

Project Title

- Testing Herbicides and Insecticides for Pest Management in Peony

Project Summary

- Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this project.

Peony growers in Alaska have been clear about the difficulty in controlling weeds in their crop and their desire for more information on herbicide efficacy so they can make science-based decisions when selecting weed control methods. Additionally, in the summer of 2014, a lygus bug infestation in interior Alaska served as a wakeup call for a need to have insecticides available that will control the next outbreak while having minimal impact on beneficial insects. The goal of the study was to screen 6 herbicides and 4 insecticides on 4 peony farms in Alaska. We expected improved (up to 50%) and sustainable yields of peonies as a result of good weed control. And we expected the insecticides would be able to stop potentially devastating losses (>50%) of peony buds if lygus bug or thrips populations suddenly increase in the spring. In addition, herbicides could save upwards \$500 per acre in reduced hand weeding costs. As a result of this project, peony growers throughout Alaska now have Alaska-based information on what pesticides will work best to control insects and weeds on their farms as part of an overall Integrated Pest Management plan.

- Describe the motivation for this project; its importance and timeliness of research.

Peonies are a rapidly expanding specialty crop in Alaska, grown both for cut flowers and eventually for tubers or container plants. The number of peony roots planted is a measure that is collected by the Alaska Peony Growers Association. Since 2004 root numbers have increased from just a few to almost 170,000 throughout Alaska. Peony is a minor, but high value, crop in Washington and Alaska, with cut-flowers ranging from \$2 to \$8 per stem depending on cultivar and the number of stems in a single order. Tubers sell for \$2 to \$50 each, and prices for individual plants range from \$18 to \$50, with some especially sought-after cultivars retailing for several hundred dollars each. The cost for establishing an acre of peonies is at least \$39,000 for plant material alone, without considering land costs, planting bed preparation, irrigation system installation and water costs, and labor. Upon reaching maturity several years after transplanting, an average peony cultivar will produce about five marketable stems per plant per year, with a gross value from \$195,000 to \$780,000 per acre.

Peony plants generally grow slowly early in the season and have a shallow root system so they are highly susceptible to weed competition, particularly during the first years after planting. Perennial weeds generally become more problematic the longer a peony planting persists, many of which are creeping perennials that are particularly difficult to control without use of herbicides. Glyphosate is sometimes used in spring to kill emerged weed seedlings prior to emergence of peony foliage, but there is danger of crop injury from glyphosate uptake by less than-fully dormant buds located above the soil line. Glyphosate will also control most creeping perennials. There are several other herbicides registered for use on peonies, but most of these have not been well studied and additional herbicides will greatly aid peony growers by providing more effective control of a broader spectrum of weeds, which will drastically reduce the cost of hand weeding.

Insect pests of peony include aphids, cutworms, thrips, and lygus bugs which can increase the percentage of deformed or otherwise unmarketable flowers. Of particular concern are pests of phytosanitary interest such as western flower thrips. If a flower shipment bound for certain countries contains even a single western flower thrips, the entire shipment may be destroyed. In the summer of 2014, an outbreak of native lygus bugs near Fairbanks damaged thousands of peony buds. Effective management of these and other insect pests is critical to maintain the economic growth of these

flower crops and expand their production. Currently, insecticide efficacy data on these insect pests in the Pacific Northwest and Alaska are lacking.

Peony ranks in the top ten of the most desirable wedding flowers. Production of quality peony flowers requires control of insect pests and weeds. The objectives of this project were to (1) evaluate herbicides to provide manufacturers with data that will give them confidence to add peony to their product labels, and (2) identify insecticides with good efficacy on insect pests known to be troublesome in peony. With reduced labor costs, increased flower production, and fewer insectdamaged blooms, Pacific Northwest and Alaska flower availability should increase, enhancing the competitiveness of this specialty crop.

To conduct this study screened 6 herbicides and 4 insecticides on 4 peony farms in Alaska. Preemergence herbicides were applied early in the spring before weeds had started growing and insecticides were applied when insect populations were rapidly increasing in early summer. These peony farms all had sticky traps that were changed weekly to measure insect populations.

Herbicides to be tested are:

Product	Active	Manufacturer
Tower	Dimethenamid-p	BASF
Freehand	Dimethenamid-p + pendamethalin	BASF
Dimension	Dithiopyr	Dow
Marengo	Indaziflam	OHP
Gallery	Isoxaben	Dow
Echelon	Sulfentrazone + prodiamine	FMC

These products provide pre-emergence control of many annual weeds in AK and WA and should assist growers in their weed management efforts. Percent weed control and weeding times will be measured for all treatments as will herbicide effects on peony foliar growth (canopy height and width) and flower number, stem length, and general quality.

Insecticides to be tested are:

Product	Active	% active	Manufacturer	IRAC class	Insects
Entrust*	spinosad	22.5	Dow	5	T
Acephate 97	acephate	97	AMVAC	1B	A,T,PB

Malathion 8	malathion	81.8	Loveland	1B	A,T,PB
Aria**	flonicamid	50	FMC	9C	A,T,PB

*Organic formulation

** Not registered in AK, but active ingredient is registered (Beleaf 50 SG, FMC) A = aphid, T = thrips, and PB = plant bugs

Three of the 4 insecticides are registered in Alaska and all 4 are registered in Washington State. Aria is the only insecticide selected that is not registered in Alaska, however the active ingredient is registered here under an agricultural use label, Beleaf® (flonicamid) and data from this study could assist registration of Aria in Alaska. None of the insecticides are labeled *restricted use* and none are listed on the *endangered species Bulletin*, plus Aria is reasonably safe for pollinators. Three of the 4 are effective against the 3 most problematic pests of peonies. Entrust provides an option for organic production against thrips. All together these 4 insecticides will provide Alaska growers with management choices for rotating mode of action chemistries among the 3 classes of insecticides for effective insect resistance management.

- If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complemented and enhanced previously completed work. Project did not build off previous research.

Project Approach • Briefly summarize activities and tasks performed during the entire grant period. Specifically, discuss the tasks provided in the Work Plan of the approved project proposal. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.

Project Activity	Who will do the work?	When will the activity be accomplished?
Herbicides were applied	Steven Seefeldt and Janice Chumley	May 2016
Herbicides were be applied	Gino Graziano	June 2017
Herbicide effects on peony and weeds will be determined	Darcy Etcheverry, Janice Chumley and peony farmers	June and July 2016 and 2017
Insecticides will be applied	Steven Seefeldt and Gino Graziano	June and July 2016 and 2017
Plants will be monitored for presence of thrips, aphids and lygus bugs	Dr. Beverly Gerdeman, Darcy Etcheverry, Janice Chumley, and peony farmers	June and July 2016 and 2017

Activities were performed as planned with all herbicide and insecticide applications. The only deviations were with the number of growers. One grower backed out of insecticide trials in 2017.

- If the overall scope of the project benefitted commodities other than specialty crops, indicate how project staff ensured that funds were used to solely enhance the competitiveness of specialty crops.

No other commodities benefited from this project.

- Present the significant contributions and role of project partners in the project. Dr. Beverly Gerdeman was essential to the project as she provided insect identification and scouting. Growers provided excellent assistance with providing adequate areas although there were other issues that impacted data that were out of their and our control (see lessons learned). The peony growers association was integral to the project providing a venue to give presentations disseminating the results of the work.

Goals & Outcomes Achieved

- Describe the activities that were completed in order to achieve the performance goals and measurable outcomes identified in the approved project proposal or subsequent amendments.

- If outcome measures were long term, summarize the progress that has been made towards achievement.
- Provide a comparison of actual accomplishments with the goals established for the reporting period.
- Clearly convey completion of achieved outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets.
- Highlight the major successful outcomes of the project in quantifiable terms
Weed control was improved through registration of herbicides for peony. Data from the study was collect as described in the Project Purpose section. The results of the experiments were analyzed. All herbicides performed equally, with no impact seen to peonies. However, the lack of consistent weed coverage in fields made herbicide efficacy comparisons difficult to measure.

Insecticide treatments for thrips, aphids and plant bugs were evaluated for peony and we proposed the economic gain for each product be determined based on reduction in the percentage of flower culls. It was anticipated that culls will be reduced by 20% by products providing effective control of these insects. However, field conditions prevented being able to identify a reduction in culls as pest pressure dropped overall due to surrounding fields being treated. Some good insight was gained, however. See the attached report from Dr. Gerdeman.

The results of the herbicide and insecticide trials were disseminated to the general public through several pathways. First, there is an Extension Bulletin about Integrated Pest Management in Peonies and data from this study will support the recommendations made in the bulletin. Second, the information from this study was presented at the annual Alaska Sustainable Agriculture Conference and at the annual Alaska Peony growers Conference. Because there were two years of data collection in this project, there were two presentations the Peony grower conference, but only one SARE conference occurred during this time. Both of these conferences attracted over 200 attendees. Third, we developed an online course that details managing insects in peony field production.

Measurable outcomes:

1. Two IPM in Peonies Extension Bulletin <https://www.uaf.edu/files/ces/invasives/2018-Lygus-6-26.pdf> <https://www.uaf.edu/files/ces/invasives/2018-Thrips-Peony.pdf>
2. Eight presentations at Alaska Annual meetings reaching over 200 people at each meeting (200 x 8 = 1,600)
3. One online course on managing insects in peony fields.
<http://peonypests.open.uaf.edu/>

Beneficiaries

- Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

Beneficiaries of this project are peony growers in Alaska.

- Clearly state the number of beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

Lessons Learned

- Offer insights into the lessons learned by the project staff as a result of completing this project. This section is meant to illustrate the positive and negative results and conclusions for the project.

Working with growers on implementing these projects had positive and negative consequences towards the outcome. Positive consequences resulted from increased interaction with the growers, and them seeing what we were doing for applications and monitoring. These interactions no doubt increased their knowledge of often overlooked details like proper ppe, how and where to set monitoring traps for insects and various other factors with applications. The negative consequences of working with producers was less control over the experiments. Ideally herbicide and insecticide trial conditions would be standardized across all treatment areas, however working with multiple growers does not allow that. The growers own practices with insecticides outside of the areas we had plots in were likely a reason for dropping levels of insects prior to our treatments which made our data less useful. In the herbicide study, every farm had different weed issues, much of which were perennial weeds when we were testing pre-emergent herbicides which are primarily for annuals.

- Describe unexpected outcomes or results that were an effect of implementing this project. Our unexpected outcome that came from implementing this project was discovery of some new damage causing agents that are not yet identified. While examining peony buds for insects Dr. Bev Gerdeman noted damage from a disease agent on buds from one producer. This producer was provided instructions on how and when to sample in order to get a proper identification.
- If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.
- Lessons learned should draw on positive experiences (i.e., good ideas that improve project efficiency or save money) and negative experiences (i.e., lessons learned about what did not go well and what needs to be changed).

We were unable to submit a peer reviewed journal article resulting from the project work because of the variability in farm weed management issues, and insects present. Studying insect pressure on peony and mediating that pressure using insecticides would be better accomplished in an area where a whole farm is dedicated to the project. This will allow for peonies to build populations of insects in untreated areas that can migrate into treated areas, thus testing the effectiveness of the insecticide. As this project was completed the adjacent fields were treated which lowered our insect pressure negating good measures of the effectiveness of individual insecticides. For the herbicides, ideally, we would start with a weed free peony field, and introduce annual weeds, seeding them into the peony field. Doing this would allow for uniform comparison of efficacy of an herbicide on weeds.

