Title: Source-sink balance determining the interrelationship between average grain weight and grain number in elite wheats

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1. Hypothesis

Commonly, wheat yield is strongly associated with grain number (GN), but there is also a common negative relationship between grain weight (GW) and GN. The interpretation is not straightforward as alternative (competitive and non-competitive) hypotheses may explain this negative relationship.

Hypothesis I. Strong competition among grains for assimilates

Hypothesis II. Increased proportion of 'small grains' when grain number increases

2. Objective

In case that the cause of the reduction in average grain weight is due to an increase in the proportion of “small grains” contributing to the average grain weight (Acreche & Slafer, 2006),

1. To elucidate whether the reduction in GW of particular grain position in response to increases in GN represents a case of source-limitation.

2. Particularly, to recognize whether GW in elite wheat cultivars is limited by resource availability to fill the grains (to select appropriate parents in prospective crosses to rise yield).

To answer these questions, source-sink manipulation is necessary to be applied and/or a very detail analysis of grain size distributions within a particular plot must be carried out.
Key results

1. Proportion (%) of proximal and distal grains by grain number

\[
y = -1.05x + 0.9952 \\
R^2 = 0.8734 \text{ (p=0.0063)}
\]

Illustration of proximal and distal grain positions

Adapted from Miralles & Slafer (1995)
Field Crops Research 43:55-66

Image source: https://www.eeob.iastate.edu/

2. Change of grain weight per position by grain number

\[
y = -0.0009x + 63.555 \\
R^2 = 0.7372 \text{ (p=0.0286)}
\]

\[
y = -0.0111x + 70.089 \\
R^2 = 0.9048 \text{ (p=0.0035)}
\]

\[
y = -0.0009x + 55.422 \\
R^2 = 0.7318 \text{ (p=0.0032)}
\]

\[
y = -0.0007x + 46.017 \\
R^2 = 0.4018 \text{ (N.S.)}
\]

3. Responsiveness (%) of GW on source-sink manipulation at 10 days after anthesis

Sink manipulation (de-graining)

Source manipulation (defoliation)

For more discussion

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