

NEEDS ASSESSMENTS

EXTENSION

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13. TITLE: Pest and Crop Forecasting Tool Needs Assessment

OBJECTIVES

- Develop a dedicated group of farmers and researchers to guide the development of decision-support tools for use by Maine farmers.
- Seek interdisciplinary expertise on expanding the existing Maine Climate Office, overseen by state climatologist Dr. Birkel to deliver pest and crop forecasting tools to better serve Maine farmers.

LOCATION: Maine, Statewide

PROJECT TIMEFRAME: May 2019 – June 2020

INTRODUCTION

Agriculture, including wild blueberry production, is intimately sensitive to weather. Changes in average and extreme weather over the last century in Maine are well documented (Jacobson et al. 2009; Fernandez et al. 2015; Easterling et al. 2017; USGCRP 2018; Wolfe et al. 2018). These changes include, warmer winter low and summer night temperatures, increased average annual temperature, delayed fall frosts, greater frequency of high intensity rain events (Spierre and Wake 2010), and decreased snow cover (Notaro et al. 2014). Higher temperatures decrease soil moisture, exacerbating an emerging pattern of prolonged summer dry periods (Anderson et al. 2010). More frequent high intensity rain events can lead to increased soil erosion, disease pressure, and delayed timing of essential management practices (Wolfe et al. 2018).

Wolfe et al. (2018) stated, "Farming success in the Northeast will require technologies that integrate site-specific monitoring with decision tools to adapt to rapid changes in environmental conditions." Farmers know their needs best and have provided positive feedback on the practicality of existing pest and crop forecasting tools. In a 2016 survey, 93% of Maine apple growers reported using the Ag-Radar suite of 30+ decision support models. By using these tools, growers reported saving \$547 per acre on pesticides and experienced 30% less pest damage (Koehler 2017, 2019). In wild blueberry, the AgriNET disease forecasting tool has been adopted by approximately 83% of growers who use fungicides to manage mummy berry disease. A 2018 survey of these growers indicated that the number of fungicide applications has decreased from 3 to 1 since the tool's introduction in 2009. Each avoided application saves the farmer \$50-\$100/acre. Wyman's of Maine indicated that the disease forecasting tool provides a 21% increase in yield (Bruce Hall, personal communication).

This project has leveraged our established relationships with wild blueberry, apple, and mixed vegetable farmers by engaging farmers in focus groups. Through these focus groups, we are currently identifying, developing, and documenting Maine farmer needs and priorities regarding weather information, services, and farm management decision support tools. Many pest and crop forecasting tools have been published in the scientific literature yet are not available in a public form for growers to use on a daily basis in Maine.

METHODS

This project is an ongoing needs assessment where both survey (paper and online) and grower meetings are employed. A pre-survey and focus group meetings were designed to assess the current methods that growers use to check the weather, grower priorities around pest and crop forecasting tools, and how access and delivery of weather information could be improved.

Pre-survey

Surveys were distributed at the Annual Wild Blueberry Field Day, Vegetable Field Day, Summer Apple Meeting, and online through Extension newsletters. Pre-survey questions and response rates are listed in Table 1. Responses from the pre-survey were reviewed by the research team to structure the focus group discussions.

Table 1. Pre-survey questions used in the preliminary need's assessment.

#	Question	# Responses
1.	What types of weather information and sources are most important to you for making farm management decisions?	86
2.	What are the most important unmet needs for access to useful, relevant weather information to help with farm management?	59
3.	Do you currently use any weather-based crop or pest management models or other tools?	83
4.	If you answered "yes" to the above question, please list the tools that you currently use.	29
5.	What is/are your most economically significant pest(s)?	77
6.	What are your most important or difficult farm management decisions affected by short-term or long-range weather?	83
7.	How can UMaine help growers with weather-related farming challenges?	52
8.	Are you interested in using web-based weather tools?	82

In-person Focus Group Meetings

One meeting with each grower group (wild blueberry, apple, and mixed vegetable) were conducted through the fall-winter of 2019. Structured round-table questions and discussion were facilitated around the following topics.

- Grower introductions with a prompt to share their biggest challenges related to weather from the 2019 field season
- Discussion around where farmers get weather data, examples of weather apps shared
- Walk through of the season and when crop management occurs and at what specific times weather information is used or would be helpful
- Presentation from UMaine project team on the different ways that weather data and pest/crop forecasting models are currently delivered to growers of Maine commodities and in other states. Specifically, AgriNET, AgRadar, AgEye, NEWA, and Climate Reanalyzer were described.
- Given the material discussed, discussion continued around the potential format that growers would like to see created to deliver pest and crop models.

Upcoming Meetings with All Growers

Following the focus group meetings, all growers from focus groups will meet together for two cross commodity meetings. The goal of these meetings is to report and reflect our understanding of the feedback received from the crop specific focus group meetings. On the January 30th meeting reporting and discussion will occur through a zoom/call-in meeting. Then the project team will draft a proposal for funding the creation of a Weather Office or Weather Team through which pest and crop forecasting models will be delivered to farmers in Maine. Then this proposal will be reviewed by farmers and discussed in person on March 25th in Augusta.

RESULTS & DISCUSSION

How Farmers Currently Get Weather Information

When evaluating the survey results of all growers combined, the greatest percentage of growers currently use NOAA (21%), followed by various television channels (14%) (Figure 1). Following the top two weather sources mentioned, AgRadar, AgriNet, Weather Underground and Weather Apps for phones were the next most commonly used weather sources and tools (12%, each).

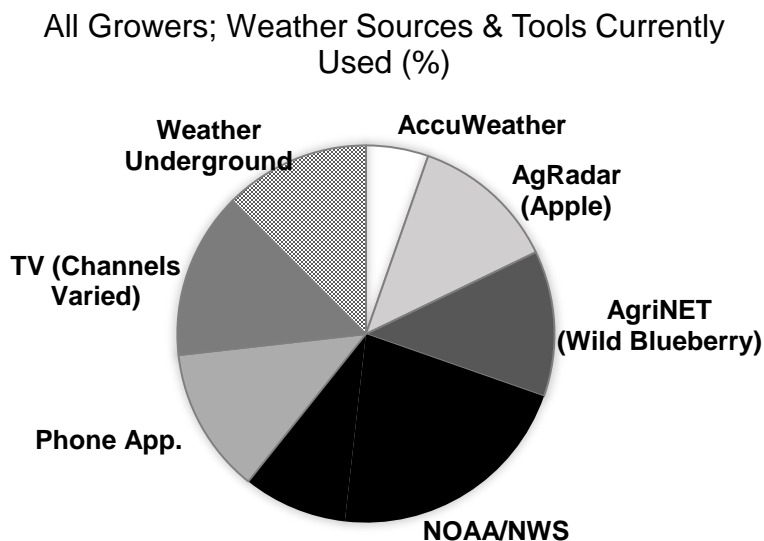


Figure 1. Weather sources and tools currently used by growers, results from the preliminary survey (Questions 1 & 4), all growers included.

Of all growers surveyed (apple, wild blueberry and vegetable), 34% currently use weather-based crop or pest management tools, while 66% do not (Figure 2). Within the same survey, 86% of growers indicated they would be interested in using such tools, while only 14% expressed otherwise. It is important to keep in mind, that many growers within the state of Maine live in remote areas without connectivity to web-based platforms. Overall, these results illustrate that a majority of growers are interested in using weather-based tools that they do not currently utilize or do not have access to.

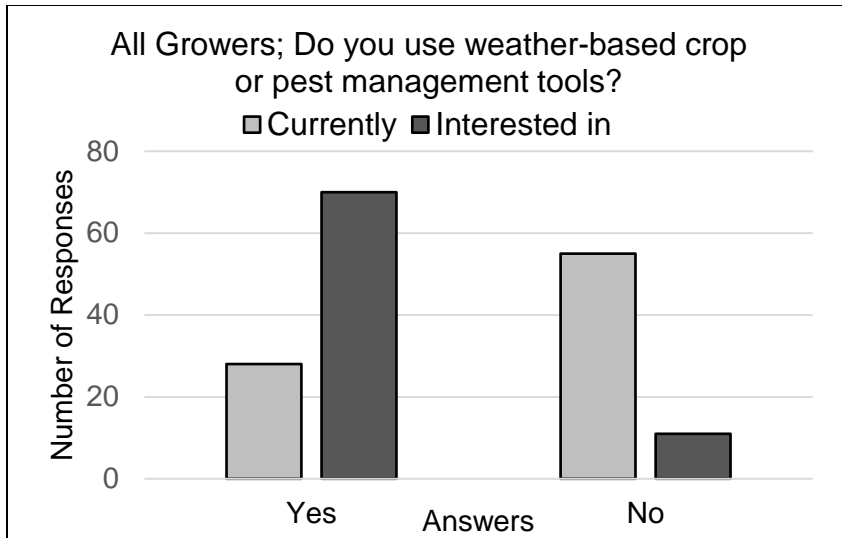


Figure 2. Total grower responses to the current use of a weather-based crop or pest management tool and those who are interested in using one (Questions 3 & 8).

Grower Specified Priorities & Needs

Survey results revealed large gaps in the capacity of current weather in availability, quality, and documentation to meet the needs of Maine growers (Figure 3). While over 5% of the respondents do not have access to the internet as mentioned above, many who do use web-based weather platforms desire greater accuracy (31%) and localization (19%). As localization is increased, local accuracy would also increase, thus, improvement of one may help solve the other. Other concerns were the need for a customizable Central Resource, where many commodities could go to retrieve reliable weather information in addition to pest/crop forecasting models. A GDD (Growing Degree Day) Source would aid growers in monitoring crop development and field-based decisions. Growers would also like to be able to access historical weather data and have improved frost prediction.

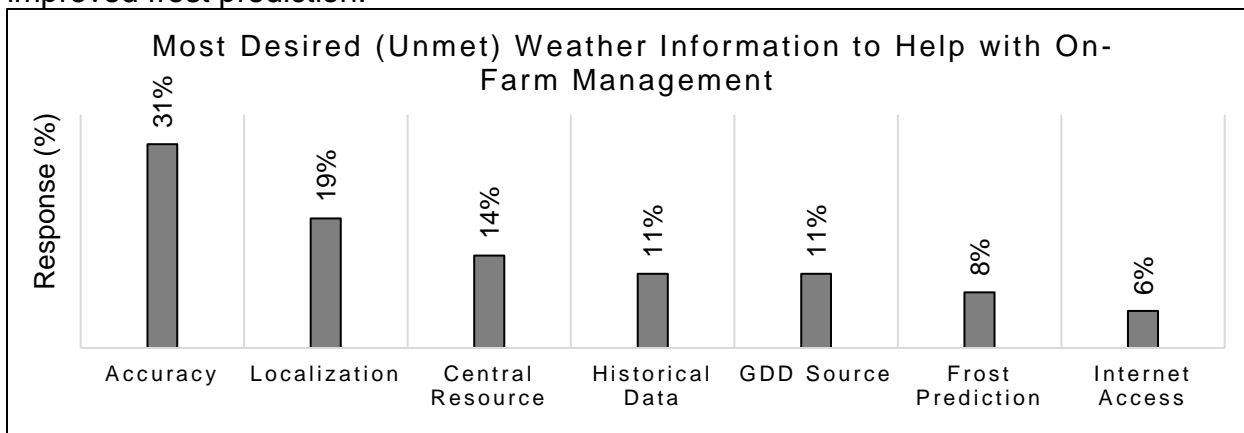


Figure 3. Survey responses showing the top unmet needs around weather information (Question 2). GDD = growing degree days.

The pests with the most economic impact (by crop group) were also documented to help discern the potential for weather based IPM (integrated pest management) tools (Figure

4). Here, the pests of greatest importance across crop groups were flea beetle and fruit fly species (spotted wing drosophila, blueberry maggot fly, and apple maggot).

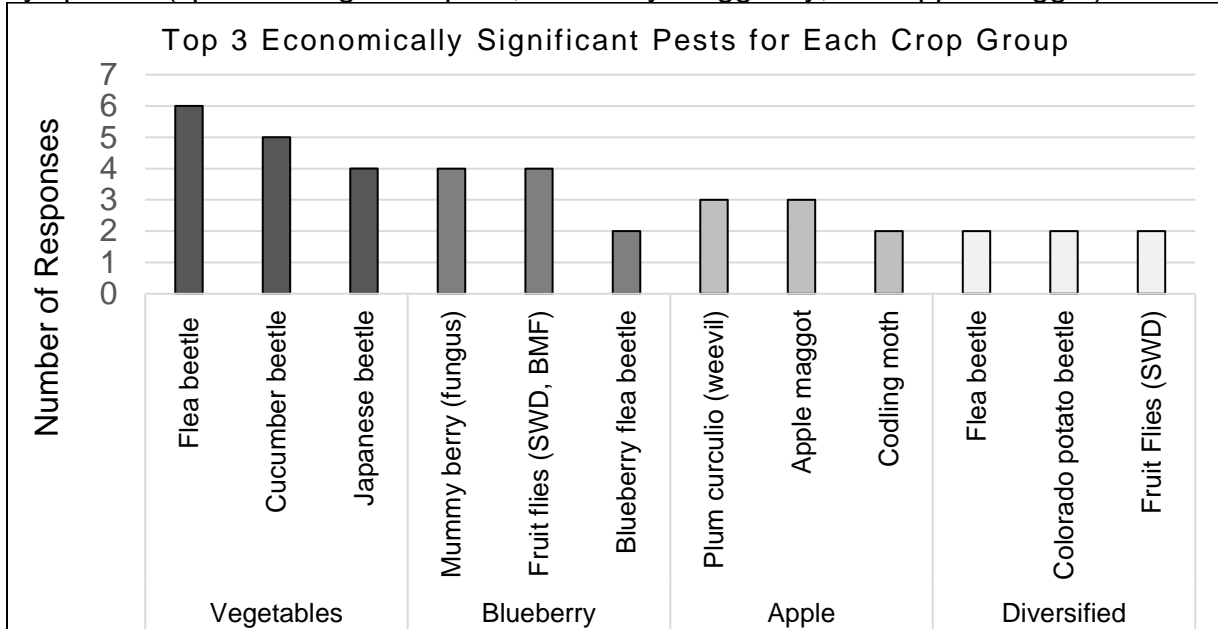


Figure 4. The top three most economically significant pests (Question 5) per crop. Here, ‘Diversified’ represents those who grow multiple crop groups.

Growers were also asked about difficult on farm decisions to help determine how the versatility of a weather-based tool could be expanded (Figure 5). Determining “when to spray” was identified as the most important/difficult decision by 47% of growers across all crops. This requires accuracy in the prediction of precipitation, dewpoint and wind (speed and direction) over multiple days. Other responses included the timing of weeding or irrigation to achieve the greatest efficacy, harvest conditions and field workability (also involving soil moisture).

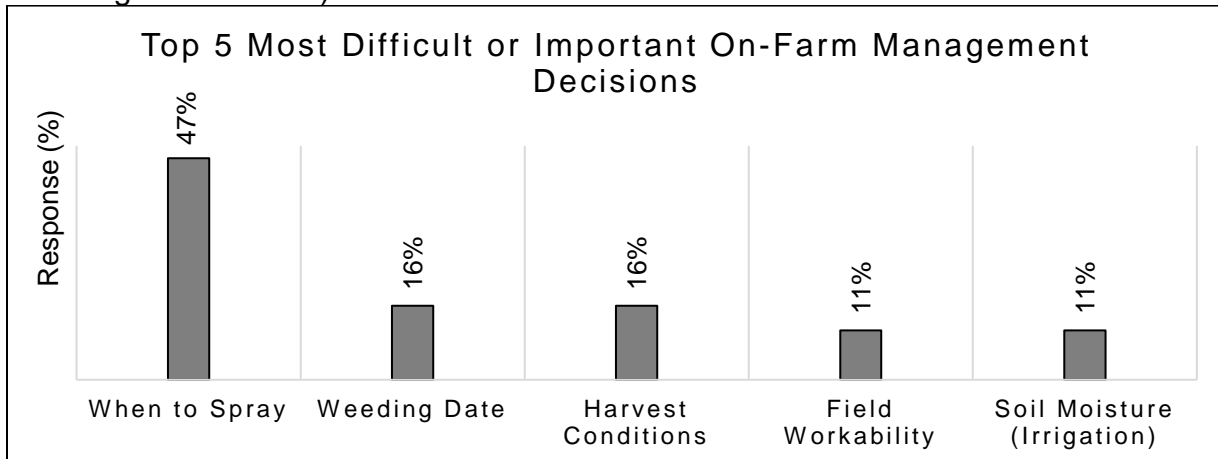


Figure 5. Survey results of the most important or difficult farm management decisions affected by short-term or long-range weather across all crop groups (Question 6).

In-Person Meetings

Focus group meetings with growers in person discussion further reinforced the preliminary survey results. Growers have emphasized a need for more accurate local weather with prediction (notification) capabilities, that is mobile friendly, customizable, easy to read, and shared across multiple crop commodities.

When asked what weather stations growers use, a majority of growers named at least two. A fruit and vegetable grower of Brunswick, Maine explained, “different stations are better for different parameters and others are confirmation sources.” Another grower stated that their decision to spray or not depends on “windows of weather”, “sometimes you are confined to that & forced to spray early & later, going from window to window.” Growers verbally indicated if a tool were developed to help with on-farm decision making, they’d like a customizable, accessible tool that “is here to stay”, with improved weather accuracy, various options for decision support tools (models) and the ability to receive alerts or notifications for extreme weather or pest events that could potentially lead to crop loss.

Established Grower Needs & Conclusions:

- Local station accuracy. This could be improved by increasing the number of local weather stations and pairing station data with NOAA gridded data.
- Local weather-based decision support tools. These include the timing of basic physiological events (budding, bloom, etc.) and pest development. Several pest and crop forecasting models exist in the literature but are not actively available to farmers to use. Additionally, some models need to be validated and possibly adjusted for use in Maine.
 - Tools should be sustainable (long-lasting), easy to use, accommodating and programable to various grower needs.
- Funding to build and maintain long-term tools for farmers may be more sustainable with member fees or monetary contributions from local commodity groups, rather than short-term grant funding.

When weather determines how these stakeholders start their day, it is clear that having accurate, local, to-the-minute weather is pertinent for these communities. Grower groups have indicated that improved weather in conjunction with decision support tools can help improve the timing and efficiency of on-farm management. With the increasing availability of advanced computer-based technology we now have the ability to combine these readily available and programable platforms with field-based science.

CURRENT RECOMMENDATIONS

CHECK OUT ALREADY AVAILABLE RESOURCES!

Past, Present & Future Weather:

Climate Re-Analyzer (<https://climatereanalyzer.org/>)

Maine Climate Office (<https://mco.umaine.edu/>)

Apple: AgRadar (<https://extension.umaine.edu/ipm/apple/ag-radar-apple-sites/>)

Wild Blueberry: AgriNet (<https://extension.umaine.edu/blueberries/forecast-blog/>)

Highbush Blueberry, Vegetable, Tree Fruit: NEWA (<http://newa.cornell.edu/>)

NEXT STEPS

- Host three more project focus group meetings.
- Continue to receive grower feedback.
- Design website and app concept.
- Search for agency funding to carry out and maintain weather-based tools.

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