Evaluation Method for Panicle Threshability of Rice

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Introduction

Panicle threshability of rice is of great economic importance. Too loose spikelet attachment to its pedicel leads to grain shattering which can cause serious yield loss. Too tight attachment reduces effectiveness of machine harvesting due to the hard threshability (Jennings et al., 1979; Okubo et al., 1995). Breeders are usually selecting for threshability trait but it is hard to standardize. Our aim was to test an improved threshing meter (ITM) during the ripening phase of four Hungarian rice varieties.

Materials and methods

To evaluate the threshability, four Hungarian rice varieties, 'Janka', 'M 488', 'M 225' and 'Ábel' were used. Panicles (10 reps.) were collected five times during the ripening period (21.08-26.09.2018) directly from the paddy field (Szarvas, Hungary). Due to the very early duration of 'Ábel', the last sampling was done on three varieties. A custom-built ITM improved by the Metrisystem Ltd. (Hódmezővásárhely, Hungary) was used to the tests (with EMX-100/111). The panicles were attached to a 200 N load cell (Tenzi TCS-03) with a holder that was moved straight-line by a pneumatic engine (v=0.5cm s^{-1}). Data were collected and analyzed as threshing force (N).

Results and discussion

It is well known that the threshing force value (TF) is not steady along the panicles due to the non-uniform grain maturity (Szot *et al.*, 1995). We found high differences in the TF depending on the grain position along a single panicle, similarly to Alizadeh and Allameh (2011). In our experiment, the highest difference between the maximum and the minimum values of the panicles was 4.59 N in case of 'M 488' (Figure 1.). The highest average TFs were also needed for 'M 488' during the ripening (Table 1.).

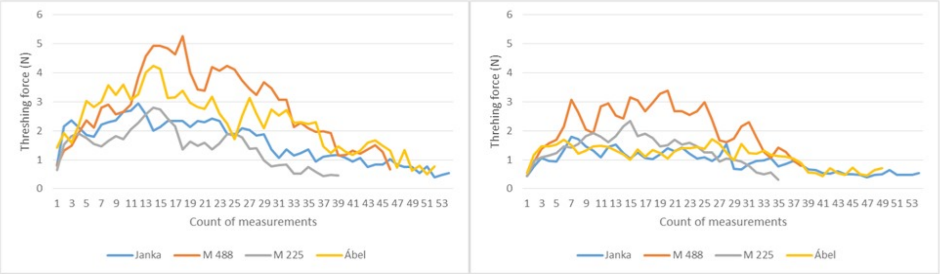

Figure 1: Average threshing force values along the panicles of four Hungarian rice varieties on the 21st of August (left) and 12th of September 2018 (right) (n=10)

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Table 1: Mean threshing force (N) value changes during the ripening of four Hungarian rice varieties (Szarvas, Hungary, 2018)

	Mean threshing force (N)			
Date	Janka	M 488	M 225	Ábel
2018.08.21	$1.58^{a} \pm 0.37$	$2.95^{b} \pm 0.45$	$1.49^{a} \pm 0.23$	$2.29^{c} \pm 0.23$
2018.08.28	$1.14^{a} \pm 0.27$	$2.40^{b} \pm 0.30$	$1.15^{a} \pm 0.33$	$1.50^{a} \pm 0.21$
2018.09.12	$0.93^{a} \pm 0.18$	$2.02^{b} \pm 0.48$	$1.35^{c} \pm 0.20$	$1.07^{a} \pm 0.13$
2018.09.19	$0.87^{a} \pm 0.21$	$2.43^{b} \pm 0.29$	$0.99^{a} \pm 0.27$	$2.05^{b} \pm 0.25$
2018.09.26	$1.15^{a} \pm 0.18$	$1.58^{b} \pm 0.43$	$1.23^{a} \pm 0.22$	

The different letters mean significant differences between the varieties at level 0.05

'Janka' and 'M 225' were characterized easy threshability, while Ábel's values showed harder threshability. During the ripening phase, the TF need was generally reducing. For example, detaching the grains from the panicles required 2.95±0.45 N for 'M 488' and 1.58±0.37 N for 'Janka' at the beginning of the harvesting period, while it was decreased to 1.58±0.43 N and 1.15±0.18 N for the last sampling date, respectively. Fangping and co-workers (2004) also said that the detaching force related to maturity.

Conclusions

According to our experiment, the ITM is a useful new equipment for standardized measuring of threshability. Our results show quantified differences among the genotypes as well as within single panicles. The grain-filling sequence is also affecting the TF. To use this evaluation method for selection, further examinations need to be done to clarify optimum value range of TF and to unravel the correlations between other yield parameters (e.g. moisture content) and threshability.

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