Using Perennial Plant Headlands as a Beneficial Insect Attractant in Cabbage

On-Farm Demonstration Research Manual

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Contents

Background

Planting various annual and perennial crops within or on crop field borders has been shown to increase beneficial insect diversity (Pascual-Villalobos *et al*. 2006; Walton and Isaacs 2011; Herrera *et al.* 2022). Herrera *et al*. (2022) observed an increase in green lacewings, parasitoids, orius, ladybugs, and other beneficials when strips of a wildflower mix were planted next to cabbage plants. In a two-year study, planting native and pollinator-friendly plants on the borders of blueberry fields was found to attract pest predators (Walton and Isaacs 2011). Most insects collected in the study were parasitoids, but pirate bugs, syrphid flies and other beneficials were also found, with syrphids and predatory wasps being significantly more abundant in fields with flowering plants in at least one of the years of study. A study done in 2006 by Pascual-Villalobos *et al*. found that planting coriander and chrysanthemum strips along field borders in lettuce increased syrphid presence in aphid colonies on the lettuce heads. However, this increase was not statistically significant compared to a monoculture control. Lacewing larvae, which feed on soft bodied insects, have been shown to prey on a variety of cabbage pests, including cabbage aphids, thrips, mites, and lepidopteran eggs (Herrera *et al*. 2022). Wildflower strips of varieties attractive to green lacewings and parasitoids may therefore provide biocontrol of a number of cabbage pests. On-farm demonstration research is a valuable approach that producers can use to evaluate the benefits of adding perennial plants in their farming landscape. Demonstration research can be replicated over a few years to gain confidence in the results.

Objective & Research Question

The objective of this on-farm demonstration research is to evaluate the effect of a headland planted with perennial plants on beneficial insect populations in cabbage.

The research questions this trial will address are:

1) Will planting perennials along a headland increase beneficial insect levels in the adjacent cabbage field?
2) Will increased beneficial insect levels decrease the aphid populations in the adjacent cabbage field?
3) Will increased beneficial insect levels decrease the number of insecticidal soap spray applications required against cabbage aphids?

Trial Design

In order to evaluate the effect of a headland planted with perennial plants on beneficial insect levels in cabbage, a perennial headland will be planted along the north edge of a 32-acre field. The headland will be approximately 1.5 m wide and 100 m long (Fig. 1). In 2023, this field will be planted in N-S running rows with several types of field vegetable crops, including cabbage. Data collection will occur within one cabbage planting.

Figure 1. Perennials will be planted in the headland at the north end of the field. The red area represents the field borders, blue area represents the location of the headland, and grey is the control hedgerow (current farmer practice). The green box represents the cabbage planting where sampling will occur.

Methodology

1) Work soil and add organic fertilizer to top 6 inches prior to planting. Perennials perform best in loose soil rich in organic matter.
2) Water perennials just before planting.
3) Plant at the same depth plants were sitting in the pot, with approximately 0.5 m between plants.
4) Place plants of different species together and ensure there is an even mixture of early, mid, and late-blooming plants throughout.
   - Approximate bloom times for each plant can be found on page 8.
5) Maintain the headland throughout the season (e.g., weeding, irrigation).

Materials List

- Perennial plants, see page 8
- Tools/equipment for cultivation, planting, irrigating, and weeding
- 1 bag of organic fertilizer
- 12 pin flags
- Datasheet, clipboard and pencil
- Beneficials ID guide (page 9)
- Hand lens
- Vials for insect collection (to confirm ID)
- Camera

Data Collection and Evaluation

Within field:
Once per month starting at transplant and ending at harvest, the cabbage planting will be inspected in two passes of six samples each, with each sample consisting of three plants, for a total of 36 plants (Fig. 2). Samples will be taken in row 15 from both the west and east edges at the following distances from the perennial headland: 0 m (at the row end), 50 m, 100 m, 150 m, 200 m, 245 m (at row end), with pin flags placed at each sampling location to ensure consistency. Cabbage aphids and beneficial insects on these plants will be counted by visually inspecting every surface of each plant (top and bottom of each leaf, and the first layer or two of the cabbage head, where applicable), and insect counts will be recorded on the provided datasheet (page 7). Since cabbage aphid populations can be very large, a rating system will be used for counting, with winged aphids and apteran (non winged) aphids recorded separately (see datasheet on page 7).

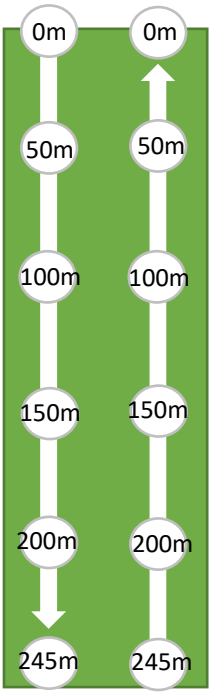


Figure 2. Sampling pattern within cabbage planting.

Within headland:
Once per month, collect observational data at six random points along the headland. At each sample, visually inspect six plants for beneficial insects for a total of 36 plants (see ID guide on page 10). It is likely that only adults will be seen, but all life stages should be recorded. Aphids of any species should also be recorded using the rating system. Record results on the datasheet on page 7.

Considerations for data collection:
Time of day and weather can greatly impact insect activity. Each month, sample at the same time of day whenever possible. Avoid sampling in extreme weather conditions.

Evaluation:
Using the insect counts from the cabbage planting, a population density map will be created using the datasheet provided on page 8. For each sample, the count of each insect type at each sample will be written in its corresponding box. By displaying the data this way, the change in aphid and beneficial populations relative to headland proximity can be visually compared.

Some important considerations for evaluating data in this trial are: 1) insect levels are traditionally higher on field edges than in the middle and 2) perennial plants may take a few seasons to establish. Therefore, in order to determine the efficacy of the perennial plants, this trial should be repeated over multiple seasons and the past three years of data should be analysed to establish a baseline and determine trends. A few data sources should be considered, including: 1) cabbage aphid and beneficial insect counts from weekly IPM monitoring and 2) past insecticidal soap spray records, to determine if perennials are increasing beneficials to a level at which fewer aphid sprays are required. Data should be recorded on the datasheet on pages 9 and 10 of this manual.

Trial Schedule	
Date	**Description of Activities**
March/April 2023	Prepare land and plant perennial headlands
May to September 2023	Data collection: monthly monitoring in cabbage planting, monthly headland observations, creation of population density maps
September 2023	Host a field day
Fall 2023	Analyze IPM data and spray records from previous seasons and compare with current data
Fall 2023	Analyse data and prepare a trial summary

Budget for Supplies (new)		
Item	**Description**	**Cost ($)**
Plants	Perennial plants from greenhouse	1200
Fertilizer	Applied during land preparation	30

Labour		
Item	**Description**	**Hours**
Planting and maintenance of perennials	Planting and maintaining the perennial plants in headland	20
Data collection	Monthly monitoring of cabbage crop and headland observations (approx. 2 hrs/month x 5 months)	10
Data entry	Input monitoring data into population density map. Look back on past IPM data and spray records to compare with 2023	4
Field day	Promo and hosting	6
Summary	Analyse data and prepare a trial summary	4

Potential Funding Options

1. Delta Farmland and Wildlife Trust - Grass Margin Stewardship Program.

- Offers $400/acre to support planting of grasses and broad-leaf plants in field margins

2. Environmental Farm Plan/Best Management Practices (EFP/BMP) funding - Creation of Pollinator Habitats (Practice Code 2207).

Datasheet Template – Field Data Collection

Date:	Time:
Temperature:	Weather Conditions:

Perennial Headland								
	Syrphids			Parasitoids		Aphids		
Sample #	adult	larva	egg	adult	mummy	winged	apteran	Other beneficials (type, number)
1								
2								
3								
4								
5								
6								

Cabbage Planting									
	Sample	Cabbage aphids		Syrphids			Parasitoids		
Row	(distance from HL)	winged	apteran	adult	larva	egg	adult	mummy	Other beneficials (type, number)
15W	0 m								
	50 m								
	100 m								
	150 m								
	200 m								
	245 m								
15E	0 m								
	50 m								
	100 m								
	150 m								
	200 m								
	245 m								

Cabbage Aphid Rating System:

*visually estimate aphid numbers and record rating

1-10	= VL
11-50	= L
51-100	= M
101-500	= H
500+	= VH

Datasheet Template – Population Density Maps

Beneficial Insects Population Density Map

Instructions: Enter the total number of beneficial insects found at each sample in its corresponding box.

Date:

	15W	15E
0m		
50m		
100m		
150m		
200m		
250m		

Cabbage Aphids Population Density Map

Instructions: Since aphids are measured by a rating system, enter the rating from each sample in its corresponding box.

Date:

	15 W	15E
0m		
50m		
100m		
150m		
200m		
250m		

Datasheet Template – Past Data (Beneficials)

Instructions-: for the week data were collected in 2023, look back at past IPM data for that crop stage (to account for different timing across seasons) for the previous three years.
For each year, divide the total number of each insect found by the number of plants sampled to get the number of insects **per plant**.

Previous Years' Data - Beneficials					
Year	Date	Syrphid Adults	Syrphid Larva	Syrphid Eggs	Parasitoid Wasps
2023					
2022					
2021					
2020					

Datasheet Template – Past Data (Aphids & Sprays)

Instructions: for the week data were collected in 2023, look back at past IPM data for that crop stage for the previous three years. For each year, record the highest rating (VL/L/M/H/VH) found throughout all samples on that week.

Previous Years' Data- Aphids				
Year	Date	Winged Cabbage Aphids	Apteran Cabbage Aphids	Mummy Aphids
2023				
2022				
2021				
2020				

Instructions: record the total number of insecticidal soap sprays in each year

Previous Years' Data - Sprays	
Year	**Number of Sprays**
2023	
2022	
2021	
2020	

List of Perennial Plants	
Approximate Bloom Start Time (Gardenia 2023)	**Plant Name**
Early summer	Lavandula angustifolia Hidcote Salvia nem. Caradonna
Mid summer	Campanula Dickson's Gold Buddleia Black Knight Helianthus Salc. Autumn Gold Phlox Blue Paradise Phlox Red Riding Hood Salvia nem. Blue Marvel Salvia nem. May Knight
Late summer	Agastache Aur-hyb Tango Buddleia Black Knight Zauschneria
All Season	Achillea New Vintage White Echinacea purp Mellow Yellows Echinacea purp Pow Wow White Gaillardia Arizona Red Gaillardia Spintop Red Sunburst Rudbeckia Denver Daisy

Cabbage Aphid ID Guide

Apteran Cabbage Aphid: pear-shaped body, dusty/waxy film

Winged Cabbage Aphid: green abdomen, black thorax, may also appear waxy

Beneficial Insect ID Guide

Syrphid:

Adult: bee or wasp-like appearance but large fly-like eyes, short antennae, tendency to hover when flying (also called hover flies).

Larva: worm-like, no distinct eyes or head, "taps" the ground when moving.

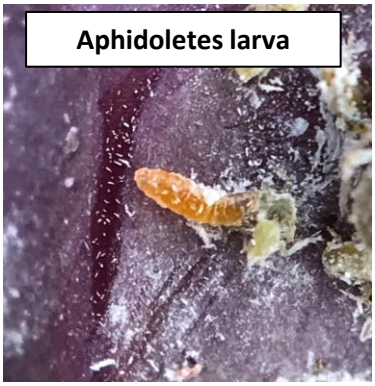
Egg: White, oblong, usually laid singly.

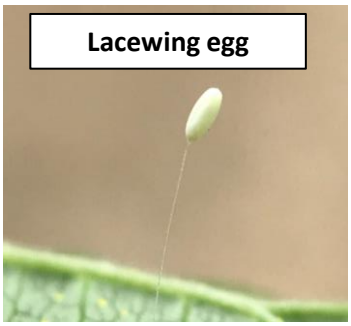
Parasitoid Wasp:

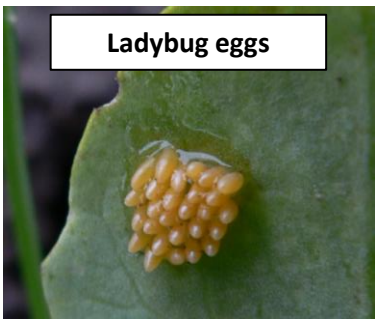
Adult: 3 distinct body segments, long antennae. Many varieties, can vary considerably in colour, size, and shape.

Mummy Aphid: very round abdomen, gold and shiny in colour.

Other beneficials:







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