Pollinator/Monarch Habitat Establishment

Seth Appelgate
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ISU Monarch Research Team
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I Don’t Care About Monarchs
Intro to the Monarch
Monarch Life Cycle

- Egg: 0-4 days
- 1-4 instar caterpillar: 4-12 days
- Chrysalis: 18-28 days
- 5th instar caterpillar: 12-18 day
- Eclosure: 27-32 days
Monarch
Danaus plexippus

Viceroy
Limenitis archippus
Importance of Milkweed/Nectar Plants

- Monarch butterflies only lay eggs on milkweed
- Monarch caterpillars only feed on milkweed
- 17 milkweed species native to Iowa
- Monarch adult butterflies feed on nectar
>90% of overwintering monarchs originate from red area
North American Monarch Population Decline

Total Area Occupied by Monarch Colonies at Overwintering Sites in Mexico

1994-2017 season average = 5.65 ha
2004-2017 season average = 3.28 ha

Data for 1994-2003 collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Natural Protected Areas (CONANP) in Mexico. Data for 2004-2017 collected by World Wildlife Fund Mexico in coordination with the Directorate of the MBBR.

* Represents colony sizes measured in November of 2003 before the colonies consolidated. Measures obtained in January 2004 indicated the population was much smaller, possibly 8-9 hectares. CT
Non-Native Grass is Poor Habitat

Bad cover
Limited food
Thick Native Grass is not Ideal Habitat

Ok cover
Limited food
Diverse Habitat is Ideal

- Good cover
- Lots of food
Practicalities
Identifying a Suitable Location
Location Considerations

- Spray/drift risk
- Erosion potential
- Maintenance access
- Site longevity
- Sunlight
- Existing vegetation
Seed
Seed Mix General Guidelines

- IA native species
- IA grown
- Limit tall, competitive grasses (big bluestem, indiangrass, switchgrass)
- Soil moisture specific
- Flower April-October
- 75% forbs
- 35+ species
- ≥2 milkweed species
- No single forb >10% of mix

Ask NRCS, DNR, or Pheasants Forever to review seed mix

Photo © Justin Meissen
Is your seed mix actually high diversity?

Individual Species Seeding Rate

0.01 seed/ft² (0.25% of the seed mix)
\[ \times 5\% \text{ survival} \]
22 plants/acre

0.005 seeds/ft² – Is this doing any good?
\[ \times 5\% \text{ survival} \]
11 plants/acre
Seed Purchase

Timing
- Buy early in calendar year

Dealer Selection
- Pricing
- Seed species availability
- Seed from IA
Seed Mixes – Grass: Forb PLS/ft²
Year 3 Plantings

<table>
<thead>
<tr>
<th>CP 42</th>
<th>CP 25, 33, 38</th>
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<tbody>
<tr>
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<td>20:20</td>
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# Pheasants Forever Seed Mixes

## CP-42 Pollinator Mixes

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
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<tbody>
<tr>
<td><strong>Total acres</strong></td>
<td></td>
<td><strong>$285 per acre</strong></td>
</tr>
<tr>
<td><strong>CP-42 Mesic Prairie Pollinator 10/30</strong></td>
<td></td>
<td><strong>$285 per acre</strong></td>
</tr>
<tr>
<td>.8lb Little Bluestem, .2lb Sideoats Grama, .01lb Prairie Dropseed, .1lb Virginia Wildrye, .015lb Prairie Junegrass, .01lb Fox Sedge, .1lb Canada Wildrye, .25lb Composite Dropseed, .1lb Big Bluestem, .02lb Indiangrass <strong>Forb mix:</strong> Black-eyed Susan, .1lb, Canadian Milkvetch .1lb, Butterfly Milkweed .01lb, Gray-headed Coneflower .35lb, Purple Prairie Clover .6lb, Partridge Pea .2lb, White Prairie Clover .05lb, Pale Coneflower .1lb, Ox-eye .1lb, Common Spiderwort .01lb, Alumroot .01lb, Prairie Blazing Star .01lb, Smooth Blue Aster .01lb, Wild Bergamot .13lb, Common Evening Primrose .06lb, Stiff Goldenrod .1lb, White Heath Aster .01lb, Prairie Mimoso .2lb, Field Goldenrod .02lb, Ironweed .01lb, Tall Tickseed .01lb, Prairie Cinquefoil .02lb, Round-headed Bush Clover .01lb, Common Milkweed .01lb, Golden Alexander’s .02lb, Prairie Rosinwe .01lb, Hoary Vervain .03lb, Swamp Milkweed .01lb, False Dragonhead .01lb, Culver’s Root .011lb, Foxglove Penstemon .025lb, White Wild Indigo .01lb, Lead Plant .01lb <strong>Mesic = normal soils.</strong></td>
<td><strong>$285 per acre</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CP-42 Wet Prairie Pollinator 10/30</strong></td>
<td></td>
<td><strong>$285 per acre</strong></td>
</tr>
</tbody>
</table>
| .25lb Big bluestem, 1lb Virginia wildrye, .03lb Fox sedge, .01 Bicknell’s sedge, .01lb Bebb’s sedge, .01 Upright sedge, .06 Fowl Mannagrass, .015lb Green Balsam 
**Forb mix:** Giant St. Johnswort .055lb, Purple Meadow-rue .01lb, Swamp Milkweed .02lb, Winged Loosestrife .02lb, Sawtooth sunflower .03lb, Blue flax .015lb, Cardinal flower .01lb, Great lobelia .005lb, Boneset .05lb, New England Aster .01lb, Blue vervain .02lb, Ironweed .01lb, Seedbox .008lb, Spotted Trumpetweed .097lb, Monkey flower .004lb, Canadian Anemone .01lb, Prairie Rosinwe .01lb, Sneezeweed .045lb, Golden Alexander’s .1lb, Riddell’s Goldenrod .1lb, Cup plant .01lb, Brown-eyed susan .05lb, Fragrant CONflower .01lb, Showy Tickseed .01lb | **$285 per acre** |
| **CP-42 Dry Prairie Pollinator 10/30** | | **$285 per acre** |
| 1lb Little Bluestem, .25lb Side oats gramma, .2lb Blue Grama, .01lb Arctic Brome, .005lb Sand dropseed, .02lb Composit Dropseed, .01lb Shortbreak Sedge 
**Forb mix:** Black-eyed susan .1lb, Partridge Pea .2lb, Prairie Mimoso .25lb, Gray-headed Coneflower .3lb, Stiff Aster .005lb, Hairy White Oldfield Aster .005lb, Western Silver Aster .001lb, Large-flowered Beardtongue .01lb, White Sagebrush .02lb, False Boneset .02lb, Prairie Sunflower .01lb, Whorled Milkweed .001lb, Butterfly Milkweed .005lb, Dotted Blazing Star .005lb, Tall Blazing Star .01lb, Rattle Box .02lb, Autumn Onion .02lb, Canadian Milkvetch .1lb, Common Milkweed .005lb, Common Evening Primrose .071, Hoary Vervain .1lb, Spider Mountain Mint .1lb, Purple Prairie Clover .6lb, Round-headed Bush Clover .005lb, Stiff Goldenrod .1lb, Wild Bergamot .12lb, Wild Petunia .005lb, Prairie Phlox .001lb, Common Spiderwort .01lb, Prairie Cinquefoil .035lb, Alumroot .01lb, White Wild Indigo .01lb | **$285 per acre** |

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**Note:** Forbs are in pounds-not ounces!
# ISU Monarch Seed Mix

## Monarch Seed Mix

**High Diversity**

The Iowa State University Monarch Research Team developed this seed mix for research purposes. The mix includes three milkweed species. Milkweed is the only host plant for monarch caterpillars. The mix also contains nectar-producing species that benefit butterflies as well as many pollinators, such as bees. All species are perennial natives to Iowa.

Grass species included in the mix are mostly short to moderate height in order to reduce competition with forbs. The plant species were selected to perform well-drained and moderately well-drained soils. Adjustments may be necessary for wet soils. Iowa State reserves the right to alter this mix as needed depending on research results. Pure Live Seed (PLS) indicates the amount of seed that is capable of developing into seedlings.

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Scientific Name</th>
<th>PLS: seed/cube</th>
<th>PLS: ounce</th>
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</thead>
<tbody>
<tr>
<td>Bluejoint Grass</td>
<td>Calamagrostis canadensis</td>
<td>0.75</td>
<td>0.75</td>
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<tr>
<td>Canada Wildrye</td>
<td>Leymus canadensis</td>
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<tr>
<td>Prairie Junegrass</td>
<td>Knapia marrubium</td>
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<tr>
<td>Bicknell’s Sedge</td>
<td>Carex bicknelli</td>
<td>0.59</td>
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<tr>
<td>Prairie Dog Sedge</td>
<td>Carex brookii</td>
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<tr>
<td>Field Oral Sedge</td>
<td>Carex molesta</td>
<td>0.26</td>
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<tr>
<td>Big Bluestem</td>
<td>Andropogon gerardii</td>
<td>0.95</td>
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<tr>
<td>Side Oats Grass</td>
<td>Brachypodium distachyon</td>
<td>1.15</td>
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<tr>
<td>Little Bluestem</td>
<td>Schizachyrium scoparium</td>
<td>0.35</td>
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<tr>
<td>Indian Grass</td>
<td>Sorghastrum nutans</td>
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<tr>
<td>Prairie Conspicuous</td>
<td>Spatola perfoliata</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Tall (Rough) Dropseed</td>
<td>Sporobolus heterolepis</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

| TOTAL (forb-evasive) | 21.29 | 21.29 |
| TOTAL (shrub-evasive) | 4.03 | 4.03 |
| TOTAL (grass) | 11.34 | 11.34 |
| GRAND TOTAL | 36.67 | 36.67 |

## Forbs

**Seed Mix**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
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<tbody>
<tr>
<td>Canada Wildrye</td>
<td>J</td>
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<tr>
<td>Redtop</td>
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<td>Liatris</td>
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<td>Prairie Gold</td>
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<td>Little Bluestem</td>
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<td>Blue Sage</td>
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<td>False Vetch</td>
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## Authors

Seth Appelgren, agricultural specialist in entomology, Sue Boggess, professor in entomology, Steven Bradbury, professor in natural resource ecology and management, Diana Dahlke, professor in sociology, Robert J. Marshall, professor in agronomy, John Nussinovitch, assistant professor in sociology, and Diana Schwarzer, program coordinator in entomology, Iowa State University, Richard Hallstick, USDA-ARS.

Iowa State University Extension and Outreach does not recommend or endorse any product or service. For a full listing of Iowa State University programs available, contact your local county extension office.
Four Milkweed Options in Iowa: Winners

- Swamp
  - Wet-Mesic Soil

- Common
  - Any Soil
Four Milkweed Options in Iowa: 2\textsuperscript{nd} place

More Milkweed Species = More Monarchs
Site Preparation
Site Prep Objectives

1. Kill non-native species
   a. 2+ herbicide applications

2. Increase % bare soil
   a. Minimize soil disturbance
Year 1

Following soybeans

Following brome
Site Prep Fails

- 1 Spring Glyphosate Application: 99% Brome
- 1 Sept. Glyphosate Application: 50% Brome
- No residue removal: 0% bare soil
Planting
Calibration

~2 acres of seed
2 Methods

- Adjust planter settings
- Mix in filler
Planting Timing

Dormant Season

- Nov 15-March 31
- Whenever soil isn’t frozen
- Wet soil = good time to broadcast

Frost Seeding

- Feb 1-March 31
Planting Depth

Depth

- 0” – ¼”
Management
Management

Year 1
- Mow 3-5 times

Year 2
- Mow once: only if necessary

Year 3 or 4
- Burn in fall
- Burn once every 3 years
Unmowed vs Mowed: Year 1
Year 2

Effects of frequent first-year mowing
Effects of Repeated Burning

Never burned

Burned every 2-3 years
Alternative Methods/Practices
Alternative Methods/Practices

Tilling
- Increases soil erosion and weed germination
- Ground must be cultipacked after
- Increases cost and time

Tarping
- Cover entire area with thick plastic to kill vegetation
- Effective, non chemical approach
- Good for small/organic areas
Alternative Methods/Practices

Spring/Summer planting
• Favors grasses
Interseeding into non-native grasses (no herbicide)
• Prairie plants won’t establish
Financial Assistance

- CRP, EQIP
- Talk to local conservation office or Pheasants Forever
Habitat is Cheaper than Mowed Grass

- **Year 5 is the breakeven**
  - **Time**: habitat takes less time to manage than mowing
  - **$:** habitat costs less than paying someone to mow
Summary

• Pollinator habitat provides benefits for many wildlife
• Everyone has a reason to establish pollinator habitat
• Prepare your site well
• Plant a high quality seed mix
• Manage your site
• Connect with your local conservationist
Photo Sources

- Maze: http://architecturegirl.files.wordpress.com/2009/01/maze.jpg
- Home: https://st.hzcdn.com/simgs/9eb1650b025c57f0_4-0361/traditional-kitchen.jpg
- ATV sprayer: https://barndoorag.com/blog/workhorse-7-nozzle-boom-kit/
- Tractor and fertilizer spreader: http://www.abiattachments.com/seed-fert/broadcast-spreader-tractor-pto/
- Soybeans: http://www.syngenta-us.com/soybeans/nk
Photo Sources

- Tillage: https://mdc.mo.gov/property/agriculture/disking
- Pheasant: https://en.wikipedia.org/wiki/Common_pheasant
Alternative Methods/Practices

Roots/Plugs

- Great for small areas garden-like areas
  - KU program: Monarch Waystations
  - $2-3/plug
- More species is better
- Watering required
- Management intensive
Habitat Establishment Demonstrations

Locations
- 46 plots
- Areas adjacent to corn/soybean fields

Timeline
- 3 field seasons: 2016-2018

Data collection
- Monarch utilization
- Vegetation
- Site Management
- Economics
Thick Native Grass is not Ideal Habitat
Timeline
CRP Reenrollment

Ok

• Before May 15: burn
• August 2: mow
• August/September: spray
• October: spray regrowth
• Nov-March: plant
• Year 1: mow 3-5 times
• Year 2: maybe mow once
• Year 3/4: burn

Better

• Wait for new contract
• Before May 15: burn
• Spray 3x during growing season
• Nov-March: plant
• Year 1: mow 3-5 times
• Year 2: maybe mow once
• Year 3/4: burn
## Monarch Habitat Economics

### Year 0: Establishment $\$

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<thead>
<tr>
<th>Item</th>
<th>$/acre</th>
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<tr>
<td>Seed</td>
<td>$700</td>
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<tr>
<td>Chemicals</td>
<td>$40</td>
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<tr>
<td>Planting</td>
<td>$20</td>
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<tr>
<td>Fuel</td>
<td>$15</td>
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<tr>
<td>Seed Filler</td>
<td>$5</td>
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<td><strong>Total</strong></td>
<td>$780 (±300)</td>
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### Time for 1 Acre

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<th>Hours</th>
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<tr>
<td>Year 1</td>
<td>9</td>
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<tr>
<td>Year 2</td>
<td>3</td>
</tr>
<tr>
<td>Year 3</td>
<td>3</td>
</tr>
<tr>
<td>Year 4,5</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>33 (±10)</td>
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- Does not factor in time and $ to travel to habitat site
Lawn Economics

<table>
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<tbody>
<tr>
<td>Fuel</td>
<td>$20</td>
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<tr>
<td>Mow (hired)</td>
<td>$125</td>
</tr>
<tr>
<td>Mow (self)</td>
<td>7.5 hours</td>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (mow: self)</td>
<td>Year 4</td>
</tr>
<tr>
<td>$ (mow: hired)</td>
<td>Year 6</td>
</tr>
</tbody>
</table>

- Fuel: $2.50/gal
- Hired mow labor: $15/hour
- Mow rate: 0.5 hour/acre (72” at 3 mph)
- Mow 15 times/year
- Mow every 10 days