Starch pasting properties by MixoLab of wheat trials differing in Falling Numbers

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1. INTRODUCTION

The falling number (FNo) determination is commonly used to **estimate** the degree of field sprouting and enzyme activity (namely a-amylases and proteases) in wheat meal and flour. The economic consequences of high a-amylase activities can be very significant. Both bread and noodle making quality can be adversely impacted by high levels of a-amylase as a result of field sprouting. Sprout damage occurs when the wheat is quite mature and cannot be harvested because of a long periods of rain. The presence of a-amylase and protease enzymes are an indicator of changes in the grain. a-Amylase breaks down starch molecules into smaller sugar molecules, while the protease breaks down protein in the grain. Therefore, grain with high levels of these two enzymes contain starch and proteins that are damaged, making them unsuitable for bread, noodle or pasta products.

Noodle appearance is the first critical judgment made by the consumer when evaluating noodle quality. Noodle appearance evaluation is based on noodle colour, brightness, appearance of specks and colour stability (discolouration). Another important aspect of noodle quality is eating quality of noodles or noodle texture. Both starch and proteins play an important role in defining eating quality of noodles.

The **objective** of this study was to investigate starch and gluten properties of wheat varieties differing in Fno.

2. MATERIALS AND METHODS

Wheat trials

Ten (10) Australian wheat varieties were grown at three locations in southern Western Australia (Salmon Gums, Cascades and Neridup) in 2015–16 growing season. Two of the three sites produced sound grain (high Fno) while the third site received significant amount of rain prior to harvest resulting in significantly lower Fno.

Noodle preparation

White salted noodles (WSN) were prepared using flour, water (34%) and salt (4%) only. A mixer model (N50, Hobart) incorporated the ingredients for 5 min before the crumbs were sheeted on a laboratory scale noodle machine (Ohtake, Tokyo, Japan) with an initial gap setting of 3.00mm. Two passes were made at this setting with the noodle sheet being folded between passes to ensure homogeneity. Before two step reduction process noodle sheet was rested for 60 min at 25°C and 85% RH. Final noodle thickness was 2.50mm ± 0.02mm. A noodle sheet piece was cut off for Minolta measurements and the reminder of the sheet was cut into noodle strands using cutter #12. Noodles were cut into 10cm strands for texture measurements.

Noodle colour and texture measurement

Noodle sheet colour was measured with a Minolta Chroma Meter (CR-310) and L* (brightness), b* (yellowness) and a* (redness) value were recorded at time zero and time 24 hr after noodle making.
Noodles were simmered for 20 min, immersed into cold and ice water to stop cooking process, rested for 15 min, before TA-XT2iPlus was used to measure noodle firmness.

MixoLab

The MixoLab is a device developed for the quality control of cereals. It measures dough and flour quality by exposing a sample to predetermined heating and cooling cycles while placing the sample under a strain field. The flour samples were run on the MixoLab (Chopin Technologies, France) according to the standard Chopin heating profile. The initial block temperature was 30°C. Water absorption was determined as the percentage of water required for the dough to produce a torque of 1.1 Nm, and the appropriate amount of water was applied to each of the flours.

Automated Solvent Retention Capacity Test (SRC)

Chopin SRC automated test (based on AACC I Approved Method 56-11) was used to measure four key quality parameters in one single test:

- Water absorption with the water solvent SRC
- Glutenin functionality with the lactic acid SRC
- Pentosan functionality with the sucrose SRC
- Damaged starch functionality with the sodium carbonate SRC.

3. RESULTS AND DISCUSSION

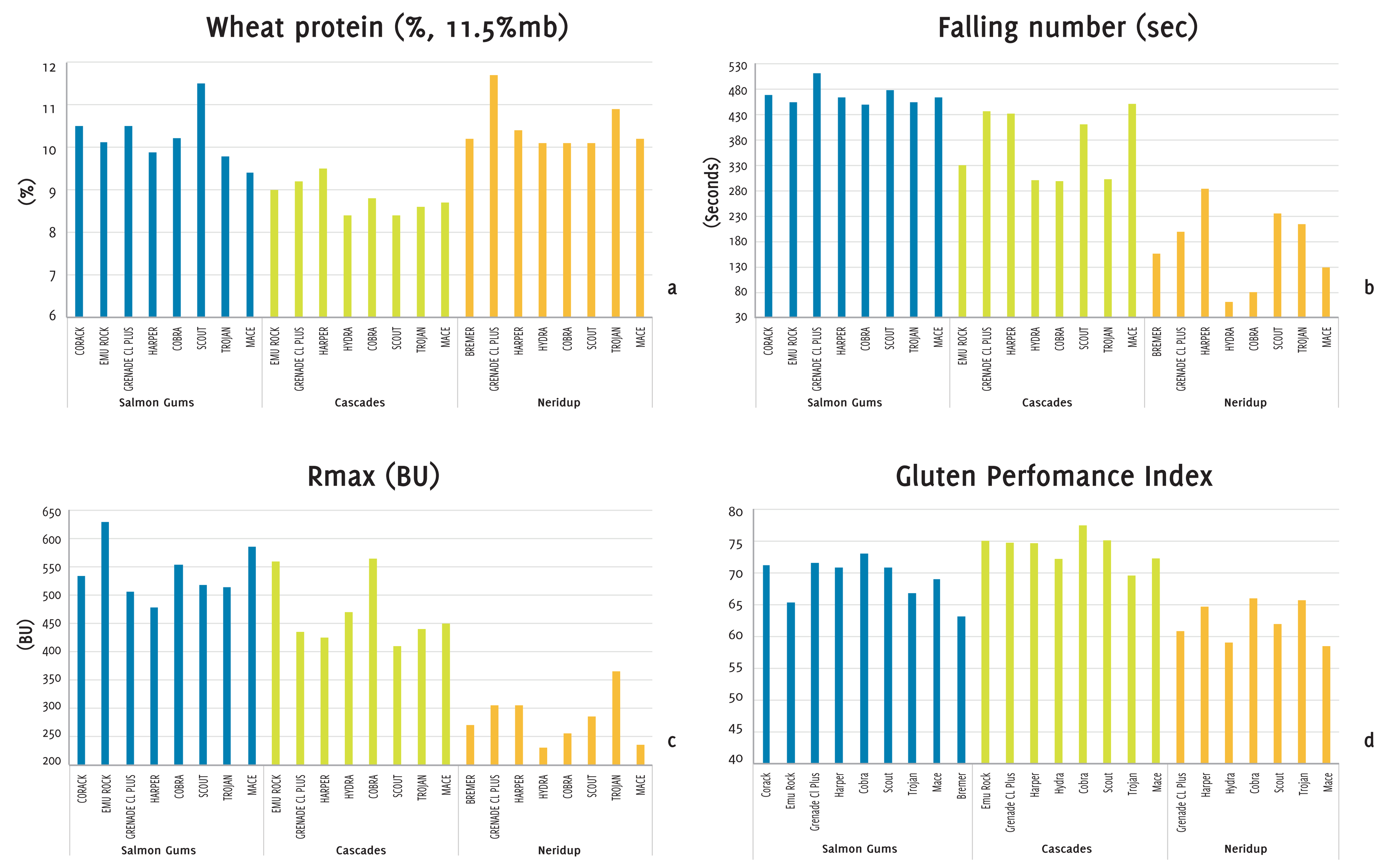

Fig 1. Wheat protein content (a), Fno (b), Rmax (c) and SRC gluten performance index (d) of three trials studied

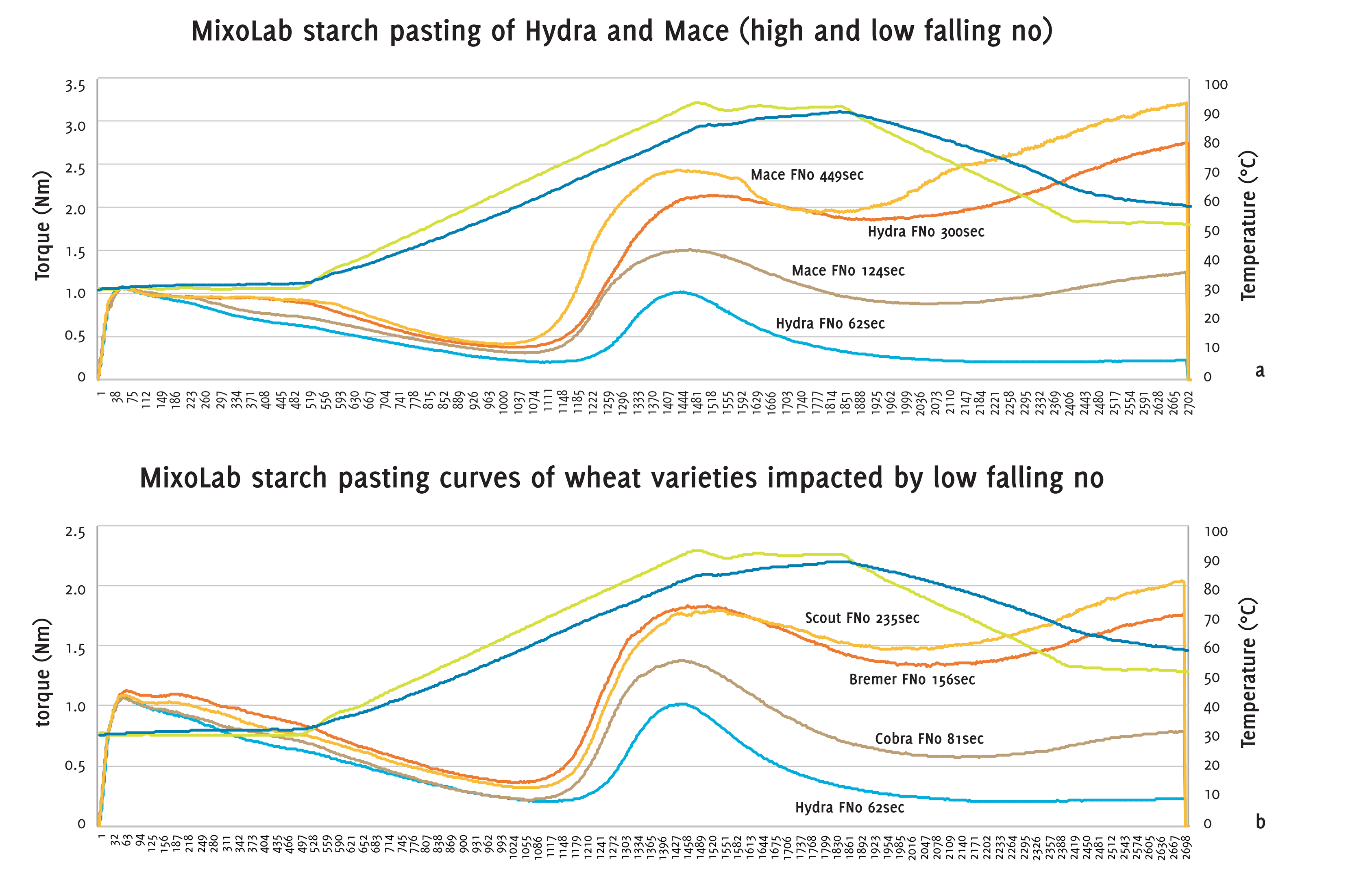

Fig 2. The MixoLab starch pasting properties of selected Australian varieties at different Fno

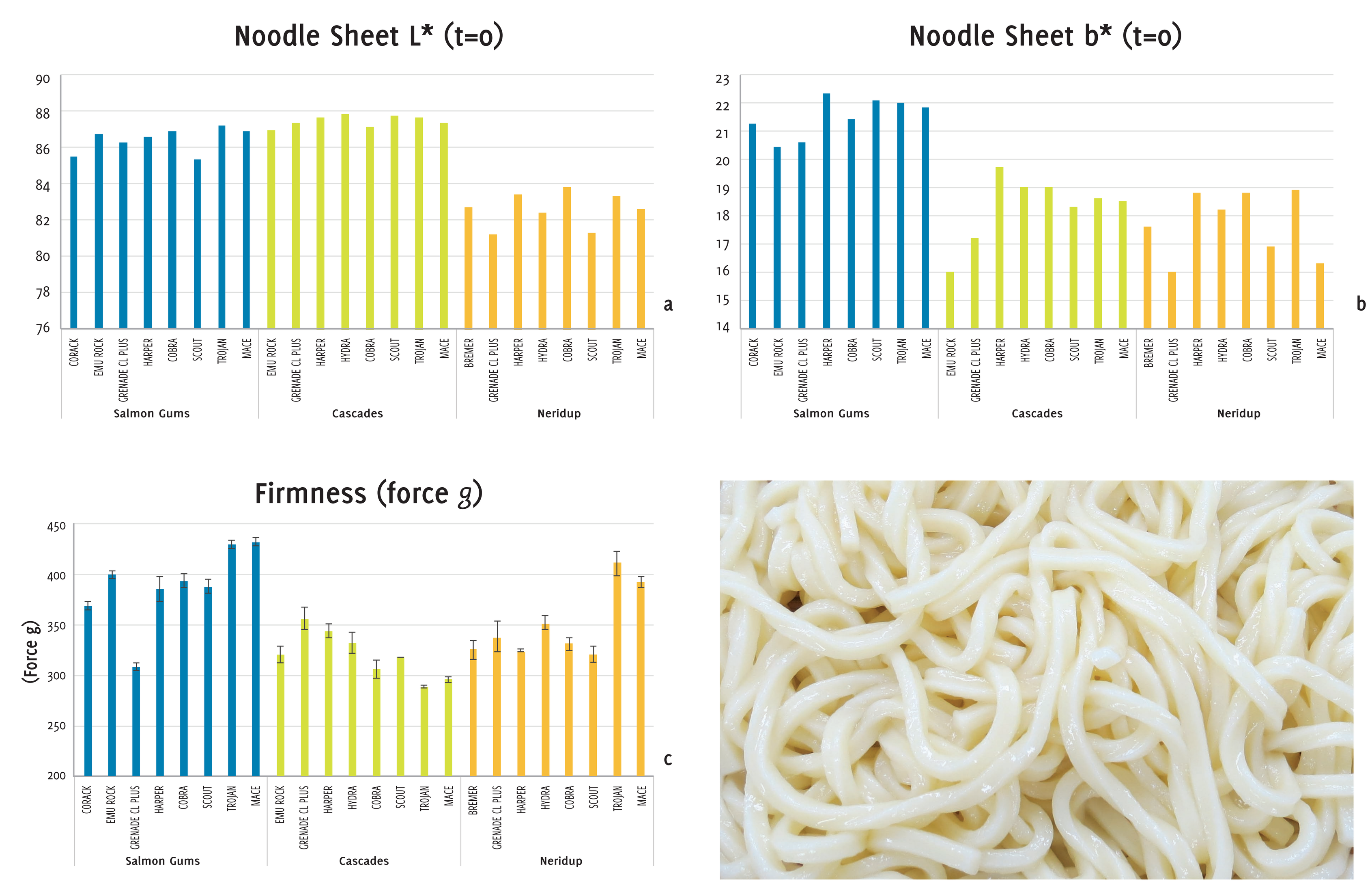

Fig 3. Noodle quality: Texture (TA-XT2) (c) and colour (Minolta L* and b*) (a and b)

4. CONCLUSIONS

Trails grown in Salmon Gums, Cascades and Neridup ranged in grain protein content from 8.4 to 11.7 (11%mb) and Fno ranged from 62 to 507 seconds (Fig. 1 a and b). Greatest impact of low Fno was seen on pasting properties of starch and weakening of proteins (gluten) (Fig. 1 c, d and Fig. 2 a and b). Trial grown in Neridup had on average higher grain protein content but lowest dough strength (Rmax) (Fig. 1c) and lowest gluten functionality, as indicated by lower Gluten Performance Index (Solvent Retention Capacity) values (Fig. 1d). Changed starch and gluten properties adversely impacted the textural properties of noodles, resulting in softer noodles (Fig. 3c). Low Fno also had adverse impact on noodle brightness (Minolta L*) (Fig. 3a), while noodle yellowness (Minolta b*) was largely impacted by location grown (Fig. 3b).

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