Specialty Crops Grant 2013 Final Report
Project Title: Chicken Moat for Pest Management

Grant Recipient: Greyrock Commons Homeowners Association
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Technical Advisor: Matt Camper, Department of Bioagricultural Sciences and Pest Management, Colorado State University

PROJECT SUMMARY
The two year “Chicken Moat for Pest Management” project demonstrated and evaluated a non-toxic and enduring pest management strategy to control crop damaging pests: primarily deer and grasshoppers. Project year one (2012), focused on the design, construction, and initial operation of the chicken moat plus comparisons of crops grown on similarly planted ‘experimental’ (inside the moat) and ‘control’ (outside the moat) plots. 2013, the final year of the project, saw the first full cycle of moat operation and focused on refinement of the moat system and continued experimental and control crop comparisons. Crop-related findings are preliminary and indicate that all crops grown in the experimental plot had less leaf damage from insects and higher yields when compared with control crops. Statistical significance testing was not done because of small sample sizes. Dissemination activities took place both project years and included public tours of the chicken moat system in 2012 and 2013, informal information sharing with many interested individuals, and the completion of a non-technical report (included with this final report). Because the year one annual report (2012) provided a detailed description of the moat system and 2012 crop data, this final report focuses on 2013 crop data, overall findings and dissemination.

MATERIALS AND METHODS
Project year one (2012) saw the design, construction and initial operation of the chicken moat system. The 2012 annual report included details on materials and methods related to moat system design, and construction, crop findings for the experimental and control plots, and initial dissemination activity.

During 2013, crops identical to those planted in 2012 were planted again in the experimental and control plots in slightly rotated positions. The experimental and control plots each included basil (Genovese, 10 plants), broccoli (Apollo, 6 plants), edamame (Butterbeans, 20 plants), and butternut squash (Waltham, 8 plants). Edamame planted in 2013 failed and was not replanted. The likely cause of the failure was too-early planting and a late freeze.

Following the first killing frost in 2012 and again in 2013, chickens were allowed to free-range and do “fall clean up” for approximately four weeks inside the community garden area which included the experimental plot. Chickens were observed to be eating remaining foliage and scratching and pecking at the soil (likely eating insect eggs, larvae, produce remnants). Chickens did not do any post season garden “clean up” in the control plot in 2012 or 2013.

Two types of crop data were collected in both 2012 and again in 2013. First, 2 independent raters examined experimental and control crop foliage on a weekly basis during the growing season and rated insect damage. The training of raters and the rating system used were described in the 2012 grant report. Second, experimental and control plots were harvested by the project coordinator within 24 hours of each other then weighed separately and recorded.

RESULTS
Graphs below provide side by side comparisons of leaf damage and harvest yields for experimental and control crops in 2013.

As in 2012, 2013 control plot crops sustained somewhat more insect damage and had smaller yields when compared with crops grown on the experimental plot.

In 2012, it was noted that grasshoppers were very evident in the experimental and control gardens between mid-May and early July, 2012. Because the grasshoppers were initially small, leaf damage was limited. By the end of June, however, we appeared to be on track for yet another bad grasshopper year with heavy crop damage. To our surprise, grasshopper numbers and damage seemed to drop significantly following 2.9 inches of rain which fell between July 7 and 9. After the July rain, all plants put on new growth and the grasshopper population inside the garden appeared to drop. Grasshopper numbers increased again in mid August in the control garden more so than in the experimental garden. Squash bugs also appeared on the butternut plants in the control garden in mid August with no squash bugs appearing in the experimental plot.

A slightly different garden cycle occurred in 2013. May started with a snow storm and natural moisture was generally more plentiful and consistent than in 2012. Also, few grasshoppers were observed early, mid, and late season. Squash bugs appeared in both the experimental and control plots with somewhat more squash plant damage in the control garden.

An important finding in both 2012 and 2013 was the complete elimination of deer and raccoons inside the moated community garden containing the experimental plot.
2013 Basil Harvest

- **Experimental Plot**: 10 plants all season; total harvest 7.64 lbs.
- **Control Plot**: 10 plants decreased to 5; total harvest 4.14 lbs.

Broccoli: 2013 Leaf Damage

- **Experimental**: Damage levels range from 0% to 8%.
- **Control**: Damage levels range from 1% to 8%.
2013 Broccoli Harvest

- Experimental Plot
- Control Plot

Experimental Plot:
6 plants all season; total harvest 24.34 lbs

Control plot:
6 plants all season; total harvest 5.35 lbs

Butternut: 2013 Leaf Damage

- Experimental
- Control

Damage levels:
0 = none, 1 = 1-10%, 2 = 11-40%, 3 = 41-60%, 4 = 61-80%, 5 = 81-100%

Assessment Date
CONCLUSIONS AND DISCUSSION

Overall project objectives were achieved on time and within budget. These included the design, construction and operation of the chicken moat system in 2012, cultivation of experimental and control crops in 2012 and 2013, comparisons of experimental and control plot crops for leaf damage and harvest yields in 2012 and 2013, and finally, project dissemination. Related to the project’s overall objective garden pest management, findings appear positive.

Chicken moat design and subsequent operation during two growing seasons was highly successful. Besides routine chicken chores (feed, water, collect eggs, occasional coop clean up), management of the moated chickens required little effort. The flock thrived inside the moat, was safe from predators, and had a vastly improved diet over previous years because of added produce tossed over the fence by chicken-loving gardeners. Shade protection for the chickens was achieved with the planting of hops along the interior moat fence. These grew quickly and hung over the moat area before the full heat of the summer. In addition to hops, intentionally planted plus volunteer sunflowers along the interior moat fence further contributed to shady areas within the moat and provided a green and attractive garden edge.

2012 and 2013 comparisons of experimental and control plots revealed, in general, that crops grown on the experimental plot (inside the moat) had less leaf damage and offered greater harvest yields when compared with the same crops grown on the control plot (outside the moat). While encouraging, crop findings are preliminary at best because of small sample sizes and a number of uncontrolled variables. On top of any crop impacts related to the chicken moat, other explanations for the relative success of the experimental crops must be considered. These include soil quality, slight differences in watering, and less overall grasshopper pressure in both 2012 and 2013. Crop differences noted in 2013 following the first year of moat operation in 2012 may be partly due to the practice of having the chicken flock help with end-of-season garden clean-up. Following the first killing frost in 2012 (and again in 2013), chickens ranged freely for 3-4 weeks inside the...
garden area which included the experimental plot. Doing what chickens do best, they scratched and ate whatever they could find hiding just below the soil surface (e.g. seeds, insects, insect larvae or eggs). To understand the impact of chicken involvement in fall clean up, further controlled study is needed over multiple garden cycles.

At the outset of this project, deer and raccoon were identified as perennial and unwelcome garden pests that might be better controlled with the construction of a chicken moat. Without a doubt, these two pests were completely excluded from the moated garden in 2012 and 2013- no evidence of deer or raccoon was found (footprints, droppings, damaged crops). Gardeners were able to successfully and happily grow and harvest sweet corn for the first time. Winter squash, another crop loved particularly by deer, remained undamaged in both 2012 and 2013.

While the experimental plot was free of deer and raccoon, the lack of deer damage to crops in the unprotected control garden remains hard to explain. During both project years and with regular frequency, deer were observed in the adjacent fields throughout the growing season but did not seem to “find” the control garden. This may be due to the high level of human activity in the area during moat construction followed by busier and more enthusiastic gardening and community composting near the garden in both 2012 and 2013. Deer were observed examining the moat fence but did not find a way to enter the moated garden.

Despite this project’s encouraging findings, further controlled study is needed to understand the full impact of a chicken moat - particularly for insect pest control and insect-related crop damage. At a minimum, a well designed and constructed chicken moat provides long term garden protection from deer and raccoon while also supporting a healthy flock of laying hens with little or no added maintenance.

**OUTREACH**

Two public dissemination/ outreach events occurred during the project: In August 2012, the Greyrock Community Garden with chicken moat participated in the annual “Tour de Farms” sponsored by the Sustainable Living Association. Approximately 40 people visited and toured the chicken moat. Then in May 2013, the Greyrock Community Garden with chicken moat was a stop on the local “Tour de Coops,” again sponsored by the Sustainable Living Association. Approximately 30 people visited, toured, and participated in a question and answer session.

More informally, numerous visitors toured the community garden and chicken moat during 2012 and 2013 as word spread among local gardeners. Greyrock gardeners were enthusiastic tour guides! After one such visit, a local gardener returned to her own rural Fort Collins home and built a smaller version of the chicken moat around her family’s vegetable garden which had been damaged several consecutive years by both deer and grasshoppers.

A final dissemination/ outreach article is provided in Appendix B. This is a non-technical article that describes the moat system and overall project. It may be used or shared by the Specialty Crops Grant program as needed.
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Project Coordinator: Karen C. Spencer

Signature: 

Date: 12/18/13