The objectives of this study are: to develop GDD-based models to effectively predict growth of select leafy green and root vegetable crops, and to identify time periods of poor model fit where additional environmental factors may need to be considered.

**METHODS**

Three crops utilized in the UK Salad Bar Program, a local food procurement program by UK Dining, have been selected for the study: lettuce (‘Salanova Red Sweet Crisp,’ ‘Salanova Green Sweet Crisp,’ ‘Salanova Red Incised,’ and ‘Salanova Green Incised’), spinach (‘Corvair’) and carrot (‘Yaya’). Lettuce and spinach data were obtained from three planting successions at four sites: the University of Kentucky Horticulture Research Farm and three field sites (Fayette Co., Woodford Co., and Scott Co.) from Fall 2020-Spring 2021. Crops were planted in beds according to local farmer practice, with data collected from 11 marked plants located in the center rows of the bed. Planting date 1 (PD1) for spinach was placed in open field systems, while subsequent planting dates (PD2 and PD3) took place after the primary growing season (i.e., in high tunnels and/or under cover). Crop growth stage was collected via non-destructive sampling methods that document vegetative and root growth appropriate to the crop and market stage (e.g., leaf count and root diameter). Growth stage data were collected every 7-10 days at each site.

GDD were calculated using the simple average method with a horizontal cutoff, which is the average temperature minus the base growth temperature or above an upper threshold temperature. GDD are calculated using the simple average method with a horizontal cutoff, described by the conditional equation:

\[
\text{GDD} = \sum_{t} (T_{\text{avg}} - T_{\text{base}}) \cdot \text{duration} 
\]

where \(T_{\text{avg}}\) is the average temperature, \(T_{\text{base}}\) is the temperature threshold, and duration is the number of days with temperatures above \(T_{\text{base}}\). This methodology is similar to the work by Andrews & Noordijk (2016), but also includes cool season crops like spinach. A more detailed description of calculating GDD and exploring the relationship between temperature, DLI, and planting date can be found in their work.

**RESULTS**

Preliminary GDD model predictions of the first season of data were evaluated using a simple linear regression (Proc REG) in SAS (SAS Version 9.4; SAS Institute, Cary, NC). Lettuce yields from earlier planting dates were greater than subsequent plantings, with ‘Green Sweet Crisp’ from PD1 as the highest yielding, and ‘Red Sweet Crisp’ from PD3 as the lowest yielding (Table 4).

**DISCUSSION**

Additional analyses and discussion with participating farmers are needed to explore differences in \(R^2\) values between sites. For example, PD3 at the Scott County site demonstrates a lower \(R^2\) value compared to other sites at the same planting date (0.59-0.68). This may be due to light limitation caused by shading of the tunnel structure, and could be informed by additional light (PAR) readings at each site.

Yield data were collected primarily for participating producers to equate crop growth stage to harvest weight. Additional yield data collected at multiple crop growth stages may improve the utility of future decision tools developed from crop growth models, as producers may harvest crops early or at variable market stages, depending on market preference and demand.

Reference Table 4. Summary of selecting the R^2 value for all varieties and planting dates. This may be due to light limitation caused by shading of the tunnel structure, and could be informed by additional light (PAR) readings at each site.

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