Grower Summary

CP 121

Towards precision inputs through improved understanding of the underlying causes of in-field variation in Lettuce crop maturity and yield

Annual 2015

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Number:	CP 121
Project Title:	Towards precision inputs through improved understanding of the underlying causes of in-field variation in Lettuce crop maturity and yield
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Industry Representative:	Ed Moorhouse
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GROWER SUMMARY

Headline

Soil variability, which can be detected using soil electrical conductivity (EC) measurements, contributes significantly to the variability seen in whole-head lettuce growth and maturity at harvest. Preliminary studies suggest that zones with low EC readings result in low yields at harvest.

Background and expected deliverables

In-field variability in crop maturity and readiness for harvest is a significant issue in field-grown lettuce. The uniformity of whole head lettuce growth is very important for achieving an optimum marketable yield that is suitable for a single-pass harvest. Over-sized and underdeveloped heads result in crop wastage. When production is initiated by transplants, agricultural practices and growing conditions in the field play a key role in achieving lettuce uniformity, mainly because relative plant growth is largely determined by heterogeneity in soil properties.

Variability in growth and development might be explained by dissimilarity in soil properties such as pH, nutrients and water levels. Spatial soil variability can be mapped indirectly by scanning the field soil for electric conductivity (EC), a measure of a material's capacity to transmit electrical current; EC is reported in units of milli-Siemens or deci-Siemens per meter (mS/m or dS/m). This projects overall aim is to identify the key soil factors influencing lettuce crop growth and yield variability and define critical relative values for these factors which would help in demarcating distinctive management zones for growers to implement precision farming techniques.

The objectives are to (i) quantify how much variability in maturity, yield and postharvest quality are accounted for by soil physical and chemical properties (ii) identify the soil factors causing the greatest variability (ii) define the critical relative ranges for these factors that would define specific grower management/treatment zones and (iv) investigate whether variability can be reduced by precision application of inputs or adjusted management for specific zones.

In 2014/2015 work was done to:

1. Test whether field zones identified using EC scans correlated with the variability in lettuce growth and yield.

2. Test whether the zones had underlying differences in soil physical and chemical properties.

3. Test if *smaller scale EC zones* would account for variability in lettuce growth and yields.

Summary

Two experiments were conducted to map the different soil zones within a field in Ely, Cambridgeshire. The field was scanned for soil EC using a Veris E3100 scanner; the scanner was running DGPS (Differential Global Positioning System) so accuracy of locations was within 30cm. Maps were created from the raw data using Gatekeeper software. Multiple soil and plant samples were taken from two successive crops over the summer (June-October 2014) and transferred to HAU for further soils physical and chemical properties analysis and yield assessments.

Objective 1

The first field experiment identified three EC zones within the field using the EC scans, which measured bulk soil conductivity. The zones were demarcated by dividing the raw scanning data into three ranges: low, medium and high:

- Band 1 / Zone A had a '*Low'* EC range of 14.62 - 40 mS;
- Band 2 / Zone B, with a '*Medium'* EC range 40 - 50 mS and;
- Band 3 / Zone C having a '*High'* EC range of between 50 - 68 mS.

The zones that varied in EC varied with up to a 20% difference in total fresh weight at mid growth. Zone A, the lowest EC band had the least total fresh weight. At harvest Zone A continued to be the least with ~50% less fresh weight than Zone B and Zone C (medium and high EC), whereas the difference in yield between the medium and the high EC-Zones was not significant.

Objective 2

In the first experiment, soil zones identified using EC scans varied significantly in clay, sand magnesium (Mg), potassium (K), phosphorus (P) and organic matter (OM). There was no significant difference in acidity level (pH). Zone A had the least levels/concentrations of all the above mentioned parameters except (K) and there was no significant differences in clay percentage between zones A and B.

Simple Linear Regression between the studied soil factors and plants parameters showed correlation between total fresh weight (FW) and levels of OM, K and Mg. Whereas, trimmed-head weight (TW) correlated mainly with magnesium and strongly with fresh weight.

Objective 3

Although objective 3 studies were conducted on a different field with different defined EC zones the experiment showed that there were no significant differences in soil or crop performance when EC ranges were examined on smaller-scale zones, except for the early stage of lettuce growth (the difference disappeared at advanced stages of growth and development).

Financial Benefits

Direct financial benefits cannot be quantified at present. It will be easier to suggest or quantify these after completion of the work planned for years 2 and 3.

Action Points

- Soil EC scans can be used for targeted sampling instead of intensive sampling, this allows a relatively higher density of observations in targeted zones and saves money and time in comparison to conventional and destructive soil sampling.
- Differences in soil EC are associated with differences in soil properties and they may have an impact on lettuce growth and development.