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Horticulture Research

Annual Wildflower and Herb Mix for Pollinators

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Web Link:
http://bit.ly/pfi_horticulture

In a Nutshell

- Four diversified vegetable farms planted strips of an annual flower mix.
- Farms assessed flower establishment and attractiveness to insects.

Key Findings

- Buckwheat dominated the mix, providing early blooms but perhaps to the detriment of other flowering species.
- After buckwheat bloomed, there was a gap before the cosmos began to bloom.
- Basil, dill and cilantro did not fare well in the mix; farmers would prefer to transplant or plant these species in monoculture blocks.

Project Timeline:
May 2017 – October 2017

Faux, August: Buckwheat in bloom.

Background

Annual wildflower and herb plantings are an easy and inexpensive way to rapidly increase the amount of forage for bees and other beneficial insects on farms. Direct seeding a variety of flowers in mixtures allows for a succession of blooms throughout the season, with minimal space and planting effort. However, there is limited information available about the performance of many annual flowers when direct seeded in combination with other species. Xerces and PFI partnered with three Iowa vegetable farmers to trial a diverse mix of annual (mostly non-native) wildflowers and herbs during the 2017 growing season. An additional small trial was conducted by Xerces staff on a farm in central Minnesota. The performance of the mix was evaluated in terms of species establishment, bloom succession and attractiveness to beneficial insects.

Methods

This project was conducted at three Iowa farms and one Minnesota farm: Jill Beebout (Blue Gate Farm in Chariton, IA), Rob Faux (Genuine Faux Farm in Tripoli, IA), Alice McGary (Mustard Seed Community Farm in Ames, IA) and Sarah Foltz Jordan (Keepsake Farm in Princeton, MN).

The Xerces seed mix was designed to include a mix of annual wildflowers and herbs known to provide excellent floral rewards for beneficial insects **(Table 1)**. Seeds were sorted into two groups: large and small seeds, and seeded into clean and smooth seedbeds after danger of frost had passed, from mid-May to early June. Large seeds were sown first, either with an Earthway seeder, or hand broadcasted and lightly incorporated by softly dragging a fine steel-tine fan rake. Small seed was sown over the same area, but not incorporated by raking (seed size can be seen in **Table 1**). Seeds were mixed with a bulking agent (1:3 ratio), and seeded at a rate of 60-80 seeds/ft^2. Most plantings were not irrigated or weeded. Plantings were monitored regularly to assess plant

establishment, bloom times, and attractiveness to beneficial insects, such as pollinators and predators of crop pests. Farmers completed qualitative reports by flower species and provided feedback on the establishment of the mix, ease of care, weed pressure and maintenance time.

Results and Discussion

All farms reported excellent establishment of buckwheat, garden cosmos, and sulphur cosmos (notes on establishment and attractiveness to pollinators is shown in **Table 2**). Buckwheat germinated very quickly, flowered profusely, and was highly attractive to honey bees and other insects. Garden cosmos and sulphur cosmos also flowered profusely, were attractive to bumble bees and other native bees, and filled an important bloom gap on many vegetable farms – blooming from late August until first frost. Sweet alyssum demonstrated good establishment on most farms, and bloomed both early and late in the season, filling an important bloom gap before the buckwheat began flowering, and attracted smaller insects like hoverflies and sweat bees.

Crimson clover and partridge pea had good establishment. They did not bloom as profusely as the cosmos and buckwheat, but they helped to cover the ground in the understory, and the nitrogen-fixing potential of these legumes was considered valuable. In addition, partridge pea flowers were highly attractive to a variety of wasps – an important group of beneficial insects for pest control on farms.

Bachelor's button, annual blanketflower, and plains coreopsis exhibited poor-to-good establishment on all farms. Limited bloom did not allow for complete assessment of attractiveness, but some floral visitation by bees was noted. The following species exhibited poor establishment on all farms: santo cilantro, dill, dwarf sunflower, cinnamon basil and holy basil. One farmer also tried growing the two basil species from plugs instead of direct seed, which was much more effective, and both species were found to be highly attractive to visiting native bees.

Cilantro, basil, dill and sunflower are commonly established from direct seed; their poor performance was surprising. Possible explanations for the poor performance of these species include: (1) they were not able to compete with the rapid establishment of the buckwheat's dense canopy, and/or (2) the seeds required more moisture for germination than was provided at the farms.

Monthly growing degree days and monthly precipitation for the current year and historical averages are reported from the nearest weather station to each farm **(Table 3)**. Beebout had 0.21 in. of rain the day after planting, and then no further rain for 10 days. The year continued to be dry; from June 30 – Aug. 15 her largest rain event was 0.28 in. McGary had steady rain the first 10 days after planting, but then had no precipitation for 15 days and very low precipitation during the month of June. Faux had good rains for establishment, followed by a wet July and a dry August.

Conclusions and Next Steps

Many of the species seeded had poor establishment in these trials, probably due to high competition with other species in the mix. In particular, the dill, cilantro, and dwarf sunflower had very poor

Table 1

Trial Seed Mix

Species/Variety	Percent of mix (by seed count)	Seed Size (approx seeds/ox)
Santo cilantro	10%	2,500
Bouquet dill	10%	17,400
Bachelor button	5%	6,000
Annual blanketflower	2%	8,400
Garden cosmos	5%	4,700
Sulphur cosmos	5%	3,900
Plains coreopsis	10%	90,000
Dwarf sunflower	3%	810
Sweet alyssum	10%	70,000
Crimson clover	10%	84,300
Partridge pea	10%	2,900
Cinnamon basil	5%	16,100
Holy basil	5%	72,700
Buckwheat	10%	15,600

Table 1: Seed mix used in annual flower trial on four farms Percents indicate proportion of mix by number of seeds.

Table 2

Flower Establishment and Attractiveness, by Species

Species	Establishment (Poor / Good / Excellent)	Attractiveness (Not assessed / Fair / Good / Excellent)
Santo Cilantro	Poor	Establishment too poor to assess, but known to be excellent for honey bees and soldier beetles, especially
Bouquet Dill	Poor	Establishment too poor to assess, but known to be attractive to hover flies, tachinid flies, lady beetles, etc.
Bachelor Button	Poor to Good	Fair
Blanketflower	Poor to Good	Good
Garden Cosmos	Excellent	Excellent for bumble bees, especially
Sulphur Cosmos	Excellent	Excellent for bumble bees, especially
Plains Coreopsis	Poor to Good	Good, visited by longhorn bees, leaf-cutter bees, and other native bees
Dwarf Sunflower	Poor	Establishment too poor to assess, but known to be excellent for a diversity of native bees
Sweet Alyssum	Good	Fair to Good, fequented by hover flies, small native bees
Crimson Clover	Good to Excellent	Good to Excellent, very attractive to a diversity of wasps
Partridge Pea	Good	Excellent, very attractive to a diversity of wasps
Cinnamon Basil	Poor	Not assessed in seeded mixture, but plug plantings were excellent for small native bees
Holy Basil	Poor	Not assessed in seeded mixture, but plug planting were excellent for small native bees
Buckwheat	Excellent	Excellent for honey bees, soldier beetles, and other insects

Table 3

Monthly growing degree days and monthly precipitation, and the long-term averages

Month	Jill Beebout, Chariton				Rob Faux, Tripoli				Alice McGary, Ames			
	Growing Degree Days		Monthly Precipitation		Growing Degree Days		Monthly Precipitation		Growing Degree Days		Monthly Precipitation	
	2017	Avg.	2017	Avg.	2017	Avg.	2017	Avg.	2017	Avg.	2017	Avg.
May	344	401	4.91	4.62	309	357	6.13	4.67	397	394	**7.45**	**4.43**
June	594	596	3.16	4.94	601	562	6.43	4.92	**664**	**591**	**1.90**	**4.78**
July	746	723	**0.70**	**4.48**	697	675	**8.30**	**4.66**	769	716	**1.47**	**3.68**
Aug.	**590**	**674**	2.50	4.19	**532**	**619**	**1.75**	**4.41**	**589**	**661**	3.64	3.99
Sept.	533	472	3.15	4.03	**501**	**412**	2.49	3.27	**545**	**460**	2.92	3.60

Table 3: Climate data were accessed from the Chariton (120 years, Beebout), Tripoli (120 years, Faux) and Ames (120 years, McGary) weather stations (Iowa Environmental Mesonet, 2017).

GDD (Base 50) values in bold indicate that the 2017 value was more than on standard deviation from the historical average. Where precipitation data is displayed in bold, 2017 values were more than 2 inches different from the historical average.

establishment in the mix, even though these species typically perform well when direct-seeded. As such, farmers thought these species would be best seeded in monoculture strips rather than in a mix. Alice McGary said, "I am concerned about managing for weeds with such a diverse mix broadcast seeded. I would prefer block planting each species along a strip, or have long, single-rows of each species."

Alternatively, dill, cilantro and dwarf sunflower could be included in mixes without buckwheat, since the dense shading by buckwheat leaves was likely a factor that limited establishment of these species. The cinnamon basil and holy basil also had very poor establishment, and since these species are rarely direct seeded, both would probably be best established from plugs in future trials.

Rob Faux said: "The buckwheat was up in 2-3 days. I saw no signs of anything else until 2-3 weeks later. Buckwheat was there until it flowered and went to seed. The upside - buckwheat can be a decent nurse crop to start the rest and attracts pollinators."

Foltz Jordan enjoyed the simple buckwheat to cosmos succession on the same strip, especially with an understory of legumes (crimson clover and partridge pea). Increasing the rate of sweet alyssum (which bloomed earlier and later than the buckwheat) would be a way to increase the density of flowers in the early season. The farmers also noticed a bloom gap after the buckwheat was finished flowering, before the cosmos were at peak bloom. Additional clover and partridge pea could potentially help with this, as well as other wildflowers not trialed in this mix. Lowering the rate of buckwheat would also be helpful in allowing a more diverse assemblage of species to establish.

Several farmers expressed concerns about weed pressure. Faux said, "Normally in an annual plot, we would not have liked letting the buckwheat go to seed; we were already thinking of doing something different in this area, so we let it run its course. But if I don't want buckwheat weeds in that plot in future years, I have to mow the buckwheat before it sets seed. Since the rest of the plants were not all that big (if even germinated) at that point, mowing the buckwheat before it set seed would be possible, but an extra job at a busy time of year (July)." Scything or weed-whipping the buckwheat post-flower/pre-seed may also be management options. Depending on soils, crop rotation, etc., buckwheat seed-drop may or may not be an issue for farmers.

At all of the farms, extensive flowering resources (native prairie, cut flower plantings, etc.) were prevalent outside of the strips, which may have influenced the relative attractiveness of this mix. Still, some farmers noted increased abundance of beneficial insects, and all farmers noted increased farm beautification and outreach/education opportunities as benefits of the planting. One farmer installed signage explaining the purpose of the planting, and had many inquiries about it during a field day at the farm.

Left: Faux, July: Buckwheat, partridge peas and a few cosmos visible. Center: Faux, August: Buckwheat flowering, cosmos and partridge pea visible. Right: Faux, September: Senesced buckwheat, flowering garden and sulfur cosmos, and partridge pea.




Top left: Beebout, July: Cosmos, buckwheat, and partridge pea visible (along with some weeds). Top right: Beebout, September: Garden and sulphur cosmos in bloom. Bottom left: McGary, July: Strip showing flowering buckwheat, cosmos and bachelor burron after a hand-weeding. Bottom right: McGary, July: Cilantro, basil, and dill visible in McGary's plots, along with buckwheat, partridge pea and bachelor button.

PFI Cooperators' Program

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