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## **Apple Growth & IPM C2021-0283-Y3**

### **Objectives**

The objective of this project is to demonstrate the use of Davis weather monitoring devices in orchard management and the subsequent utility of phenology models to predict the growth stages of apple insect and disease pests.

### **Summary**

This year concludes the research work done on implementing the use of Davis weather monitoring technology for orchard management in New Brunswick started in 2020 by NBSCIA. Based on the three years of this project, site specific weather monitoring and technology like Davis Mobilize can be a useful tool for New Brunswick apple producers in adopting precision agriculture practices for better crop management and higher profitability. It was also determined that this technology can be utilized in other horticultural crops as well. The main project deliverables were met. NBSCIA has prepared a “Guide to Davis Mobilize for use in New Brunswick” which will be made available on the NBSCIA website for producers to access.

### **Conclusion**

Based on the three years of this project, site specific weather monitoring and technology like Davis Mobilize can be a useful tool for New Brunswick horticultural crop producers in adopting precision agriculture practices for better crop management. Apple producers are encouraged to consider this technology to see if it would fit in their operations as initial start-up costs run over \$2500. The main project deliverables were met in that a guide for New Brunswick producers in using Davis Mobilize was produced.

## **Croissance des pommes et lutte intégrée contre les parasites C2021-0283-Y3**

### **Objectifs**

L'objectif de ce projet est de démontrer l'utilisation des appareils de surveillance météorologique Davis dans la gestion des vergers et l'utilité subséquente des modèles phénologiques pour prédire les stades de croissance des insectes et des maladies nuisibles du pommier.

### **Résumé**

Cette année conclut le travail de recherche effectué sur la mise en œuvre de l'utilisation de la technologie de surveillance météorologique Davis pour la gestion des vergers au Nouveau-Brunswick, commencé en 2020 par l'AASCNB. Pendant les trois années de ce projet, la surveillance météorologique spécifique au site et la technologie comme Davis Mobilize peuvent être un outil utile pour les producteurs de pommes au Nouveau-Brunswick dans l'adoption de pratiques d'agriculture de précision pour une meilleure gestion des cultures et une plus grande rentabilité. Il a également été déterminé que cette technologie peut être utilisée pour d'autres cultures horticoles. Les principaux résultats attendus du projet ont été atteints. L'AASCNB a préparé un " Guide to Davis Mobilize pour l'utilisation au Nouveau-Brunswick" qui sera disponible sur le site Web de l'AASCNB à l'intention des producteurs.

### **Conclusion**

Sur la base des trois années de ce projet, la surveillance météorologique spécifique au site et la technologie comme Davis Mobilize peuvent être un outil utile pour les producteurs de cultures horticoles au Nouveau-Brunswick dans l'adoption de pratiques d'agriculture de précision pour une meilleure gestion des cultures. Les producteurs de pommes sont encouragés à considérer cette technologie pour voir si elle pourrait s'adapter à leurs opérations, car les coûts initiaux de démarrage s'élèvent à plus de 2500\$. Les principaux résultats attendus du projet ont été atteints, puisqu'un guide d'utilisation de Davis Mobilize a été produit à l'intention des producteurs du Nouveau-Brunswick.

**Project Title:** Apple Growth & IPM C2021-0283, Year 3

### **Project Collaborators**

NBSCIA Coordinators: Andrew Sytsma, Zoshia Fraser & Joseph Graham (Project Lead)  
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### **Abstract**

This year concludes the research work done on implementing the use of Davis weather monitoring technology for orchard management in New Brunswick started in 2020 by NBSCIA. Based on the three years of this project, site specific weather monitoring and technology like Davis Mobilize can be a useful tool for New Brunswick apple producers in adopting precision agriculture practices for better crop management and higher profitability. It was also determined that this technology can be utilized in other horticultural crops as well. The main project deliverables were met. NBSCIA has prepared a “Guide to Davis Mobilize for use in New Brunswick” which will be made available on the NBSCIA website for producers to access.

### **Introduction**

The NB apple industry has a history of over 100 years of commercial production. Apple production occurs on about 200 hectares (500 acres) of apples in two main areas: South East region (Cocagne / Memramcook area) and the Central region (St. John River Valley from Woodstock to Gagetown / Queenstown). The industry’s economic value is estimated at \$3 million dollars annually.

Detailed monitoring of the environment or weather conditions is critical to understanding the success or failure of a new variety as well as the ongoing production management of a successful orchard. Integrated Pest Management (IPM) in apple production, rather than simply trying to eradicate pests considers all available information, accounts for multiple objectives, and considers every preventive and curative option. Fundamental to an IPM program is a network of weather monitoring devices and the robust delivery of the sensor data for further analysis and interpretation.

This is the third year of the project. In 2021, the Davis Mobilize app used with the Davis weather monitoring technology showed that it can be an excellent tool for irrigation management and frost risk monitoring and management. Mixed results were seen with the integrated pest management (IPM) modules of Davis Mobilize and their accuracy for use in New Brunswick orchards. Several phenology models of insect and disease pests affecting apple production in New Brunswick appeared to give accurate damage risk alerts while several did not. A greater understanding was acquired on using the Davis Mobilize and the IPM modules. It was determined that further testing/research was needed in order to properly apply them to New Brunswick’s climate conditions and use for orchard management in New Brunswick, which was the objective of this year of the project.

### **Project Objectives**

The objective of this project is to demonstrate the use of Davis weather monitoring devices in orchard management and the subsequent utility of phenology models to predict the growth stages of apple insect and disease pests.

## Project Deliverables

Improved understanding of weather monitoring instrumentation and data analysis for orchard management by orchard owners, NBSCIA coordinators and NBDAAF crop production specialists. Definition of procedures and operating manuals to deliver various models in the 2022 season.

NBSCIA created a “Guide to Davis Mobilize for use in New Brunswick” as a result of this project.

## Technical Innovation

Davis weather monitoring and IPM technology was adopted for this project in 2020 and expanded upon in 2021 with two additional soil moisture probes and one additional leaf wetness probes per orchard. The full scope of the technology used includes:

- **Vantage Pro2 weather station:** used for measuring outside air temperature, humidity, rainfall, wind speed and wind direction. The outside temperature is utilized as the canopy temperature of the apple trees for the IPM phenology models.
- **Weatherlink Live:** connects weather station to the internet for real-time uploads of sensor data.
- **Davis Weatherlink app:** Displays real-time weather data collected by the weather station and sensors as well as past records.
- **Davis Mobilize app:** uses the data collected from the weather station and sensors to provide IPM data. Tracks the development of insect and disease pests and gives alerts when there is risk of damage on a scale of no risk of damage, low risk, medium risk and high risk. Users can select which pests are monitored and which phenology model is used. Displays data in real time. Weatherlink Pro+ subscription is required for access to the IPM program in Davis Mobilize.
- **1 x leaf wetness & soil temperature/moisture station:** collects sensor data from leaf wetness sensors, soil temperature sensors and soil moisture sensors.
- **3 x stainless steel temperature sensors:** Sensors are placed at 6” and 12” soil depth to record soil temperature. One sensor is placed a few inches above ground level to record temperature at ground level.
- **3 x soil moisture probe:** placed at 6”, 12” and 18” soil depths to measure soil moisture between 0 centibars (saturated soil) and 200 centibars (extremely dry soil).
- **2 x leaf wetness sensor:** measures water sitting on the leaf and placed at the top of the tree canopy. Gives wetness readings on a scale of 0 to 15, where 0 indicates leaf is completely dry and 15 completely wet. One sensor is north facing and the other is south facing to measure potential differences in leaf wetness in shaded and/or full sun conditions.
- **1 x radiation shield:** goes over the stainless steel temperature sensor placed at ground level to prevent sunlight from influencing temperature reading.

- **Wireless Signal Repeaters (as needed):** extends the connectivity of weather station and leaf wetness & soil temperature/moisture station range with the weather station console by up to 300 m per repeater. Allows for greater flexibility in where monitoring equipment can be placed.

## **Evaluation Plan**

The utility of the Davis cloud database and IPM models for application in New Brunswick were evaluated. This was done by consulting with NBDAAF staff and literature if high-risk alerts for insect/disease damage and infection given by the Mobilize app were valid. Codling moth, oriental fruit moth and apple maggot traps were placed in orchards to help validate risk ratings given by Davis Mobilize.

## **Results and Discussion**

This is the third year of the project. The goals for this year of the project were to do further testing of the IPM models on Davis Mobilize to validate whether they can be used in New Brunswick.

As part of the project deliverables, a guide on how to use Davis Mobilize in New Brunswick was created. This guide is based on the results and research done for this project. Refer to NBSCIA's "Guide to Davis Mobilize for use in New Brunswick" for a detailed look on the results of this project and how Davis Mobilize can be used in New Brunswick to better manage apple orchards. Davis Mobilize also can be used for other horticultural crops as well.

The previous years of the project focused on using the risk ratings given by the phenology models as the basis for management. It was determined that this can largely work for the disease models such as fireblight and apple scab. In this case, Davis Mobilize can be useful for the producer to make management decisions such as increased scouting or when to plan fungicide applications, for example. In the case of fireblight, the phenology models available indicate when weather conditions are favorable for infection. When the risk ratings climb to medium or high risk, the producer could decide to increase scouting/monitoring for fireblight infections. In the case of apple scab, the ascospore maturity model can be used to determine when the primary infection period is over, and the Modified Mills table can be used for determining the risk of infections during the secondary infection period based on weather conditions. This can result in more precise pest management and eliminate some of the guesswork involved.

For the insect pest models, it was determined that they are best utilized for growing degree day (GDD) tracking for individual insect pests. In 2021, there was the concern that the models would not be suitable for New Brunswick and that some did not appear to work. This was based on the incorrect view that spray applications should line up exactly with the risk ratings given by Davis Mobilize instead of using the GDD accumulation. When using the GDD accumulation for determining if a model could be used in New Brunswick, several insect models were determined to be suitable. Many of the insect models have recommendations on when to spray based on the GDD accumulation. These models can allow producers to time their spray applications to exactly when it would be most effective, which can result in better insect control and reduced damage from major pests, such as codling moth and oriental fruit moth for example. Other insect models, such as for fruittree leafroller, have no recommendations on GDD thresholds for when to spray, so they would be for tracking lifecycle events. There are numerous insect phenology models on Davis Mobilize, however only the models that could be cross referenced for GDD thresholds are recommended for use in New Brunswick at this time.

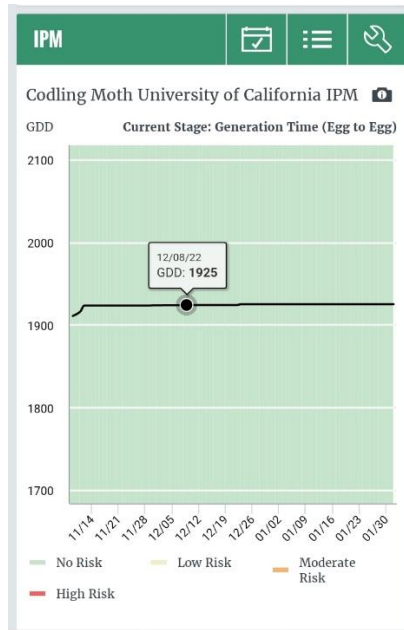


Fig.1: Example of GDD tracking for codling moth

Similar to the previous year, weather monitoring technology and Davis Mobilize was found to be useful for improved tree growth management. This includes soil temperature and moisture monitoring, frost tracking, irrigation management, general growing degree day tracking, and chilling hour tracking. Although chilling hours are usually not a concern for apple growers in New Brunswick, it can be helpful for determining whether new varieties can thrive in New Brunswick and for estimating when trees will break dormancy in the spring. It can also be utilized by non-apple growers, such as strawberry producers.

A new weather station and sensors to install in an apple orchard in the Salisbury area was acquired in 2022. Installation was to occur in the spring of 2022, but due to challenges with the location regarding internet connectivity, the weather station could not be installed. Installation is planned for the 2023 season.

## Conclusions

Based on the three years of this project, site specific weather monitoring and technology like Davis Mobilize can be a useful tool for New Brunswick horticultural crop producers in adopting precision agriculture practices for better crop management. Apple producers are encouraged to consider this technology to see if it would fit in their operations as initial start-up costs run over \$2500. The main project deliverables were met in that a guide for New Brunswick producers in using Davis Mobilize was produced.

## Communication

The final report and the “NBSCIA Guide to Davis Mobilize for use in New Brunswick” will be posted on the NBSCIA website. Project team leaders will deliver presentations in early 2023 at commodity professional meetings and to industry professionals.