

New method to quantify the degree of hydration of barley grains using a grain scanner

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Introduction

- Steeping process consist in submerging grain in water until the moisture content reached the required level.
- The water absorption depends on barley variety, year or harvesting conditions, the grain size and steeping regime during malting process.
- The degree of hydration of barley during malting process is an important factor to understand and determine.
- The aim of this study was to develop a new and reliable method to quantify the degree of hydration using a grain scanner.

Results & Discussion

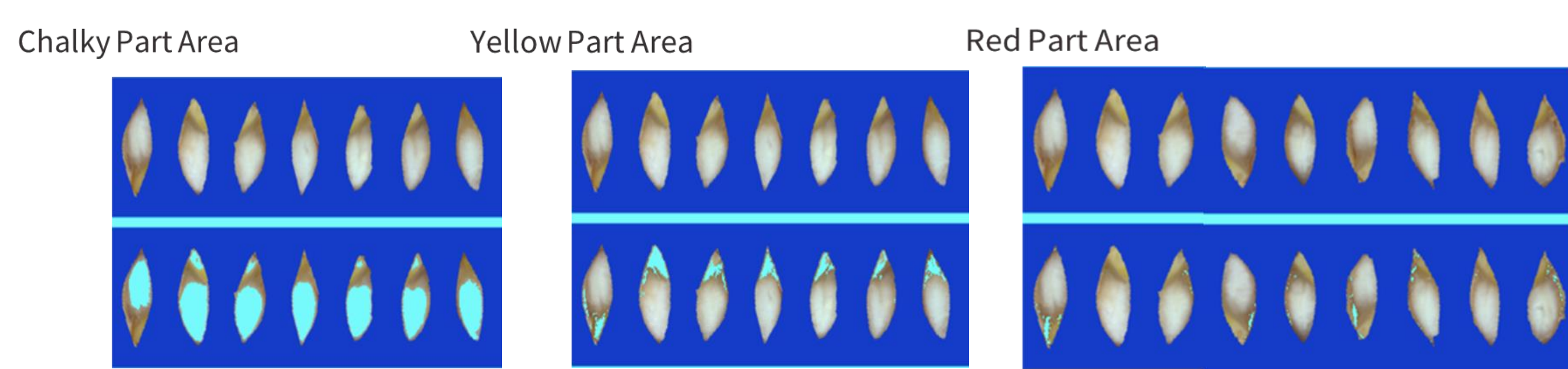


Figure 3 - Photos of Chalky, Yellow and Red part area of the grains

- Chalky Area parameter was adjusted to determine the bright white area that corresponds to the non-hydrated part. The Yellow and Red parameter was adjusted to quantify the husk area (Figure 3).
- The classification was based on the Chalky Area Ratio (bright white area/total area of the grain). For non-hydrated barley grains, the data need to be extracted to an excel file, in order to obtain a Chalky Area Ratio according to the classification.
- As 25 grains were used for the analysis, the Steeping Index takes values from 0 (non hydrated, white) to 100 (fully hydrated, translucent).
- Steeping index results, of each malting step, from different malting schedules, without considering variety as variable, are shown in Figure 4. Significant differences were found in 72h Germ program at 44h and 72h, and this was explained by the lack of moisture correction during the germination process. On the other hand, both program (One Steep and MNECC) that had the moisture correction presented significant differences at 24h and 48h, having lower steeping index One Steep than MNECC. After 72h and 96h germination, did not present significant differences.
- Including variety as a variable is shown in Figure 5. Statistical analysis demonstrate that both variables: malting schedule and variety were significant. Furthermore, the variability of the index was explained by 91,4% from each step of malting schedules, and 3,5% more by the variety. Arcadia variety reached the lowest steeping index value in three malting program analyzed.

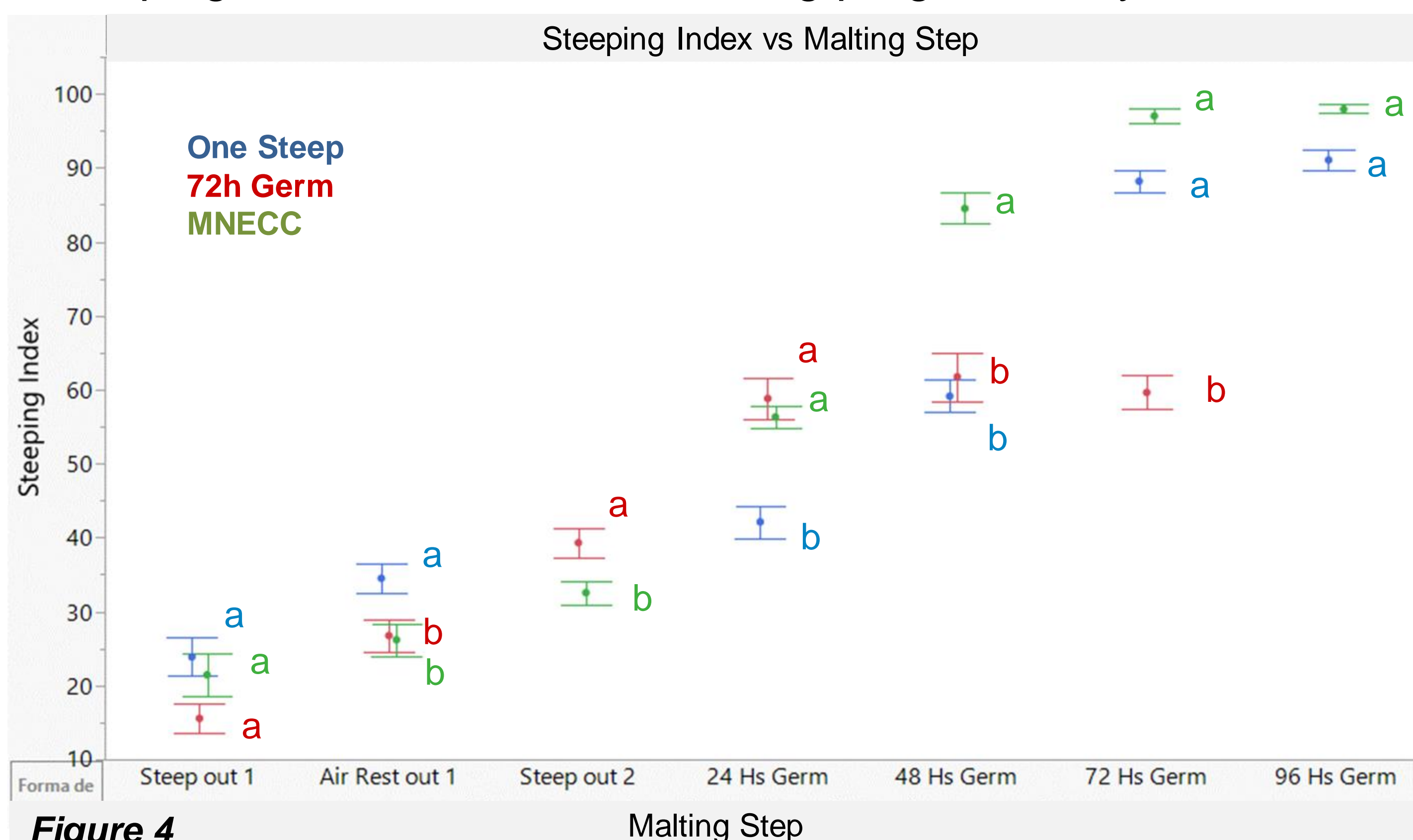


Figure 4

Methodology

- Four barley varieties from Uruguay were used; Arcadia, Arrayán, Cle 304 and Cle 307.
- Samples were micromalted using CustomLab equipment, under three different malting schedules (Table 1)
- The Chapon method was applied and then grains were scanned and evaluated using a Satake scanner grain analyzer color and shape software (Figure 1). Steeping Index was calculated as = $A*4 + B*3 + C*2 + D*1$ (Figure 2)

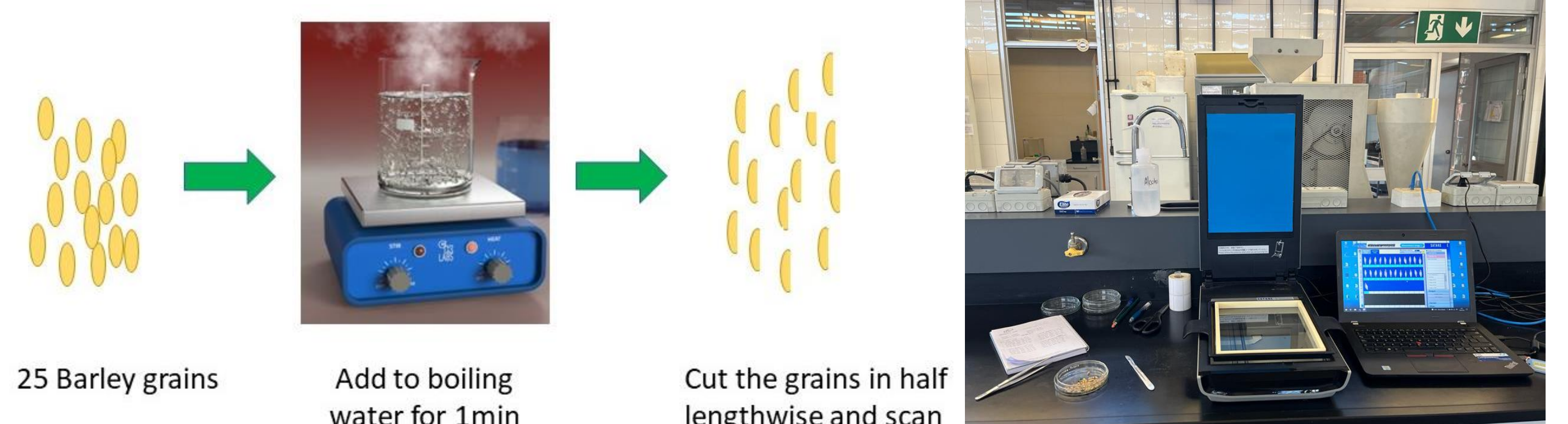


Figure 1 - Scheme of Chapon method and Satake grain scanner

Malting Schedule	Steeping	Germination	Kilning
MNECC	Steep 1 - 4h	43h - 18°C	10h - 60°C
	AirRest 1 - 8h	10h - 14°C	1h - 70°C
One Steep	Steep 1 - 10h	43h - 15°C	8h - 80°C
	AirRest 1 - 10h	10h - 14°C	1h - 70°C
72h Germ*	Steep 1 - 4h	43h - 18°C	10h - 60°C
	AirRest 1 - 8h	10h - 14°C	1h - 70°C
	Steep 2 - 4h	19h - 15°C	8h - 80°C

Table 1 - Malting Schedules. *without moisture correction at 24h and 44h of germination

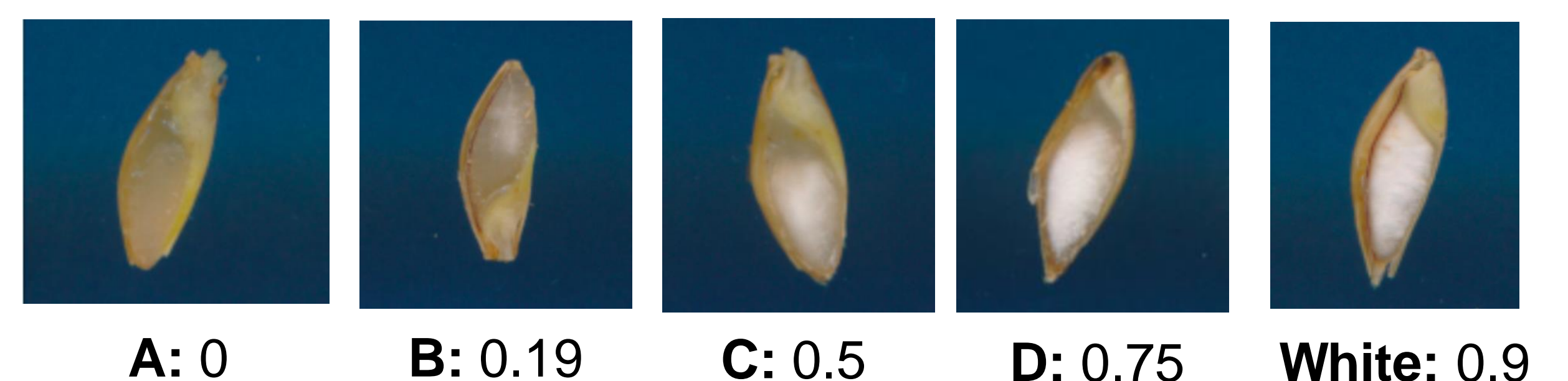


Figure 2 – Chapon Scale and values of Chalky Area Ratio

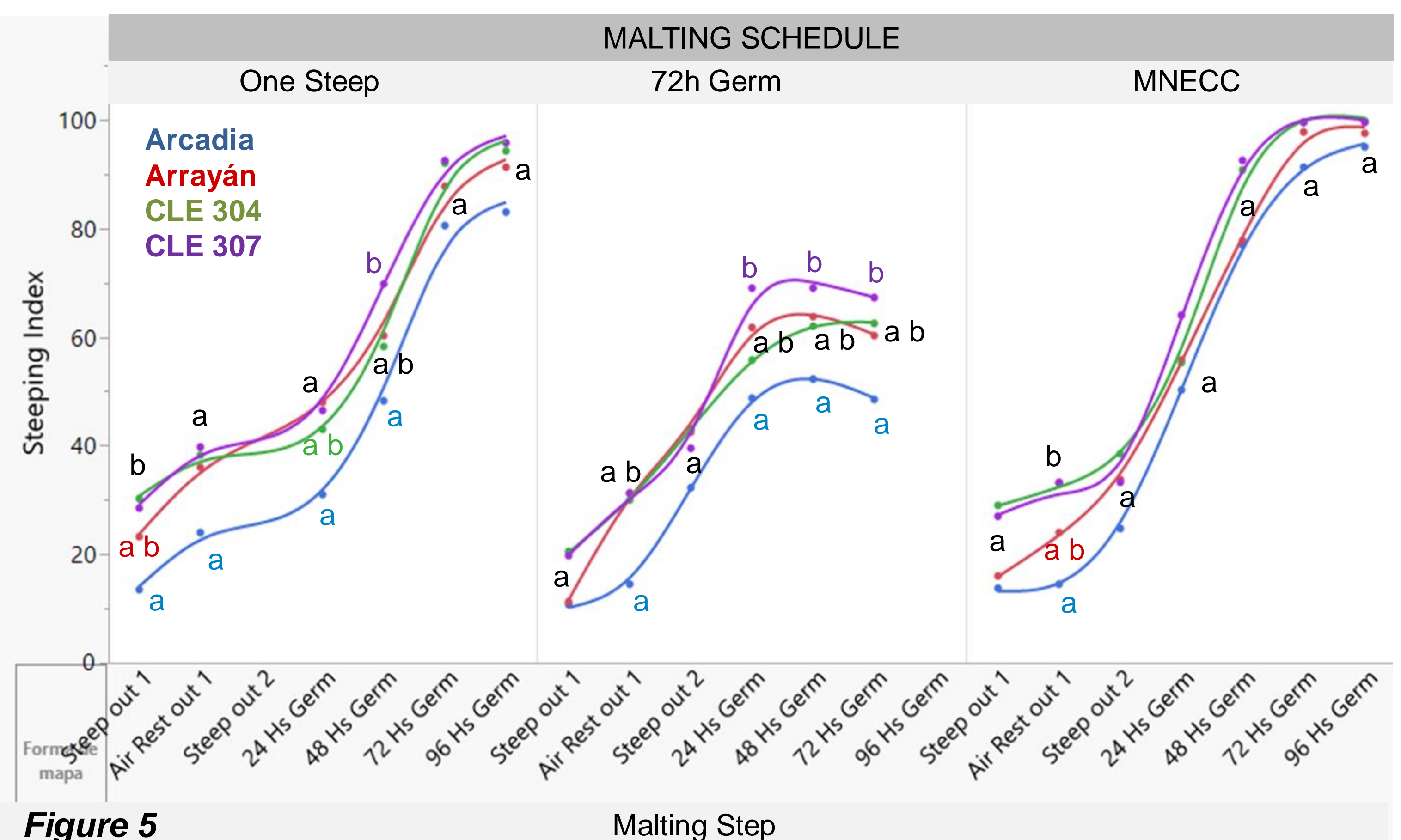


Figure 5

Conclusions

- An equivalent range of Chapon scale was established and samples were quantified and could be differentiated as was expected.
- Malting schedule and barley varieties had a significant effect on steeping index, being malting schedule the most important.
- A reliable and permanent method to determine the degree of hydration of barley grains was achieved.