

Technical Working Party for Agricultural Crops**TWA/53/5****Fifty-Third Session****Original:** English**Virtual meeting, May 27 to 30, 2024****Date:** April 29, 2024

DEVELOPING NEW CHARACTERISTICS FOR BARLEY VARIETY EXAMINATION*Document prepared by an expert from the United Kingdom**Disclaimer: this document does not represent UPOV policies or guidance*

The annex to this document contains a copy of a presentation “Exploring new characteristics for Spring Barley variety examination”, to be made by an expert from the United Kingdom, at the fifty-third session of the Technical Working Party for Agricultural Crops (TWA).

[Annex follows]



Exploring new characteristics for Spring Barley variety examination

TWA 2024

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Spring Barley – United Kingdom DUS testing

- ~ 50 new applications for spring barley per year
- 29 DUS characteristics
- Two cycles of test, but often third cycle is required for Distinctness
- Becoming more difficult to distinguish between spring barley varieties using the current DUS character set



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Possible new characteristics

- Proanthocyanidin – approved by United Kingdom authorities and National Protocol is currently being revised to include this as an additional characteristic
- Glycosidic nitrile production – under discussion
- Ear characteristics (rachilla length and rachis width) – under discussion

Proanthocyanidin presence in barley seed

- One of the major groups of flavonoids found in barley seeds
- Influences the haze stability of beer
- Proanthocyanidin-free barley varieties have been developed
- Specialist trait to be observed when requested by the applicant as a special test for distinctness

Proanthocyanidin presence in barley seed

- Vanillin-HCl staining can detect the presence/absence of proanth in the seed coat of mature barley grains



State of expression "absent"
No colouration of seed coat



State of expression "present"
Red/pink colouration of seed coat

- Recommended sample size for uniformity – 100 submitted seeds (population standard of 1% with an acceptance probability of $\geq 95\%$)

Glycosidic nitrile production

- Ethyl carbamate, a potential carcinogen, can be produced during malt distilling.
- Primary source of ethyl carbamate in distilled spirits was identified as originating from a glycosidic nitrile in malted barley, known as Epiheterodendrin (EPH).
- Low/No glycosidic nitrile (GN) spring barley varieties in high demand for the distilling industry and the testing system for approval of new distilling malt barley varieties requires GN analysis.
- Approx. 25-35% of United Kingdom candidate varieties are GN producers.

Glycosidic nitrile production – method of observation

- Molecular marker KASP™ assay to identify EPH non-producers

Developed by researchers from the James Hutton Institute and the Scotch Whisky Research Institute (SWRI)

<https://www.huttonltd.com/news/new-genetic-marker-identify-potential-eph-non-producing-barley-varieties>

- Biochemical assay - Measurable cyanide assay

200 g seed sample malted using a micro-malting machine

5 g sample of ground malt is mashed and distilled, and cyanide assayed

GN content calculated from the cyanide concentration of the distillate

Samples with less than 100ppb are classified as Non GN producers

Ear characteristic investigation

Sixteen ear characteristics assessed for their potential to distinguish between similar spring barley candidates:

Bevel depth
First rachis segment: margin hairs
First rachis segment: width
Grain (husk) colour
Grain wrinkling
Grain: location of widest part
Grain: rachilla - length
Grain: shape
Grain: tilt
Lodicule hair length
Lodicule size
Outer lateral nerve: spicules
Palea: apex shape
Palea: tip length
Ventral crease pit
Ventral crease: width

Ear characteristic investigation

Aims of the study

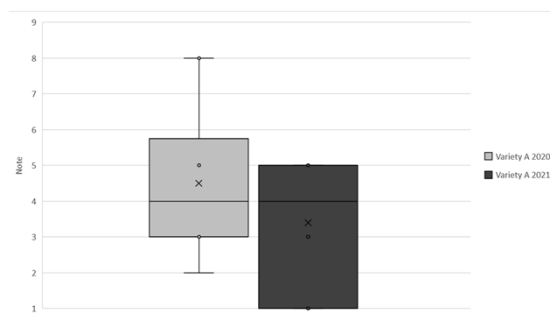
- Are characteristics sufficiently consistent and repeatable between plants and field seasons?
- Is there sufficient variation between similar varieties for these characteristics to be useful in establishing distinctness?

Material examined

Archived ear material from harvest seasons 2020 and 2021, five year 3 candidates and their most similar varieties

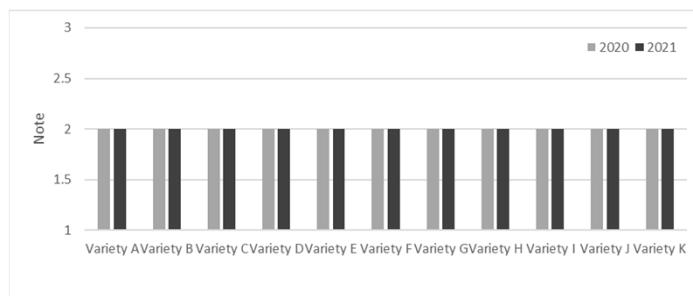
Inconsistent expression between plants and field seasons

- 7 out of 16 characteristics were not sufficiently consistent
- E.g. First rachis segment: margin hairs (QN characteristic; 1 = absent or v. weak; 9 = very strong)



Little to no variation between the varieties studied

- 7 out of 16 characteristics were consistent and repeatable between plants and seasons but no variation between varieties
- E.g. Lodicule hair length (QN characteristic; 1 = short; 3 = long)

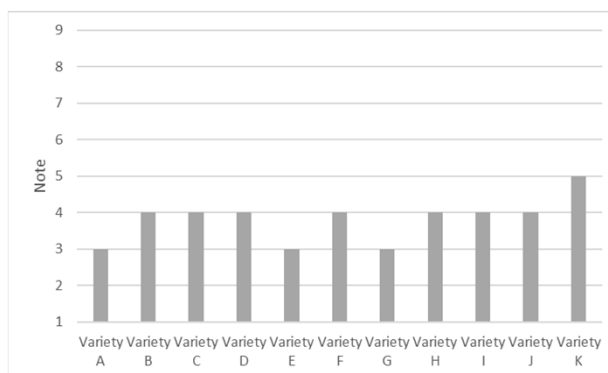
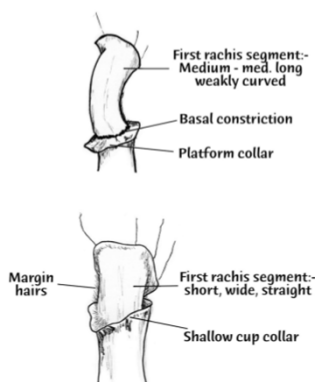


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Potential for distinguishing between similar spring barley varieties

- First rachis segment – width (QN characteristic; 1 = very narrow; 9 = very wide)

First rachis segment width score for 11 similar varieties (2020 + 2021 archive samples)

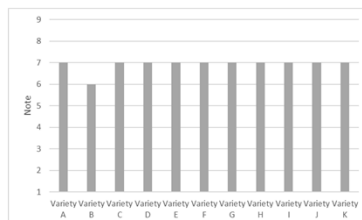
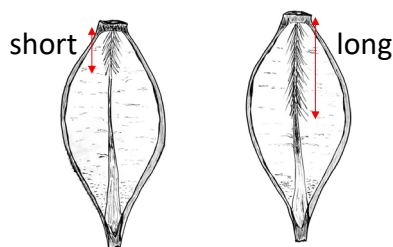


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Potential for distinguishing between similar spring barley varieties

- Grain: rachilla – length (QN characteristic; 1 = very short; 9 = very long)

Rachilla length score for 11 similar varieties (2020 + 2021 archive samples)



Additional data from 2023 on a larger number of spring barley varieties:

- One variety = note 5
- Six varieties = note 6
- Six varieties = note 7
- Nine varieties = note 8

Ear characteristic investigation – summary and future work

- Initial observations suggest that Rachilla – length and First rachis segment – width may be useful to distinguish between similar spring barley varieties
- These two characteristics could be observed alongside the current routine character set with minimal additional workload
- Work is in progress to identify a suitable set of example varieties and evaluate these two ear characteristics on a wider range of current spring barley candidates in 2024

Developing new characteristics for spring barley

- We would welcome comments from UPOV members and observers that have experience of any of these characteristics



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