Strawberry Production

Alberta Farm Fresh School 2016
Olds, AB

Outline

- Basic / General Requirements
- Biology
- Cultivars
- June-bearing production
  - Establishment / Maintenance / Straw application
  - Bearing year maintenance / Renovation / Pest mgmt
- Day-neutral production

General Site Requirements

- Near large customer base
- Easy access, all weather road
- Irrigation or licensed water source
  - NOT a well – water quality = poor; quantity likely insufficient

General Requirements

- Site Characteristics
  - Moderate slope
    - Good soil and air drainage
  - Full sun
  - Protection from wind
Field considerations

- Shelterbelts
  - Plan to establish
  - Established shelterbelts (BONUS!)
- Necessary
  - Reduce desiccation & loss of soil H2O
  - Captures snow
- Temporary shelter
  - Snow fence, corn, sunflower, board fence

STRAWBERRY BIOLOGY

June-bearing Strawberries

- Flower buds set at 14 hour or shorter day lengths
- Production over a 4-6 week period
  - Typically late-June into early August
    - Somewhat variety dependent
- Plant one year, harvest the next year(s)
  - Often harvested for 2-4+ years

Day Neutral Strawberries

- Photoperiod insensitive
  - Flower buds develop under any day length
  - Produce roots, runners, leaves, flowers and fruit all at once
- Fruit produced in 1st year
  - May be a multi-year crop
- Majority of production – mid-Aug until frost
- Can be grown on plastic
Major Parts of the Strawberry Plant

Strawberry Root Structure and Distribution in Soil Profile

- Most roots in top 6 inches
- Day neutrals = shallower rooting

Strawberry Runner Growth

Strawberry Crown and Growing Point Structure

Strawberry Flower and Inflorescence Structure

EQUIPMENT
**Example Equipment**

- **Tractor**
  - 3-point hitch, small 4WD, (40hp) tractor, wheel spacing flexibility
- **Stirrup hoe**
- **Cultivator** and/or disc
- **Rototiller** (use sparingly/optional)
- **Transplanter** (with packing wheel)
- **Frame for packing plants & deblossoming** (optional)

**Example Equipment (cont’d)**

- **Tractor-mounted sprayer**, capacity 150 psi & 100 gal/acre
- **Backpack sprayer**
- **Rotary mower**
- **Pitch fork OR Rake** to remove straw mulch in spring
- **Straw spreader / Bale buster**

**Choosing cultivars**

- **Buy certified plants**
- **Factors to consider**
  - Winter hardiness
  - **Yield and quality**
  - **Target market**
    - U-pick vs. Community Shared Agriculture (CSA) vs. Farmers’ Market
    - Season
    - Disease and insect resistance

---

**CULTIVARS**

- **MALWINA**
- **PORTOLA**
- **EVIE II**
- **TRISTAR**
- **SEASCAPE**
- **ALBION**

*Photos by Lloyd Hausher*

*[Other photos* by various photographers*]
### June-bearing Strawberry Cultivars

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>KENT</th>
<th>GULOSOCAP</th>
<th>CAVENDISH</th>
<th>HONEOYE</th>
<th>MALVINA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>High</td>
<td>High</td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vigour</td>
<td>Medium to High</td>
<td>Very good</td>
<td>Very good</td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>Large to Medium</td>
<td>Large</td>
<td>Medium to Large</td>
<td>Large</td>
<td></td>
</tr>
<tr>
<td>Firmness</td>
<td>Very good</td>
<td>Firm</td>
<td>Firm</td>
<td>Not as firm as Glooscap</td>
<td>Good</td>
</tr>
<tr>
<td>Description</td>
<td>Glossy, dark</td>
<td>Slightly pubescent</td>
<td>Attractive, bright</td>
<td>Very dark interior</td>
<td></td>
</tr>
<tr>
<td>Flavour</td>
<td>Excellent</td>
<td>Good</td>
<td>May have off-flavour on heavy soils</td>
<td>May have off-flavour on sandy soils</td>
<td>Excellent</td>
</tr>
<tr>
<td>Relative season</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Mid</td>
<td>Very Late</td>
</tr>
<tr>
<td>General comments</td>
<td>Tolerant of hot; dislikes wet harvest periods</td>
<td>Can have uneven ripening</td>
<td>Tend to have a white tip during ripening</td>
<td>Production starts after Kent; not strong runnering = 1-2 seasons</td>
<td></td>
</tr>
</tbody>
</table>

### Day Neutral Strawberry Cultivars

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>TRISTAR</th>
<th>SEASCAPER</th>
<th>ALBION</th>
<th>PORTOLA</th>
<th>EVIE II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>High</td>
<td>High</td>
<td>Less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>Medium</td>
<td>Med-Large</td>
<td>Large</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td>Firmness</td>
<td>Firm</td>
<td>Firm</td>
<td>Soft</td>
<td>Soft</td>
<td>Soft</td>
</tr>
<tr>
<td>Description</td>
<td>Deep red out / med-red in; good sweetness</td>
<td>Bright, consistent colour in/out</td>
<td>High quality; cone-shaped</td>
<td>Lighter colour than Albion</td>
<td>Light colour</td>
</tr>
<tr>
<td>Flavour</td>
<td>Very good</td>
<td>Excellent</td>
<td>Good</td>
<td>Average / Watery</td>
<td>Good</td>
</tr>
<tr>
<td>Relative season</td>
<td>Late</td>
<td>Late</td>
<td>Late</td>
<td>Late</td>
<td>Late</td>
</tr>
<tr>
<td>General comments</td>
<td>Benefits from deblossoming for 1-6 weeks</td>
<td>Quality, solid producer</td>
<td>Variable performance in AB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PLANTING & ESTABLISHMENT (NON-BEARING YEARS)

### NOTE: FOR JUNE-BEARING STRAWBERRIES
1-2 Years Prior to Planting

- Critical period – DON’T SKIP THIS!!!
- Eliminate weeds – especially perennials
- Soil test to establish baseline soil fertility
- Add soil amendments to increase OM
- Avoid fields where nightshade family, alfalfa, or raspberries were grown in previous 4 years

Field Preparations – Planting Year

Some Pre-Planting Activities
- Apply nutrients, as required
  - Apply high phosphorous, 11-52-0
  - May be done at planting
- Pre-plant incorporated herbicide
  - Cultivate field, two different directions to incorporate
- Set out irrigation pipe

Planting

- Bareroot plants
  - Keep 1-3°C before planting
- Timing
  - As early as possible
- Plant
  - Hand / cultivator trench / transplanter
  - Want damp soil, but not wet

Planting Depth

- Half way up the crown
**Plant Spacing**

- 12-18” in the row
- 4-5’ between rows
- Check depth after planting
  - Reset as required
- Requires an average 10,000 plants per acre

**Moisture Requirements**

- Irrigate for good root establishment
- Requirement:
  - 12”/year average (depends on precipitation)
- Sufficient moisture in root zone at all times
- Avoid “wet feet” or roots in standing water

**MAINTENANCE (NON-BEARING YEARS)**

**Deblossom**

- Flowers set in nursery
  - Deblossoming:
    - 3-4 weeks after planting (approx. June)
    - Remove entire flower stalk before fruit set
    - May need to deblossom 2 or 3 times/season
  - Results in higher yield next year
  - Earlier & increased runnering; more developed roots
**Nutrient Management – Post-planting**

- Light application of N at runnering
  - 1 or 2 light applications, early/mid Aug, one week apart
    - Approximately 25-50 lbs N/acre (total)
  - No later than mid-August
  - Granular fertilizer must be watered in

**Nutrient Management – Post-planting – Organic Systems**

- Apply only composted manures, not raw/fresh
- Applications will have to be made in advance
  - Allows for incorporation, breakdown and release
- Application of soil amendments should be made in the fall to “top up” soil nutrient levels

**Nutrient Management – Organic Systems**

<table>
<thead>
<tr>
<th>Planting age</th>
<th>Actual amount of N (lbs/acre)</th>
<th>Time of year to apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30</td>
<td>Early June*</td>
</tr>
<tr>
<td>1+</td>
<td>70</td>
<td>At renovation</td>
</tr>
</tbody>
</table>

* - adjust amount based on leaf analysis

---

Table from “2015 Organic Production & IPM Guide for Strawberries” – Cornell University Cooperative Extension
Runner Management

- Monthly after plant establishment (July-Sept)
- Drag runners into the row
- Hand or small cultivator shank
- Same direction
- Before runners start to root

Weed Management

- Hand weed (at any time)
- Control weed seedlings when small
- One shallow cultivation (1-2in), if necessary

Other examples of weeding equipment

- HILLSIDE CULTIVATOR
- ECO WEEDER

Shallow cultivating to drag runners into row

Newly established field

Tools for hand weeding

Photo by Grace Fedak – Serviceberry Farms

Rotovating young plants

Photo by Grace Fedak – Serviceberry Farms
Weed Management - Herbicides

- Chemical herbicides may be applied:
  - Non-bearing plants
    - Once crop is established / before runners root
    - In fall

<table>
<thead>
<tr>
<th>Weed Problem</th>
<th>Preplant</th>
<th>2-4 weeks</th>
<th>4-6 weeks</th>
<th>Late Summer</th>
<th>Late Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerged weeds</td>
<td>Glyphosate (spot treatment/directed spray)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-bearing plants</td>
<td>Treflan EC</td>
<td>Rival DF/EC</td>
<td>Bonanza 400/480</td>
<td>Dual II Magnum</td>
<td></td>
</tr>
<tr>
<td>Once crop is established / before runners root</td>
<td>Botanix 8 EC</td>
<td>Sinbar / Sinbar WDG</td>
<td>Devrinol 50DF/ DF- XT/2 XT²</td>
<td>Sinbar / Sinbar WDG</td>
<td></td>
</tr>
<tr>
<td>In fall Planting Year</td>
<td>Venture L⁵</td>
<td>Venture L⁵</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seeding weeds (annual &amp; perennial)</td>
<td>Gramoxone</td>
<td>Devrinol 50DF/ DF- XT/2 XT²</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Avoid to irrigate after treatment may result in damage to plants.
2. Apply only once per season.
3. For post-transplanting applications.
4. June - bearing only - do not apply to varieties that may bear fruit.
5. Consult label for appropriate pre-harvest intervals.
6. Consult label for appropriate pre-harvest intervals.

Straw Mulch Application

- Protects from drying winds & cold temperatures
- Clean wheat or rye straw
- Plants need to be dormant
  - After 3-4 nights of -5°C
  - Needs to be before damaging temperatures

How Much Straw?

To apply 4-6 inches of straw over rows:
- 2-3 tons/acre (4.6-6.7 t/ha)
- 120 small square bales / acre
- 10-12 large round bales / acre

Apply 4 inches over each row and then 1-2 inches over 4-5 rows
Spring Mulch Removal

- Done when new growth begins (Apr/early May)
- Move straw into aisles
  - Two passes – rotary mower & rake
  - Leave approximately 1/2” of straw over plants
- Delaying removal reduces yield
Benefits of straw mulch (in row)

- Keeps berries clean
- Conserves moisture
- Suppresses weeds
- Ease of picking in wet weather

Spring Fertilizer Application

- 1st application
  - Light rate, 10-15 Nitrogen lbs/acre
  - Can be spread over the straw before removal or afterwards
- 2nd fertilizer application when flower buds are emerging
- Optional = foliar spray later on

Nutrient Management – Spring – Organic Systems

<table>
<thead>
<tr>
<th>Planting age</th>
<th>Actual amount of N (lbs/acre)</th>
<th>Time of year to apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30</td>
<td>Early June&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Early September&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1+</td>
<td>70</td>
<td>At renovation</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Early September&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> – be sure plants are growing well prior to application
<sup>b</sup> – adjust amount based on leaf analysis

Frost Protection

- Open blossoms = most vulnerable
- Begin when air temperature = 0°C
  - Overhead fine mist, 1/8” nozzles
  - Continue irrigating until ice melts
- Signs of Frost:
  - Black centres
  - No fruit

Nutrient Management – Spring – Organic Systems

- Annual nitrogen guidelines for June-bearing strawberries
- Planting age | Actual amount of N (lbs/acre) | Time of year to apply
- 0 | 30 | Early June<sup>a</sup>
- 30 | Early September<sup>a</sup>
- 1+ | 70 | At renovation
- 30 | Early September<sup>b</sup>

<sup>a</sup> – be sure plants are growing well prior to application
<sup>b</sup> – adjust amount based on leaf analysis

Frost Protection

- Open blossoms = most vulnerable
- Begin when air temperature = 0°C
  - Overhead fine mist, 1/8” nozzles
  - Continue irrigating until ice melts
- Signs of Frost:
  - Black centres
  - No fruit

Nutrient Management – Spring – Organic Systems

- Annual nitrogen guidelines for June-bearing strawberries
- Planting age | Actual amount of N (lbs/acre) | Time of year to apply
- 0 | 30 | Early June<sup>a</sup>
- 30 | Early September<sup>a</sup>
- 1+ | 70 | At renovation
- 30 | Early September<sup>b</sup>

<sup>a</sup> – be sure plants are growing well prior to application
<sup>b</sup> – adjust amount based on leaf analysis

Frost Protection

- Open blossoms = most vulnerable
- Begin when air temperature = 0°C
  - Overhead fine mist, 1/8” nozzles
  - Continue irrigating until ice melts
- Signs of Frost:
  - Black centres
  - No fruit
WEED MANAGEMENT

Weed Management

- If kept clean, should be minimal
- May need to spot treat or deal with perennial weeds (hopefully limited)
  - There may be volunteers from straw
- Typical timing
  - Spring, @ renovation or fall applications (as required)

Typical timing
- Spring, @ renovation or fall applications (as required)

Bearings Year

<table>
<thead>
<tr>
<th>Weed Problem</th>
<th>Early Spring</th>
<th>Renovation</th>
<th>Soon After</th>
<th>Late Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual grass &amp; quickgrass</td>
<td>Venture L², ³</td>
<td>Venture L²</td>
<td>Venture L²</td>
<td></td>
</tr>
<tr>
<td>Annual weeds</td>
<td>Devrinol SDDF/DF, XT2-X³</td>
<td>Sinbar / Sinbar WDG³</td>
<td>Sinbar / Sinbar WDG³</td>
<td>Devrinol SDDF/DF, XT2-X³</td>
</tr>
<tr>
<td></td>
<td>Glyphosate² (spot treatment, directed spray)</td>
<td>Dacthal W-75⁴</td>
<td>Dacthal W-75⁴</td>
<td>Gramoxone</td>
</tr>
<tr>
<td></td>
<td>Dacthal W-75⁴</td>
<td>Chateau WDG³ (hooded spray or broadcast)</td>
<td>Chateau WDG³ (hooded spray or broadcast)</td>
<td></td>
</tr>
<tr>
<td>Canada Thistle</td>
<td>Glyphosate² (spot treatment, directed spray)</td>
<td>Lontrel 360º</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. ³ Failure or irrigate after treatment may result in damage to plants
2. ² Apply only once per season
3. ⁴ hooded spray for non-dormant plants
4. ⁵ Post-transplanting application
5. ⁶ June bearing only – do not apply to varieties that may bear fruit

Disease Management

- Most is protective or preventative, not curative
- Pesticide applications made pre-bloom onwards, if required – e.g. Botrytis
- Cultural practices:
  - Ensure good airflow
  - Not excessive fertility
  - Good watering practices
  - Maintain straw mulch layer
- Clean Harvest

Insect Control

- Can be a challenge
  - Careful/thorough monitoring = critical
Harvest

- Approximately **30 days from flower to fruit**
- Harvest period
  - **4-6 weeks** – early July-Aug
  - Pick approximately every 3 days
- Average provincial yields
  - **3200-7500 lbs/acre**
    - Can be less (or more)
- Sell by weight or by volume (depends on preference)

Renovation

- Regenerate June-bearing plants
- Encourages new leaf growth
- Incorporate fertilizer & organic matter
- Aerate soil
- Narrow the row

Renovation

- **Immediately after last picking** (No later than August 5)
  - Mow tops of plants to remove old leaves
  - If late harvest, can mow August 5-15 (no later), but mow only top 3”
  - Broadcast fertilizer
    - 50 lb N/acre
  - Rototill on either side of row by removing centre tines
  - Narrow the row
  - Irrigate

---

**Tarnished Plant Bug – adult / damaged seeds / catfaced berry**

**Two-spotted spider mites & damaged plant**

**Strawberry bud/clipper weevil damage**

**Harvest**

**Renovation**

**Photo by Robert Spencer**

**Photo by Grace Fedak – Serviceberry Farms**

**RENOVATION**

**Photo by Robert Spencer**

**Photo by Grace Fedak – Serviceberry Farms**
Mowing tops of plants with rotary mower

Mowed plants

Mowed plants

Mowed tops of plants – Note – exposed berries

Narrowing row with rototiller (centre tines removed)

### Nutrient Management – Renovation – Organic Systems

#### Annual nitrogen guidelines for June-bearing strawberries

<table>
<thead>
<tr>
<th>Planting age</th>
<th>Actual amount of N (lbs/acre)</th>
<th>Time of year to apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30</td>
<td>Early June*</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Early September*</td>
</tr>
<tr>
<td>1+</td>
<td>70</td>
<td>At renovation</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Early September*</td>
</tr>
</tbody>
</table>

* – be sure plants are growing well prior to application
b – adjust amount based on leaf analysis

Table from "2015 Organic Production & IPM Guide for Strawberries" – Cornell University Cooperative Extension
Fall Straw Mulch Application

- Same process as in Establishment Year
- Some time between Thanksgiving and Halloween
  - Based on weather and plant dormancy

Day Neutral Production

- Produces fruit the first year
- Expands picking season into fall
- Can be more challenging to grow
  - Active plant growth requires steady nutrition
  - Crop cooling
- Historically grown for 1 season at high density, but now more common to grow for 2+ (similar to June-bearers)

DAY NEUTRAL STRAWBERRY PRODUCTION

Differences from June-bearing

- Shallower roots
  - More winter injury, moisture and nutrient management
- Will set flower buds at any day length
- Daytime temperature 28°C or higher
  - Reduced flower initiation
  - Crop cooling required

Planting Day Neutrals

- Plant as early as possible (earlier than JB)
- Field preparations = same as June-bearing
**Day Neutrals – Annual Production**
- Crop single year
- High density
  - Staggered double row – 12" apart
  - 5' between rows
- Remove runners
- 1st flush of berries will be smaller

**Day Neutrals – Multi-year Production**
- Crop 2+ years
- Single row similar to June bearing
- Runners are not removed
- DO NOT RENOVATE

**Day Neutral Management**
- Pay more attention to fertility & moisture
  - Requires 10-20 lbs N/acre/month
  - Apply 1-4x/month
- Pay careful attention to moisture management
  - Shallow roots

**Day Neutral Management**
- Apply straw 6-8 weeks after planting
- Derunnering (annual production)
  - Channel more resources to flowers and fruit
- Deblossom Tristar (for 1st 6 weeks)

**Day Neutral Management**
- Crop cooling at 28°C or higher
  - Reduce flower initiation
- Disease/insect control
  - Note days to harvest
- Frost protection in fall to extend season
  - Irrigation
  - Covers

**STRAWBERRY PRICE AVERAGES**
**Strawberries – Prices (2014/2015)**

- **Strawberries**  
  - U-pick berries $2.60 - $8.00 / pound (Avg ~ $3.76/lb)
  - Pre-pick berries $4.00 - $7.75 / pound (Avg ~ $4.89/lb)
  - Farmers’ Market $3.93 - $7.75 / pound (Avg ~ $4.00/lb)

Assume 4L pail holds 5 pounds

---

**U-PICK CONSIDERATIONS**

---

**U-pick Considerations**

- Clean, neat, mowed, weed free farm
- Locate fields away from house and living area
  - Separate driveway, if possible
  - Fences and locking gates

---

Photos by Grace Fedak - Serviceberry Farms

- Locking gate; Separate driveway
- Driveway and signage – good traffic flow
- Grassed parking area
- Paved roads; grassed parking
- Washrooms & handwashing stations
- Sales building; picnic tables
- Clear signage
Upick Considerations (continued)

- Provide pails for picking
- Assign rows/area to pick
- Use flags as markers
- Give good instruction
- Have enough trained staff

QUESTIONS???

Rob Spencer, BSA, MSc, P.Ag.
Commercial Horticulture Specialist
robert.spencer@gov.ab.ca

Alberta Ag-Info Centre
310-FARM