harvest potential
- Ornamental quality
Aka: black chokeberry
Well adapted to CO
Very nutritious
2-4 tons/ac @ maturity
Row culture
Mechanically harvestable
Process market
Ornamental quality
Cold hardy varieties probably suitable
Oregon tree hazels may be too tender
Eastern Filbert Blight potential
  - Select resistant varieties
Potential winter-kill of catkins (pollen cones)
Bush varieties offer new cultural options
Mechanical harvest possible
Co-cropping potential
Hazelnut/Filbert Products

- **In-shell nuts**
- **Hazelnut oil**
  - 60%+ oil content
  - Very similar to olive oil
  - By-product meal
    - Very high in protein
    - Health food products
    - Animal feed
- **Processed nuts**
  - Including ancillary uses (confections, flavoring, etc.)
- **Branches from coppicing**
  - Furniture industry (wicker-style weaving)
  - Woody biomass
Local Results

- Northern Hardy Hybrids surviving at Franktown without protection
- Oregon Varieties
  - Doris died
  - Halles Giant survived
- Native varieties found in the area

Young Hazel at Hidden Mesa
Highbush Cranberry

- Viburnum not Vaccinium
- Beautiful in landscapes
- Cranberry flavor
Goji/Wolfberry

- Zone 5-6
- Prefers alkaline to neutral soil
- Very nutrient dense
Maypop Passionfruit

- Zone 5
- Dies to ground each year
- Gorgeous in landscape
- Does not often ripen fruit
- Blooms daily
Other Unique Edibles

Rhubarb

Autumn Olive

Goumi

Princepia

Hops
Peaches

- Early Bloom (losses ave. 2/3 years)
- Use late/hardy bloom varieties
- Protection Potential
  - High Tunnels (suitability undetermined)
  - Row Covers
  - Surround treatment (white coat-reduces warming)
  - Sodium Alginate treatment (delays bud break)
- Lost all peaches outside over last two winters (2013-14 & 2014-15)
- Peaches in high tunnels thriving
Frost Resistant Varieties Worth Trying

- Flamin’ Fury PF 24C*
- Contender*
- Intrepid*
- Carolina Gold*
- China Pearl*
- Reliance*
- Madison
- Poly
- Redhaven
- Veteran*
- Raritan Rose
- Harrow Diamond*
- Glohaven*
- Challenger*
- Nectar*

*Currently in Research Orchard
Apricots

- Early Bloom (losses ave. 6/7 years)
- Use late blooming/hardy bloom/long bloom varieties
- Protection Potential
  - High Tunnels (suitability undetermined)
    - Vertical V
    - Espalier/fan on dwarf RS
  - Row Covers
  - Surround treatment (white coat-reduces warming)
  - Sodium Alginate treatment (delays bud break)
Latest Blooming Varieties for West
Ranked from Full-Bloom (latest to earliest)

- Westley (died)**
- Zard
- Afghanistan
- Suphany
- Nicole
- Goldensweet
- Sugar Pearls (died)**
- Henderson
- Tomcot (died)
- Jerseycot* (died back severely)**
- Florilege
- Harglow* (died)**
- Harcat
- Helena
- Hargrand* (died)**
- Golden Giant
- Precious
- Harlayne* (died)**
- Goldbar
- Harval
- Lorna
- Hoyt Montrose
- Robada
- Castlebrite
- Apache
- Harogem* (died)**
- Westcot* (survived 2014)
- Debbie’s Gold* (survived 2014)
- Morden 604
- Brookcot

Source: Bob Purvis Idaho Study 2012

* Currently in Research Orchard
** Died/ damaged over last 2 winters
Other Apricot Varieties
Believed to have frost tolerance, late bloom, or long bloom duration

- Tlor Tsiran (apricot/myloban plum hybrid) (died)
- Adirondack Gold
  - one of few to survive 2014-15 winter
  - Is thriving
- Puget Gold (died)
- Hunza (died)
- Montrose (died)
Edible Landscaping

LANDSCAPE CONTAINS:

PIE CHERRY TREE
ITALIAN PLUM TREE
4 SASKATOON BUSHES
2 BUSH CHERRIES
2 HONEYBERRY (HASHKAP)
3 SEABERRY
2 HAZELNUT
1 RED CURRANT
2 GRAPE VINES
TRADITIONAL & ALPINE STRAWBERRY EDGING

1 year after planting

6 years after planting
Small Plot Intensive Culture

Fruit with Micro-farming potential
Questions??
SMALL FRUIT PRODUCTION IN COLORADO
Options for the Front Range

Andy Hough
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Apple Varieties

® Selected for:
- Hardy to zone 5A minimum
- Fireblight Resistance
- Early to Mid-Season Ripening
- Quality Fruit

® Other Considerations:
- Bloom Time
- Yield
- Annual Bearing
- Resistance to other disease/Insects
Apple Varieties at Hidden Mesa 2014-15 Injury

- Williams Pride
- Redfree (died)
- Pristine (damage)
- Akane
- Zestar!
- Priscilla (damage)
- Freedom (severe damage)
- Jonafree
- Snowsweet
- Enterprise (died)
Apple Varieties at Hidden Mesa 2014-15 Injury

- Sweet 16 (2 died/2 lived)
- Honeycrisp
- Liberty
- Pixie Crunch (died previously)
- Redstone Canyon Gold (died previously)
- Red Barron
- Cortland
- Haas
Apple Varieties at Hidden Mesa
2014-15 Injury

These trees were planted spring 2014 and were younger going into freeze

• Macfree (died)
• Sansa
• Grimes Golden (died)
• Galarina (died)
• Frostbite
• Winecrisp (died)
Adaptable to Intensive Culture

- Tall Spindle
- Dr. Terence Roninson (Cornell University)
  - Fruit in 2nd Leaf
  - Up to 1300 trees/ ac
  - Up to 40,000 lbs. yield/ ac (New York)
  - $15-20K/ ac installation costs

Photo: Ron Perry, MSU, 
Apple Rootstocks

® Fireblight Resistance
- Budagovsky series (B9, B118)
- Geneva Series (G11, G16, etc.)
- M 7

® Climatic Adaptability

® Pest/ Disease Resistance

® Dwarfing Characteristics

® Anchoring Characteristics

® Soil Tolerance
Released GENEVA® Apple Rootstocks Arranged by Tree Size

M.27 Size
M.9 T337
M.9 PAJ 2
M.26 Size
M.7-MM106 Size
Seedling Size

G.65
G.11
G.41
G.935
G.202

G.30
G.890
G.969
G.210
G.222

New Releases

Early Bloom may be problematic

Select Varieties that are:
- Hardy to Zone 5A minimum
- Fireblight (FB) Resistant
- Early to Midseason Ripening
- Good Fruit Quality
- Rootstock
  - OHxF best
  - Quince may be problematic (FB, cold hardiness problems)
Luscious
Hudar
Honey Sweet
Ayers
Ure
Waterville
Beierschmidt
Nova
Southworth
O’Berg
Barnet-Perry
Ubileen
Hendre Huffcap—Perry
Barland—Perry
Magness
Harrow Delight
Maxine
Blake’s Pride
Harrow Sweet
Harrow Crisp
Moonglow

* FB resistant variety
Hidden Mesa Pear Varieties

- Harvest Queen*
- Ewart (died)*
- Aurora
- White Doyenne
- Gem*
- Shenandoah*
- Collette
- Flemish Beauty

- Seckel*
- Romainian
- Potomac*
- Savignac

* FB resistant variety
Option on Front Range

Select:
- Cold hardy
- Later blooming cultivars

Mount Royal plum in edible landscape 2012

Part of Mount Royal harvest 2012