GROWING KNOWLEDGE

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Oregon State University USDA

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Image 1: A sweat bee inside of a red cultivar of California Poppy (*Eschscholzia californica* 'California Mikado') PHOTO COURTESY OF OREGON STATE UNIVERSITY

Pollinator plant trials

Researchers test the value of Willamette Valley natives and nativars

BY JEN HAYES AND GAIL LANGELLOTTO

INTEREST IN NATIVE PLANT gardening is at an all-time high. For example, native plants were ranked as the top landscape garden trend for 2017–2018 by the American Society of Landscape Architects, and for 2018–2019 by Garden Media Group's Garden Trends Report.

The demand is such that consumers are willing to pay premiums for plants labeled as native (Yue *et al.*, 2011) and for landscape designs that include natives (Helfand *et al.*, 2006). This growing interest in native plants is largely related to their purported benefits to wildlife (Brzuszek *et al.*, 2010; Becker, 2015; Halleck, 2015; Narem *et al.*, 2018) and in particular, bees (Halleck, 2015; Khachatryan *et al.*, 2017).

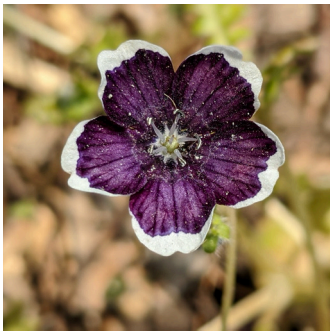
Despite increased demand, the native plant market represents a relatively small segment of overall nursery plant sales (Becker, 2015). In a previous *Digger* article, Oregon State University (OSU) doctoral student Aaron Anderson detailed the barriers that both consumers and producers face to growing the native plant market (Anderson, 2019). These barriers include the niche nature of the native plant market, which makes it difficult for even the most motivated consumers to find natives at retail nurseries (Brzuszek *et al.*, 2010).

In terms of barriers faced by producers, many native plants do not respond well to nursery plant production: they perform poorly in retail containers and fail to meet customers' expectations (Halleck, 2015). In addition, native plant species often lack efficient and scalable propagation methods, which limits their ability to be worked into nursery plant production systems.

The development of improved native cultivars ("nativars") is one potential solution to this barrier of native plant production. Native cultivars are often easier to propagate in large numbers, and are perceived as being more attractive in containers and in landscapes (Lubell, 2017).

However, there are perceived drawbacks of native cultivar use. Native cultivars may not support wildlife, especially pollinators, as well as true natives (Halleck, 2015; Lubell, 2017). Research

Pollinator plant trials



From left: *Nemophila menziesii* native, aka Baby Blue Eyes; *Nemophila menziesii* 'Penny Black', native cultivar #1;, *Nemophila menziesii* 'Snow White, native cultivar #2.

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evaluating the ecological value of native plants versus native cultivars has yet to be published in the peer-reviewed literature, and no project has yet examined these concerns for plants native to the Pacific Northwest.

One notable study on pollinator preferences for native plants and their cultivated counterparts was conducted by Dr. Annie White, as part of her dissertation work at the University of Vermont. Her study of 14 native, herbaceous perennials had mixed results.

Across all pollinating insects, the native plants were preferred in nine instances, the native cultivar was preferred in one instance, and there was no significant preference for either the native or native cultivar in four instances (White, 2016).

Additional work has been conducted by Jessica Lubell-Brand, who established a USDA-funded native shrub and cultivar trial at the University of Connecticut in 2016 (Lubell-Brand, 2019). However, recent work from her lab, a thesis by Ricker (2019), had similarly inconclusive results. Additional ongoing research on the native-nativar issue includes a citizen-science effort by the Chicago Botanic Garden, evaluating palettes of native plants and cultivars for three hardiness zones (budburst.org, 2020), as well as a trial of shrubs and trees at the Mt. Cuba Center in Delaware (Eirman, 2015).

Our project at OSU, to the best of our knowledge, will be the first to trial both annual and perennial natives and native cultivars, and also be the first to focus on plants native to Oregon's Willamette Valley. We selected eight native plant species that are suitable for use in home gardens and had at least one native cultivar available in the retail market. Native plant species selection was guided by Aaron Anderson's 2017–2019 study of Oregon native plants.

From Aaron's collection of 23 Oregon natives, we selected a subset of eight plants that were found to be highly attractive (e.g. *Symphyotrichum subspicatum, Eschscholzia californica, Clarkia amoena*), moderately attractive (e.g. *Sidalcea malviflora, Achillea millefolium, Nemophila menziesii*), and less attractive (e.g.

Image 2: Experimental garden plots at Oak Creek Center for Urban Horticulture in Corvallis, Oregon.
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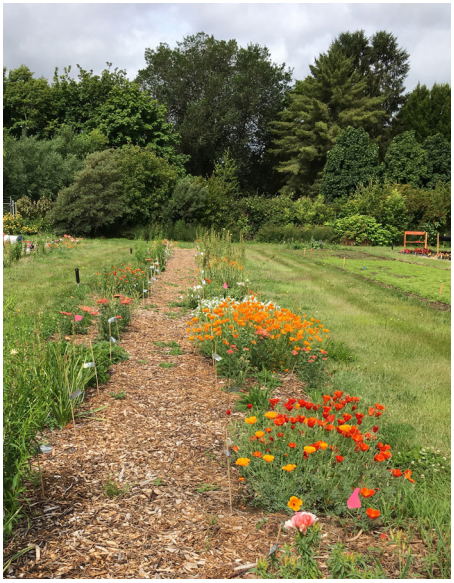


Camassia leichtlinii, *Aquilegia formosa*) to pollinators (Anderson, in prep.).

Our study includes plants with low, moderate, and high levels of attractiveness to pollinators in order to understand how selection for specific plant traits (e.g. color or bloom size) might increase or decrease pollinator visitation to native cultivars. Native cultivars may receive increased pollinator visitation (relative to wild types) by increasing the visibility of plants to pollinators via increases in bloom size, bloom duration, and color saturation.

Alternatively, changes in bloom morphology or color hue may decrease visitation by negatively altering pollinator recognition of a plant. We have included one non-native plant, *Lavandula* × *intermedia* 'Grosso', as a benchmark species; many studies have documented that lavender is highly attractive to pollinators (Balfour *et al*., 2013; Garbuzov & Ratnieks 2014; Frankie *et al*., 2019) and it can commonly be found on pollinator plant lists. We will compare pollinator abundance on native plants and cultivars in relation to lavender.

In November of 2019, we established four (1-meter by 30-meter) experimental garden beds at the Oak Creek Center for Urban Horticulture in Corvallis. Plants were started using a combination of bulbs, seeds, and plugs; bulbs and seeds were planted in the fall and 4-inch pots were transplanted in the spring. Each plant was randomly planted in five different 1-meter by 1-meter plots, located at least one meter away from a plot with the same plant type. We began our

Pollinator plant trials

Native species	Native cultivar #1 (or hybrid)	Native cultivar #2
Yarrow *Achillea millefolium*	*A. millefolium* 'Calistoga'	*A. millefolium* 'Salmon Beauty'
Western Red Columbine *Aquilegia formosa*	*Aquilegia* × *viridiflora* 'Xera Tones'	n/a
Great Camas *Camassia leichtlinii*	*C. leichtlinii* 'Caerulea'	*C. leichtlinii* 'Sacajawea'
Farewell-to-spring *Clarkia amoena*	*C. amoena* 'Aurora'	*C. amoena* 'Dwarf White'
California Poppy *Eschscholzia californica*	*E. californica* 'California Mikado'	*E. californica* 'California White'
Baby Blue Eyes *Nemophila menziesii*	*N. menziesii* 'Penny Black'	*N. menziesii* 'Snow White'
Rosy checker-mallow *Sidalcea malviflora*	*S. malviflora* 'Party Girl'	*S. malviflora* 'Purpetta'
Douglas Aster *Symphyotrichum subspicatum*	*S. subspicatum* 'Sauvie Sky'	*S. subspicatum* 'Sauvie Snow'
Benchmark species		
Lavender *Lavandula* × *intermedia* 'Grosso'		

observations in April, when the first plants (great camas) began flowering.

Twice a week we conduct bloom counts for all flowering plots. Once the number of flowering plants in a plot exceeds two, we performed weekly pollinator observations and sampling.

Observations and sampling occur between 9 a.m. and 4 p.m. on days when the weather is favorable to pollinator activity (temperature at least 60 degrees, minimal cloud cover, and wind gusts less than four meters/second). We record and identify insect visitors within a plot during five-minute observation periods, and note the activities they exhibit (foraging, resting, basking, mating, etc).

Butterflies are identified to the species level, and all other insects are identified to the lowest taxonomic level possible. For example, we identify honey bees to species (e.g. *Apis mellifera*), whereas bumblebees may be recorded only to the genus level (e.g. *Bombus*), syrphid flies to the family level (e.g. *Syrphidae*), and true bugs to order, (e.g. *Hemiptera*). Plots are vacuum sampled using a modified Ryobi hand vacuum until all pollinators have been collected (except for honeybees, of which only one is collected per plot).

Once per season, when a plant reaches peak bloom across all five of its plots, we measure floral traits. Two open flowers from each plot are selected and measurements for corolla width, corolla depth, and approximate nectar tube length are recorded. These factors influence the types, specifically in size and tongue length, of pollinators that are able to access a plant's floral resources.

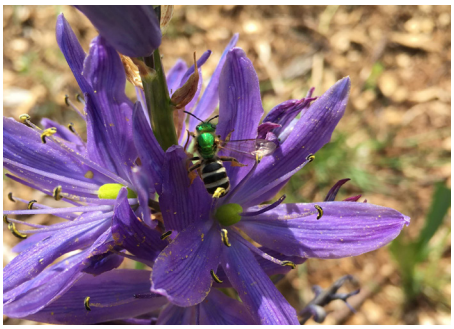
We additionally plan to analyze flower color and appearance to pollinators through a combination of methods, including converting measurements from a colorimeter to the nearest Royal Horticultural Society Color Chart chip and ultra-violet photography. Our goal in combining abundance and diversity sampling with measurements of floral traits is to better understand what, if any, changes in floral morphology between native species and native cultivars are associated with changes in pollinator visitation.

In addition to noting the attractiveness of study plants to insect pollinators, we also intend to ask gardeners their opinion on the native plants and native cultivars in our study. Aaron Anderson's Ph.D. research found that some of the most bee-attractive plants in his study were the least attractive to home gardeners.

This is our first summer of data collection, and we anticipate collecting data for at least two years. Thus, it is too early for us to share any first impressions with you. However, we hope that you'll stay tuned and visit our lab website (**tinyurl.com/y5pphn27**) to follow our progress.

This project has received support from a Garden Club of America scholarship.

Image 3: A sweat bee (*Agapostemon sp.*) visiting a Great Camas flower.
PHOTO COURTESY OF OREGON STATE UNIVERSITY



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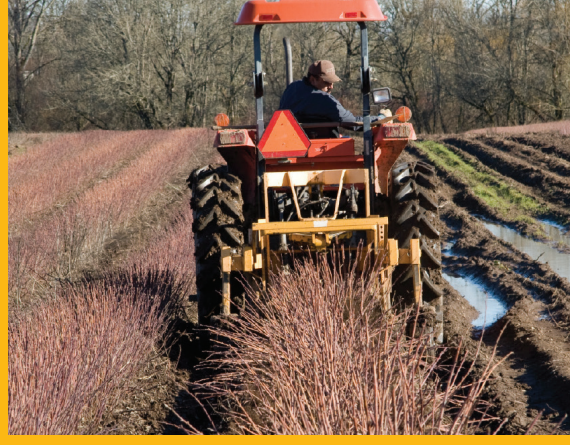

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