Specialty Cut Flower Production and Handling

Roberto G. Lopez
Department of Horticulture
Michigan State University
rglopez@msu.edu
Traditional Cut Flowers

- Most cut flowers are imported
  - Columbia, Ecuador, Kenya, Israel, Thailand, and Netherlands
    - Roses, carnations, alstroemeria, gerbera, mums, orchids
- Can ship well
- Popular
- Bulk of arrangements
Specialty Cut Flowers

- What are they?
  - Flowers that do not ship well or have short post-harvest vase-life
  - Dahlia, lisianthus, lilies, peonies, snapdragon, sunflower, and zinnia

- Worth over $450 million annually in the U.S.
  - 90% wholesale (florists, etc.)
Specialty Cut Flower Markets

- Wholesale
- Direct to florists
- U-pick
- Roadside stands
- Farmers markets
- Subscription
  - CSA, restaurants, offices, etc.
Top 10 Specialty Cut Flowers (sales)

- Cut tulips  • $65,330,000
- Oriental lily  • $38,287,000
- Gerbera  • $35,231,000
- Gladioli  • $25,140,000
- Asiatic lily  • $25,062,000
- Iris  • $13,863,000
- Sunflower  • $13,747,000
- Snapdragon  • $12,187,000
- Dahlia  • $10,356,000
- Peony  • $7,765,000
Association of Specialty Cut Flower Growers Cut Flowers of the Year

http://www.ascfg.org/

- Board of Directors nominate 5 fresh herbaceous, 5 fresh woody and 5 dried / bulb flowers
  - Top performers from ASCFG trials
  - Membership suggestions

- ASCFG membership select top fresh, dried/bulb, and woody cut flowers through electronic voting
Specialty Cut Flower of the Year - Fresh

- 2016 – Snapdragon 'Madame Butterfly'
- 2015 – Celosia ‘Sunday Orange’
- 2014 – Snapdragon Chantilly Series
- 2013 – Stock ‘Katz Cherry Blossom’
- 2012 – Zinnia ‘Queen Red Lime’
- 2011 – Lisianthus ‘Mariachi Carmine’
- 2010 – Dahlia ‘Karma Naomi’
- 2009 – Zinnia ‘Uproar Rose’
- 2008 – Eryngium ‘Blue Glitter’
- 2007 – Hydrangea ‘Limelight’
- 2006 – Echinacea ‘Ruby Star’
- 2005 – Ilex verticillata ‘Winter Red’
- 2004 – Dianthus ‘Amazon Neon Duo’

Picture Source: http://www.ascfg.org/
Specialty Cut Flower of the Year - Dried

- 2011 – Capsicum ‘Nippon Taka’
- 2010 – Panicum ‘Frosted Explosion’
- 2009 – Achillea ‘Coronation Gold’
- 2008 – Sorghum bicolor
- 2007 – Amaranthus ‘Hot Biscuits’
- 2006 – Lavandula xintermedia ‘Grosso’
- 2005 – Nigella damascena ‘Cramers Plum’
- 2004 – Paeonia ‘Sarah Bernhardt’
- 2003 – Hydrangea paniculata
- 2002 – Celosia ‘Chief’ Series
- 2001 – Artemisia ‘Silver King’
Specialty Cut Flower of the Year - Bulbs

• 2016 – Tuberose Mexican Single
• 2015 – Ranunculus La Belle Series
• 2014 – Anemone ‘Galilee Blue’
• 2013 – Ranunculus ‘Super Green’
• 2012 – Lily ‘Royal Sunset’

Picture Source: http://www.ascfg.org/
Specialty Cut Flower of the Year - Woody

- 2016 – Hydrangea 'Annabelle'
- 2015 – Caryopteris ‘Longwood Blue’
- 2014 – Hydrangea Everlasting Series
- 2013 – Symphoricarpos ‘Amethyst’
- 2012 – Viburnum ‘Wentworth’
- 2011 – Physocarpus ‘Coppertina’
- 2010 – Viburnum ‘Snowball’
- 2009 – Hydrangea 'Hamburg™'

Picture Source: http://www.ascfg.org/
Specialty Cut Flower Production

• Site Selection:
  – Well-drained
  – Fertile soils

• Raised Beds

• Field, High Tunnel or Greenhouse
Field Cut Flower Production
High Tunnel Cut Flower Production
High Tunnels

- High tunnel = unheated single or multi span poly-house or hoop house
  - taller and more uniform temp than a cold frame
- Cost to construct $1 to 3 per square foot
- For overwintering plants typically adds 2 USDA hardiness zones additional protection
High Tunnels

- A temporary structure (single or multi-span) made from a pipe or other durable material framework that is covered in a single layer of greenhouse-grade 4 to 6 millimeter plastic and has no electrical or heating systems.
  - Low set up cost
  - Possibility for fast return on investment
Ventilation is absolutely necessary during the day, even when outside air temperatures are not extreme.
High Tunnel Cut Flower Production

- Provides season extension
  - Early spring and fall extension (4 to 6 weeks)

- Protects crops from wind, rain, and hail

- Usually higher quality stem
  - Increased stem length and caliper, earlier flowering, larger flowers
Preparing the High Tunnel

- Topsoil (fine-silty, mixed, mesic Typic Endoaquoll) contained ≈3.2% organic matter and has a pH of 7.0.
- Raised beds gilled with topsoil and compost (pH 6.6)
Raised Beds production in HT
In ground production in HT
Raised bed Production Outdoors
Cut flower High tunnel Research

- Bellflower
  - ‘Campana Deep Blue’
- Bells of Ireland
- Celosia
  - ‘Chief’
  - ‘Bombay Firosa’
- Dahlia
  - ‘Karma Thalia’
- Dianthus
  - ‘Amazon Neon’
  - ‘Amazon Neon Neon Purple’
- Gomphrena
  - ‘Fireworks’
- Lisianthus
  - ‘Mariachi’
- Matricaria
  - ‘Vegmo Snowball Extra’
- Snapdragon
  - ‘Rocket’
  - ‘Potomac’
  - ‘Potomac Lavender’
- Stock
  - ‘Katz’
- Sun Flower
  - ‘Sunrich Yellow’
  - ‘Premier’
- Zinnia
  - ‘Benary Giant’
‘Bombay Firosa’ celosia

High Tunnel

Field
‘Chief’ Celosia

High Tunnel

Field
‘ABC 3 White’ lisianthus

High Tunnel

Field
‘Katz’ stock

High Tunnel

Field
‘Benary Giant’ zinnia

High Tunnel

Field
‘Premier Lemon’ sunflower

High Tunnel

Field
High Tunnel

Field
High Tunnel

Field
Results

- **Bellflower**
  - ‘Campana Deep Blue’
    - No difference between HT or field

- **Bells of Ireland**
  - HT yielded 10 more stems per 11 ft$^2$
  - HT stems were >3.5 in. longer, larger flowers
  - Reduced TTH in HT by 6 days

- **Celosia**
  - ‘Chief Red’
    - HT yielded 14 more stems per 11 ft$^2$
    - HT stems had 17% smaller flowers by width
  - ‘Bombay Firosa’
    - HT stems were 6 in. longer and had 12% larger stem caliper

- **Dahlia**
  - ‘Karma Thalia Dark Fuchsia’
    - Reduced TTH in HT by 4 days
Results

- **Dianthus**
  - ‘Amazon Neon Cherry’
    - In HT, 185 more stems per 11 ft² and 10 day reduction in TTH
  - ‘Amazon Neon Purple’
    - Field stems were >3.5 in. longer
    - 7 day reduction in TTH

- **Gomphrena**
  - ‘Fireworks’
    - HT stems were >3.5 in. longer

- **Matricaria**
  - ‘Vegmo Snowball Extra’
    - HT stems were 2.5 inches longer

- **Lisianthus**
  - ‘Mariachi Blue’
    - HT stems ≈6 in longer with 8 % larger flowers by width
Results

- Snapdragon
  - ‘Rocket’
    o HT yielded 26 more stems per 11 ft²
    o HT stems >5 in. longer with 29 % longer inflorescences
  - ‘Potomac Lavender’
    o HT stems >4 in. longer with 5 % smaller stem caliper

- Sunflower
  - ‘Premier’
    o Reduced TTH in HT by 8 days
  - ‘Sunrich Yellow’
    o HT stems had 8% larger flowers by width

- Stock
  - Katz Lavender Blue’
    o HT stems ≈5 in. longer, 32 % larger stem caliper, 21 % longer inflorescences, 24 % larger flowers by width
Results

- Zinnia
  - ‘Benary Giant Scarlet’
    - HT yielded 192 more stems per 11 ft\(^2\) (59%)
    - HT stems ≈3.5 in. longer, 13% larger stem caliper, and 12% larger flowers by width
## Average Stem Length (in.)

<table>
<thead>
<tr>
<th></th>
<th>High Tunnel</th>
<th>Field</th>
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<tbody>
<tr>
<td>Bell’s of Ireland</td>
<td>27.5</td>
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<tr>
<td>Campanula</td>
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<td>Lisianthus</td>
<td>22.6</td>
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<tr>
<td>Matricaria</td>
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<tr>
<td>Snapdragon</td>
<td>25.8</td>
<td>24.1</td>
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## Total Marketable Stems Harvested per 40 ft²

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<tr>
<td>Campanula</td>
<td>194</td>
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<tr>
<td>Celosia</td>
<td>214</td>
<td>216</td>
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<tr>
<td>Dianthus</td>
<td>811</td>
<td>889</td>
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<tr>
<td>Gomphrena</td>
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<td>Lisianthus</td>
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<td>27</td>
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<tr>
<td>Matricaria</td>
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<td>388</td>
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<tr>
<td>Snapdragon</td>
<td>297</td>
<td>194</td>
</tr>
</tbody>
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Greenhouse Cut Flower Production
Greenhouse Cut Flower Production
Oriental Lily Greenhouse Production
Planting

- Direct sow or transplant
  - Plugs started in greenhouse/high tunnel

- Spacing
  - Species/cultivar dependent
  - Planted closely to encourage stem elongation
Irrigation

- Sprinkler or hand irrigation

- Drip tape
  - Gets water directly to the roots
  - Avoid getting foliage/flowers wet
Wind Protection

- **Wind Breaks**
  - Field plantings or structures
  - High Tunnel
  - Greenhouse

- **Stem Support**
  - Wire or plastic mesh
Pest Control

- **Insects**
  - Aphids, thrips, Japanese beetle, cut worm, grass hoppers
  - Biological or chemical control

- **Diseases**
  - Fungal; Powdery Mildew
  - Resistant cultivars
What Was Found:

TOP PESTS:
1. Japanese beetle
2. Caterpillar species
3. Thrips
4. Spider mites
What was Found:

SUSCEPTIBILITY OF FLOWERS:
1. Dahlia
2. Zinnia
3. Snapdragon
4. Sunflower
5. Stock
6. Dianthus
7. Lisianthus
8. Celosia
# Insect Intensity

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
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<tbody>
<tr>
<td>Japanese Beetle</td>
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<tr>
<td>Caterpillars</td>
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<tr>
<td>Thrips</td>
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<tr>
<td>Spider Mites</td>
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<tr>
<td>Grasshoppers</td>
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<tr>
<td>Leaf Miners</td>
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<tr>
<td>Cucumber Beetle</td>
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# Plant Susceptibility

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<th>Aug</th>
<th>Sept</th>
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</thead>
<tbody>
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<tr>
<td>Zinnia</td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Snapdragon</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower</td>
<td></td>
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<tr>
<td>Stock</td>
<td></td>
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<tr>
<td>Dianthus</td>
<td></td>
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<td></td>
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<tr>
<td>Lisianthus</td>
<td></td>
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<tr>
<td>Celosia</td>
<td></td>
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</tbody>
</table>
Caterpillars

Virginia Tiger Moth: Dahlia

Marsh Caterpillar: Dahlia

Yellow-Striped Armyworm: Zinnia, Lisianthus
Thrips
Runners up!

Grasshoppers

Leaf miners
### What we found:

**FLOWER SUSCEPTIBILITY:**
1. Dahlia  
2. Zinnia  
3. Snapdragon

**TOP PESTS:**
1. Japanese beetle  
2. Caterpillar species  
3. Thrips  
4. Spider mites

### Grower Summary:

**TOP FLOWERS GROWN IN MIDWEST:**
1. Zinnia  
2. Celosia  
3. Sunflowers

**TOP PESTS:**
1. Japanese beetle  
2. Thrips  
3. Aphids  
4. Other
Herbicide Damage
Pre-harvest Factors Affecting Postharvest Life

• Quality
  – Poor quality declines faster
• Nutrition
• Insects and diseases
  – Grounds for rejection by customer
  – Provide entry points for botrytis
  – Increase ethylene production
Pre-harvest Factors

- High light levels promote high carbohydrate levels
  - Maximizes postharvest life
  - Maximum light tolerated for each species without reducing quality

- Lowering temperatures 2 to 10 °F during the last 1 to 3 weeks of the production cycle enhances flower color and quality
When to Harvest?

• Spike-shaped inflorescences (multiple flowers per stem) are harvested when one-fourth to one-half of the florets are open

• Composite family flowers (daisy types) are often harvested when the outer petals are fully developed
Harvesting

- Cut flowers should be harvested in the morning
  - Plants have highest water content
  - Tissue is coolest
  - Cut into water, if possible

- Dry foliage

- Cut location
  - High on the stem
    - best postharvest
    - Less dirt
  - Low on the stem
    - Longest stems
    - More contamination
Harvesting

- Foliage and flowers must be turgid
- But......surfaces must be dry to prevent *Botrytis*
Postharvest Handling of Cut Flowers
Why do we worry about postharvest handling?

- Flowers may look good at harvest but.... Vase life quality can quickly decrease for the consumer
Why do we worry about postharvest handling?

- Allow flowers to reach their full potential:
  - Flowers open completely
  - Flower color develops
  - Buds open / spikes elongates / sprays open
  - Fragrance develops
Long Vase Life

• Allows for postharvest handling, shipping, storage, and outdoor display at markets

• Provide a long period of enjoyment by the consumers and repeat sales!
Key Concepts for Postharvest

- Water
- Carbohydrates
- Ethylene
- Temperature
- Disease prevention
Water

- Keeps flowers alive and turgid
- Effects
  - Prevents wilting
  - Any wilting will decrease vase life
- Sources
  - Held in the stem at time of harvest
  - Provided by the grower in a postharvest solution
Water Uptake

- Vase life declines due to lack of water uptake
- High quality water
  - Promotes water uptake
  - Low salt best: 0.2 – 0.5 dS/m
  - pH 5.0 – 7.0 initially
  - pH 3.5 – 4.0 after treatment
- Knives and stem cutters
  - Sharp and clean
  - Don’t crush the stem
- Flowers should not wilt
Stem Blockage

- Microorganisms block xylem (water transport)
  - Bacteria and fungi occur naturally on plants and in tap water
  - Build up in buckets
  - Use a cleaner/soap
  - SANITATION!
Stem Blockage

- Air embolisms (plugs)
  - Form from air drawn into xylem
  - Whenever stems are out of water, recut to remove plug
  - Recut under clean water or recut in the air
Carbohydrates

• Sugars fuel cut flowers

• Effects
  • Open buds
  • Develop/maintain color

• Source
  • Made by the leaves/stored in the stem
  • Provided by the grower in a postharvest solution
Ethylene

- Many flowers are sensitive to ethylene
- Effects:
  - Petal, leaf, flower and bud abscission
  - Bud abortion
  - Shortened vase life
Ethylene

- Sources:
  - Natural aging process
  - Other flowers
  - Engine exhaust, smoke, incomplete combustion from malfunctioning heaters, etc.
  - Rotting leaves, pathogens, fruits, etc.

**NEVER STORE/DISPLAY CUT FLOWERS NEAR FRUIT!**
Preventing Ethylene Effects

- Lowering temperature
- Applying anti-ethylene agents
  - Silver thiosulfate (STS) on cuts
    - Effective for longer, but safe disposal is a major issue
  - 1-Methylcyclopropene (MCP) for both cuts and containers
    - Not as long lasting, but very safe to use. Multiple applications can be made
Temperature

- High temperatures in the dark (low light) reduces carbohydrate levels
  - Increase respiration
  - Reduce postharvest life
Temperature

- Cold as possible for the species
  - Close to 32 °F for most species, except tropicales
  - Decrease water loss
  - Decrease carbohydrate loss
  - Decrease ethylene production and reduces ethylene sensitivity
Diseases during Shipping and Storage

- **Botrytis**
  - Water required for spore germination
  - High humidity for growth
- Pack with dry foliage and flowers
- Pretreat with fungicides
Postharvest practices –
What you can do

- Increase water uptake
- Prevent ethylene effects
- Lower temperature
- Prevent diseases
- Use floral preservatives
Floral Preservatives

- Contain one or more:
  - Sugar source
  - Citric or other acid to reduce water pH
  - Anti-microbial agent
  - STS, 1-MCP
  - Plant growth regulators
Floral Preservatives

- Processing/holding solutions
  - Many types available
  - Some specific to the water quality

- Consumer vase solutions
  - Sugar, acidifier, anti-microbial agent
Shipping and storage

- Short as possible!!!!
- Coolers
  - Keep clean
  - One air exchange per hour
  - High humidity (90 – 95%)
Acknowledgements

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