CITY OF Lethbridge

2022 Grasshopper Mitigation Plan

Grasshopper Introduction

Grasshoppers are insects that are in the Family-Acrididae, Order-Orthoptera, Class-Insecta. There are more than 80 species of grasshoppers found in our area. Only 6 are deemed pests, and of these 6, the two-striped grasshopper (Melanoplus bivittatus) was the specie of concern. This particular grasshopper feeds on a wide variety of green plants, and can lay many eggs.

What Happened in 2021?

Grasshopper numbers tend to grow rapidly in dry warm environmental conditions. This is because the hatching success and survival rates are increased with dry (drought-like) soil conditions. In warm weather, they are able to move through their life cycle more rapidly than in cool conditions.

2021 was a very dry and warm spring and summer. The weather conditions were favorable for successful hatching and the few weeks for unseasonably high temperatures in early June sped up development. Warmer weather speeds feeding, cool weather stops it. Consecutive warm and dry years can bring population numbers to alarming levels.

What the City Has Done So Far

In 2021 the City surveyed the locations with high grasshopper numbers, these locations were patchy and the numbers found ranged between 1-2 per square meter to over 200. No action was taken. There are no pesticides that are approved for use in residential areas, and the land in which the grasshopper population was moving into the residential areas is not managed by the City of Lethbridge.

The Parks and Cemeteries department has partnered up with Dan Johnson from the University of Lethbridge to gain insight on our management plan and treatment options. Mr. Johnson is currently a Professor of Environmental Science at the University of Lethbridge, with research in biogeography, environmentally sustainable agriculture, entomology, biodiversity, rational pest management, biological control, ecology, insect movement, biometeorology, alternatives to chemical pesticides, insects as vectors of plant diseases, methods of forecasting, wildlife ecology, environmental safety, and analysis and modeling of environmental and experimental data.

He is currently Principal Investigator and National Coordinator of the Canadian Zebra Chip and Potato Psyllid Monitoring Network. He has conducted research and taught short courses in

China, Africa, and Southeast Asia. He currently teaches university courses in biogeography, environmental science, natural resources, and data analysis. Previously, Dan was Canada Research Chair for Sustainable Grassland Ecosystems (CRC Evolution and Ecology). He is a member of the Alberta Environmental Appeals Board. Before taking his current academic position, Dan was a Senior Research Scientist with Agriculture Canada and Agri-Food Canada. He was President of the Entomological Society of Canada (ESC) at the time of the Millenium joint meeting with the Entomological Society of America and Société d'entomologie du Québec . He has served in Africa as a TDY Consultant to USAID, and in SE Asia for the Canadian International Development Agency. He received the *C. Gordon Hewitt* medal in entomology from the ESC. He organized and chaired the 2005 world meeting of the Orthopterists' Society, held in Canmore, Alberta.

Dan has published over 100 scientific articles, and an additional 200 other science articles, chapters, books, reports, and maps. He teaches four or more classes each year at the University of Lethbridge, and feels a strong personal commitment to promoting public understanding of science. He recently established and co-edited the public outreach column "Public Professor" published in the Lethbridge Herald, 2010-2013. Dan grew up on grassland in South Dakota, and has lived in Alberta for 30 years.

Training: Dan attended University in Minnesota initially, and graduated from the University of Saskatchewan (BSc High Hon. in Biology; second concentration in Geography), and University of British Columbia (MSc and PhD in Plant Science, at the Institute of Animal Resource Ecology), where he received NSERC and Killam Scholarships.

Mitigation Plan

With the Integrated Pest Management Plan (IPM), there are 6 steps:

1. Monitor: Is there a problem?
2. Identification: What is the pest?
3. Know the Target Pest Biology: Will it be a long-term problem or could it be naturally managed in a short time?
4. Determine an Action Threshold: Do you need to act?
5. Select Management Plan: What is the best treatment?
6. Evaluate: Did it work? What went well? What should change?

Step 1: Monitor: Is there a problem?

Yes, we have determined that there is potential for high grasshopper numbers this year. Some contributing factors were noted by Dan Johnson that indicate the grasshopper populations should not be as high in the 2022 season as the 2021 season. Still, there is always a chance we could have the perfect conditions to promote another highly successful year for the

grasshoppers. In 2021 Dan noted that some of the female grasshoppers were affected by Entomophaga grylli, a fungal pathogen that infected and killed grasshoppers before egg-laying. There should be a reduction of viable eggs in the environment because of this.

There are natural predators found in the environment. The potential for their number to be more substantial this year is likely due to the abundant source of food and reproduction opportunities encountered by the high grasshopper numbers.

We will develop a monitoring program that can begin in early June. The monitoring precedes the anticipated June 15th hatching date. With this monitoring program in place, we will be able to make population predictions and implement an effective management program. In the 2021 season, the population was patchy, with some areas resulting in extremely high numbers per metre squared and other locations alongside them with little to no population. Numbers ranged from 100-200/M2. to 0-10/M2

Along with monitoring grasshopper numbers, we will be looking for the presence of natural predators (beneficial species) that could impact the grasshopper numbers. Knowing the fungal, disease, bacteria, and other animal predators that are present can impact the action threshold for chemical application.

Step 2: Identification: What is the pest? Where does it grow?

The species of concern in this location is the two-striped grasshopper (Melanoplus bivittatus). The vast majority of grasshoppers found in monitoring were this pest species. Although this seems like a negative, it can result in a "good news" situation if looked at as if we do need to implement a control program; we will not be harming many beneficial or non-pest species.

Step 3: Know the Target Pest Biology: Will it be a long-term problem or will it be naturally managed in a short time?

Mother Nature decides this. There is potential for the problem to persist if we continue to have high-temperature, low precipitation summers. The few weeks of high temperatures in the spring of 2021 with little to no precipitation allowed the grasshoppers to move through their lifecycle stages at an accelerated rate; this, combined with the high reproductive success rate, resulted in an early population boom. The good news is that grasshoppers will only have 1 generation per year; we will not have to manage multiple generations.

Step 4: Determine an Action Threshold: Do you need to act?

Action threshold will be determined as we develop the program. The action threshold can be a moving target based on service request numbers, population density, pesticide label requirements or other factors.

Step 5: Select Management Plan: What is the best treatment?

Chemical options are limited due to product label restrictions. Grasshopper numbers will determine the best treatment course. Below are some products available to control grasshoppers, Nolo Bait being the one that is a biological insecticide.

- Eco Bran
- Seven
- Coragen
- Dibrom
- Lorsban
- Nolo Bait

We have the opportunity to create test plots and implement alternate control measures to evaluate the effectiveness of the chosen control program. The test plots will consider alternative measures such as diatomaceous earth, targeted water, and vegetable oil applications. We would need to work with Dan Johnson to help set up alternative control measures and give general guidance towards developing a program implementing industry best practices.

Other control options are:

- Silica gel dusted on the dry, warm sites
- Essential oils of herbs
- Horticultural oil, which slows down the younger ones

Step 6: Evaluate: Did it work? What went well? What should change?

This aspect of the IPM program will continue throughout the process and yearly. Evaluating the program will allow changes when needed to strive for continual improvements and the most effective and efficient program possible.