

## Multinutrient management for increased yield and quality on barley in South of England

Griffin, E. <sup>1</sup>, Stilwell, A. <sup>1</sup>, Garnett, S. <sup>2,3</sup>, Morell, F.J. <sup>3</sup>

<sup>1</sup>Bartholomews, <sup>2</sup>International Potash Institute, <sup>3</sup>ICL Fertilizers Europe

### INTRODUCTION AND OBJECTIVE

Crop management strategies interact among them. Balanced multi-nutrient crop nutrition together with split application of nitrogen (N), can led to improved grain quality and yield. A multi-factorial field trial on barley (*Hordeum vulgare L.*) examining response of different varieties, and nutrient management was set in South England to analyze interactions among different management strategies. ICL PotashpluS<sup>®</sup> was evaluated as a source of additional nutrients like potassium, sulphur, magnesium and calcium. It is a new granular fertilizer formulated with potash and Polysulphate<sup>®</sup>, and contains 37% K<sub>2</sub>O, 23% SO<sub>3</sub>, 2.8% MgO and 8% CaO.

### MATERIALS AND METHODS

In 2019 cropping season, a 4 replicated field experiment was established on a calcareous soil in Wiltshire. The treatments were tested across 3 barley varieties (Laureate, Propino and Planet). This is three-year trial, the experiment will be repeated for 2 more seasons.

#### N management treatments:

- **2 levels of N:** 150 kg N ha<sup>-1</sup> and 175 kg N ha<sup>-1</sup>.
- **3 different splitting:** 2 split applications (50-50% proportion), 3 split applications (33-33-33% proportion) and 3 split applications (20-50-20% proportion).
- Nitrogen was supplied as a solid ammonium nitrate sulphate fertilizer (27% N, 9% SO<sub>3</sub>).

#### Additional fertilization treatments:

- **Control:** No K, S, Mg and Ca addition
- **Muriate of potash (MOP) and kieserite (magnesium sulphate):** 75 kg K<sub>2</sub>O ha<sup>-1</sup>, 48 kg SO<sub>3</sub> ha<sup>-1</sup> and 23 kg MgO ha<sup>-1</sup>
- **ICL PotashpluS<sup>®</sup> (MOP+polyhalite):** 75 kg K<sub>2</sub>O ha<sup>-1</sup>, 48 kg SO<sub>3</sub> ha<sup>-1</sup>, 6 kg MgO ha<sup>-1</sup> and 16 kg CaO ha<sup>-1</sup>

Yield and grain weight density were determined at harvest. The analyses of variance (ANOVA) of both variables allowed the identification of significant factors. The mean comparison (Tukey pairwise comparisons) was done among the levels of those factors (or their interaction) that showed significant (P<0.05) in the ANOVA.

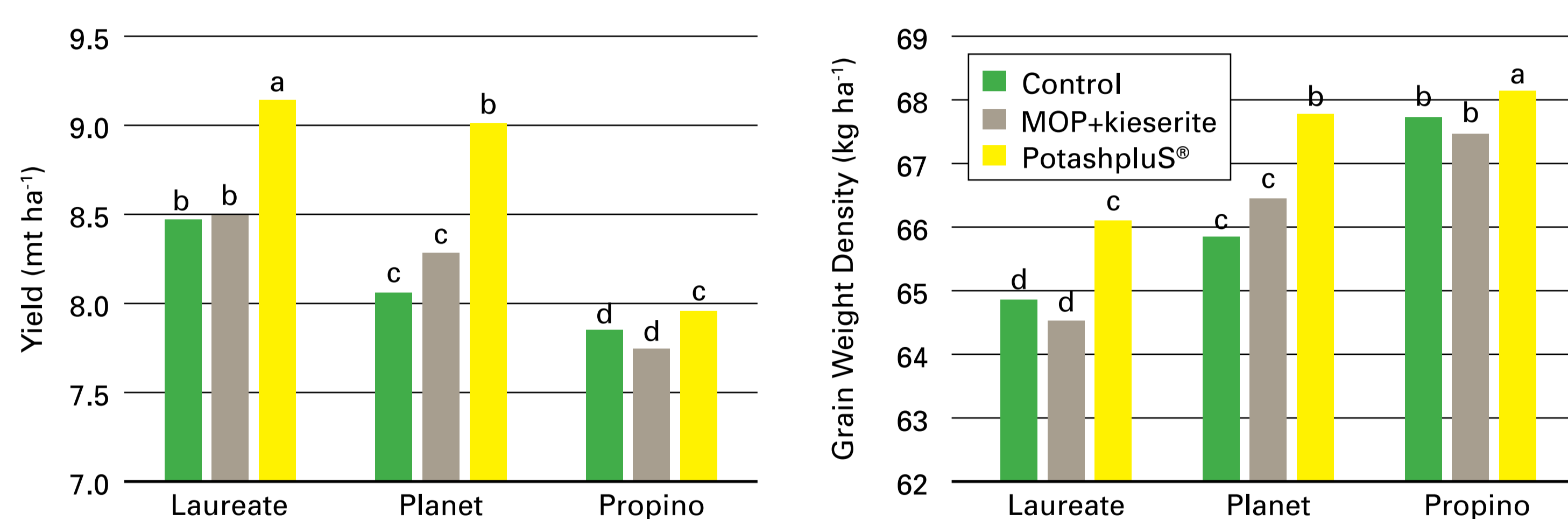
### RESULTS

**Table 1.** ANOVA of yield and GWD. Factors: nitrogen (N) level and splitting (N Level, N Splitting), additional fertilizer (Additional Fertilization, AF).

	YIELD		GRAIN WEIGHT DENSITY	
	F	p-value	F	p-value
<b>N Level</b>	<b>7.928</b>	<b>0.00051 ***</b>	<b>2.510</b>	<b>0.08428</b>
N Splitting	0.198	0.82080	0.720	0.48815
<b>Additional Fertilization (AF)</b>	<b>38.259</b>	<b>1.85e-14 ***</b>	<b>32.435</b>	<b>1.14e-12 ***</b>
<b>Variety</b>	<b>182.519</b>	<b>2.00E-16 ***</b>	<b>125.291</b>	<b>2.00E-16 ***</b>
N Level x N Splitting	0.866	0.42262	0.151	0.85960
N Level x AF	0.106	0.89947	0.468	0.62687
N Splitting x AF	0.320	0.86399	0.035	0.99761
<b>N Level x Variety</b>	<b>2.450</b>	<b>0.04807 *</b>	<b>0.624</b>	<b>0.64572</b>
N Splitting x Variety	0.705	0.58965	0.515	0.72494
<b>AF x Variety</b>	<b>7.629</b>	<b>1.11e-05 ***</b>	<b>4.034</b>	<b>0.00376 **</b>
N Level x N Splitting x AF	0.378	0.82390	0.249	0.91007
N Level:N Splitting:Variety	0.326	0.86053	1.483	0.20951
N Level:AF:Variety	0.399	0.80938	0.582	0.67582
N Splitting:AF:Variety	0.578	0.79532	0.757	0.64142
N Level:N Splitting:AF:Variety	0.774	0.62586	0.195	0.99128

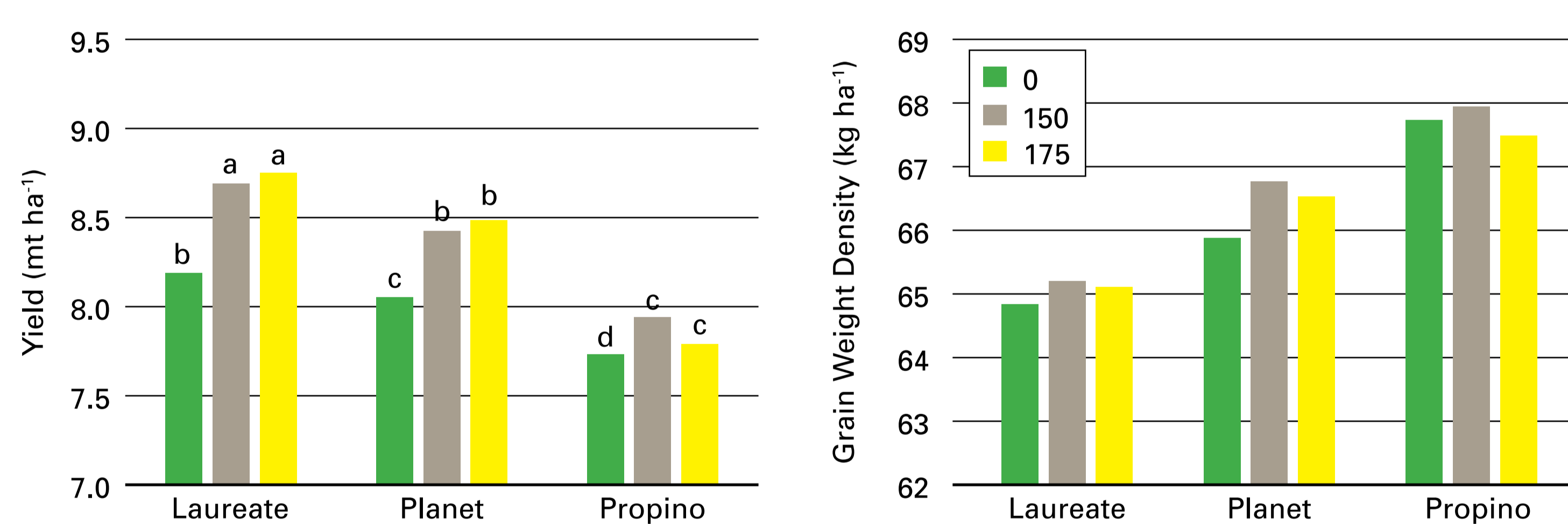
Signification codes: '\*\*\*\*', 0.001; '\*\*\*', 0.01; '\*\*', 0.05; '\*', 0.1.

Yield was significantly affected by variety, total amount of N, and additional fertilizer inputs. However, the splitting pattern of N application did not show a significant effect in neither yield nor in grain weight density.



**Figure 1.** Effect of different strategies of additional fertilizer input in 3 varieties of barley. Left graph, yield response, and right graph, grain weight density. Different letters indicate significant differences (Tukey pairwise comparisons).

The application of supplementary crop nutrients (potassium, sulphur, magnesium, and calcium) with PotashpluS<sup>®</sup> consistently increased yield and grain weight density across all 3 varieties.



**Figure 2.** Effect of different N levels (0, 150 and 175 kg N ha<sup>-1</sup>) in 3 varieties of barley. Left graph, yield response, and right graph, grain weight density. Different letters indicate significant differences (Tukey pairwise comparisons).

N level led to significant differences between the control and either 150 or 175 kg N ha<sup>-1</sup>, but no significant differences among these two levels of application.

### CONCLUSIONS

PotashpluS<sup>®</sup> fertilizer significantly increased yields and quality of barley. The results of the first year showed that with equal amounts of K and S, there is a benefit from PotashpluS<sup>®</sup> due to additional calcium input. Also, the prolonged availability of the S in PotashpluS<sup>®</sup> may have contributed to the enhanced yields and quality.

### ACKNOWLEDGMENT

