Tackling issues of the pulse insect pest complex in the Golden Triangle Region

By Anamika Sharma, Ramadevi Gadi, and Gadi V.P. Reddy, Montana State University, Western Triangle Agricultural Research Center, Conrad, Montana

Figure 1. Adults of pea leaf weevil, pea weevil, and cowpea weevil (for cow pea weevil, Photos courtesy of: https://en.wikipedia.org/wiki/Callosobruchus_chinensis)

Montana's economy is driven by its agricultural production. Other than wheat, which is a primary crop, barley, canola and pulse crops are important crops. Pulses are an integral part of Montana farming system. Montana is a leading state in US pulse production and Field peas in Montana accounts for 48% of the total production of USA. Similarly, 46% of lentil production of USA come from Montana. Pulse crops, in the Golden Triangle region of Montana, work as an excellent option for rotation since pulse crops are economically beneficial for growers, soil health and they also promote biodiversity. Use of pulse crops is becoming popular among wheat growers since these crops also enable the breaking up of insect and disease life cycles. Pulse crops are an important source of protein, fiber, vitamins, and minerals and have less cholesterol component in them hence are very nutritious for human consumption.

Nonetheless, pulse crops in Montana are the host of several insect pests such as pea leaf weevil (*Sitona lineatus*), pea weevil (*Bruchus pisorum*), pea aphid (*Acyrthosiphon pisum*), lygus bugs (*Lygus* spp.), and cowpea weevil (*Callosobruchus chinensis*). Pea leaf weevil is a well-established insect pest in Montana whereas pea weevil and cowpea weevil are emerging pests. These insect pests may cause major economic loses to the pulse crops in Montana. At Western Triangle Agricultural Research Center (WTARC), we are trying to incorporate various ways to manage insect pests of pulse crops which include use of bio-pesticides (pesticides developed from plants, bacteria, fungus, and minerals), pheromone-based traps, varietal testing, and survey for emerging insect pests.

Two life stages of the insects - adults and larvae both are economically damaging. Pea leaf weevil adults feed on leaves and leave a 'half-moon' shaped notch on the leaves. Pea leaf weevil cause economic damage to field peas and fava beans. Their secondary host for overwintering can be clover and alfalfa. In the spring season, female pea leaf weevil lay eggs on the soil surface and after hatching larvae feed on the root nodules of the host plant, hence causing damage to roots. For pea leaf weevil, in recent past years (2015–2018) we have tested bio-pesticides and pheromone traps. In terms of bio-pesticides, we have tested commercially available bio-pesticides such as Entrust WP® (Spinosad, *Saccharopolyspora spinosa*), PyGanic EC® (Pyrethrin), Mycotrol ESO® (*Beauveria bassiana* GHA), Xpulse OD® (*B. bassiana* GHA + Cold pressed Neem extract) and Xpectro OD® (*B. bassiana* GHA + Pyrethrin) against adult pea leaf weevils. These experiments were done in lab and cage conditions. Entrust WP®, Mycotrol ESO®, and Xpectro OD® are effective to cause mortality of pea leaf weevil adults in both fall and spring populations. Most effective treatment was Entrust. Same biopesticides were also tested on beneficial insects, lacewing and ladybeetle. Our results indicated that both Entrust and Mycotrol are generally harmless to larval stage of beneficial insects but Xpectro can be somewhat harmful.

To monitor the populations of pea leaf weevil, we have installed pheromone-based traps at Conrad, Valier, Ledger, and Chester in the Golden Triangle areas of Montana. An established pheromone (4- methyl-3, 5-heptanedione) was used in lures in these traps. Pitfall, ramp, delta, and ground traps were used to install the pheromone traps. Pitfall traps proved to be most successful in attracting the maximum population of pea leaf weevil. For our future work, we are planning to develop an attract and kill method for pea leaf weevil. We can use pheromone as an attractant in a granular form which can be installed in the ground along with insect killing fungus as a killing agent to kill the insect after adult insects get caught in pheromone traps in ground. In 2019, we are also installing the pheromone lures in different fields in Golden Triangle Area to monitor the population of pea leaf weevil.

In 2018, we have screened more than 30 varieties of spring peas for leaf damage by adults. In 2019, we are again screening several varieties of peas to scale the most susceptible and resistant varieties of pea against pea leaf weevil. To do this we are assessing the leaf damage levels caused by adults in spring and fall at Conrad and Havre locations. We are also assessing the damage caused by larvae of pea leaf weevil on the root nodule of pea plants.

Another insect pest, pea weevil feed on field peas only and overwinters in nearby trees and storage bins. Pea weevil is not a stored grain pest but it can be found in stored pea seeds. Pea weevil completes its life cycle infield but can overwinter in stored peas, however, it never re-infests stored peas. Pea weevil was first time reported from Hi-Line area of Montana in 2014. Since then we have conducted an extensive survey for this insect. In 2017 and 2018, we have surveyed thirty-three pea fields, five elevators and 16 farm bins in Pondera, Teton, Toole and Liberty Counties. Pea fields in the blooming stage were also surveyed by sweeping the fields. The pea samples are regularly being brought to the WTARC laboratory to analyze them for damage. Although we have not found any incidence in our survey, damaged seeds with live pea weevils were confirmed from the

CONTINUED ON PAGE C46

Basic types of ventilation in swine barns

By Casey Zangaro, Michigan State University Extension

Technology, such as pit fans, curtains, and heaters, is being implemented into swine barns today in an effort to become more efficient at providing an optimal environment for pigs. Ventilation has seen particular developments as more and more swine barns become reliant on electronic modes and mechanics. Due to the advancement of technology, ventilation management in swine barns has become more complex noting fan stages and more precise inlets for air movement; which may lead to a lack of understanding on the science of how to ventilate a barn to the pig's optimal health and comfort.

Ventilation can be defined as a process for controlling several environmental factors by diluting inside air with the mixing of fresh outside air (The Service, 1990). Basically, ventilation brings in oxygen and expels or dilutes harmful dusts, gases, and undesirable odors, as well as airborne organisms and moisture from the pigs. The ventilation system within a barn affects various temperature and moisture components including air temperature, moisture level, surface moisture concentration, air temperature uniformity, air speed across animals, and airborne dust and gases, which can result in decreased health performance. The ventilation system is also known to control odor and gas concentrations as well as combustion fumes from un-vented heaters inside the barn (Jones and William, 1996).

In pork production today, there are three types of known building ventilation systems; mechanical, natural, and a combination of the two. Mechanical ventilation forces air through the building with fans. Mechanical ventilation is the most popular form of ventilation and is more technologically advanced. Natural ventilation, on the other hand, is more dependent on the wind and thermal buoyancy of the weather outside of the barn. Typically, natural ventilation favors older pigs that can retain more body heat, whereas mechanically ventilated barns are typically recommended for farrowing and nursery pigs to control air temperature during winter and summer.

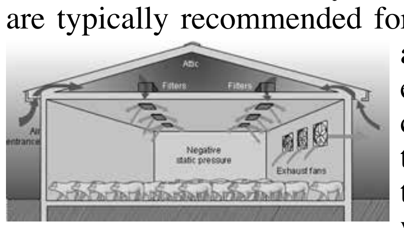

Photo by www.pig333.com

Mechanically ventilating systems within swine production can either be negative pressure barns, positive pressure barns, or neutral pressure barns (The Service, 1990). Negative pressure barns force outside air away from the structure, which are typically inlets, and out through fans. Positive pressure barns force outside air into the structure with fans. Neutral pressure barns use fans to force air into and out of the buildings, typically one fan pushes outside air into the barns through a duct, while exhaust fans pull stale air out of the barn. With mechanically ventilated barns, airflow and distribution is immensely important. Proper airflow rate, which is when air is properly moved through the building, on average is 800 to 1,000 cubic feet per minute. If this is not achieved, pig behavior and comfort can be influenced which is demonstrated by changing their dung patterns and sleep locations. The barn air exchange rate depends on fan capacity; however, the inside air distribution uniformity depends on air inlet location, design, and adjustment; which directly affects where air is exhausted from of the barn.

Naturally ventilated systems include two main types; cold and modified-environment with the option of a gable or monoslope roof. A naturally cold ventilation system is designed to maintain winter indoor temperatures within a few degrees of outdoor temperatures (The Service, 1989). These buildings do not require insulation. A modified-environment system is designed for higher winter indoor temperature with insulation for the barn. Both types rely on animal heat to warm the building and the dry, outdoor environment to remove moisture from the barn, which is preferable for older animals who are able to retain their own heat and withstand colder temperatures. Site selection for naturally ventilated systems in critical. The ideal location would be on higher ground where obstructions such as trees do not disturb airflow around or through the building.

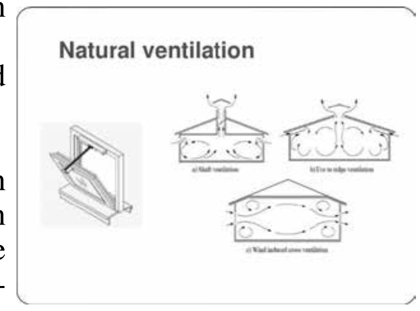

Photo by Iowa State Extension

In conclusion, ventilation systems are complex. When considering what type of ventilation may work best for your respective farm, be sure to research the various parameters, such as gas exchange, as well as temperature and humidity of outdoor conditions, in advance to make an informed decision to optimize pig health and comfort. Although natural ventilation seems to be cheaper, it may require more labor intensive management. In contrast, mechanical ventilation may be more efficient and precise in providing airflow to pigs.

Tackling issues of the pulse insect pest complex

CONTINUED FROM PAGE C44

Chester area (December 2017) by the State Grain Lab. We are continuing this survey this summer.

Similar to pea weevil, another stored pulse insect is cowpea weevil. This weevil has a wide host range including peas, chickpea, pigeon pea, garden peas, cowpeas, mung beans, black-eyed peas, soybeans, lima beans, lentils, and wild legumes. Larvae of cowpea weevil also feed in the pulse seed and adults overwinter in seeds as well as nearby seeds. However, this insect does not cope with the cold weather of Montana and has less chances of establishing. In Montana, cowpea weevil was first reported in 2015 from lentil shipping containers. In 2019, along with pea weevil, we are also surveying and assessing the damage caused by cowpea weevil. We will be sweeping pea fields and checking storage bins.

At WTARC, our entire team is committed to study and resolve the ongoing insect pest issues and are also focusing on future insect problems. We are studying life cycles and behavior of insect pests of pulse crops to understand their activities in climatic conditions of Montana. We are continuously working on improving management strategies by incorporating environmentally friendly options such as bio-pesticides in our studies. We are also focusing on new strategies such as pheromone-based attract and kill strategy and exploring the resistant variety of peas. Nonetheless, there is still a lot more study is needed in terms of pulse crops insect pest complex to improve the quality and production of pulse crops in Montana.