

PaddyVision® and Quality Score – Frequently asked questions

What is PaddyVision® and how does it work?

The PaddyVision® is an innovative instrument that non-destructively measures the potential milling quality of unhulled paddy rice. The instrument was invented by Dr Mark Talbot (AGS) and takes photos of individual grains arranged in wells in a tray with light at varying angles shining through the grain. It identifies grains with single and multiple cracks, pearled, immature, and green grains, as well as grain length and width measurements, all independent of grain moisture and type.

The instrument has been in testing and operation for the last 3 harvest years. During the 2022 harvest the instrument was trialled at every AGS site and ran in parallel with the previous appraisal method. Since then, it has replaced the 'Whole Grain Yield' (WGY) appraisal system, and every truckload is now assessed and given a Quality Score at the time of testing.

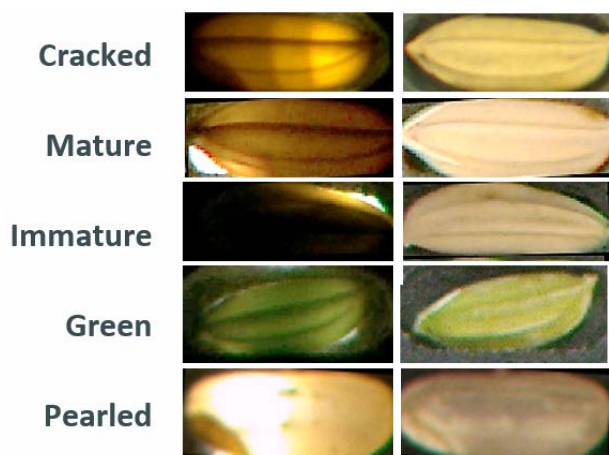


Figure 1 Photo of the PaddyVision® instrument

What is the Quality Score (QS) made up of?

PaddyVision® detects cracked and immature (shriveled and highly chalky) grains in a sample of paddy rice, as these two grain defects are directly related to WGY. The Quality Score is calculated by subtracting the percentage of defective (cracked and immature) grains from 100 and dividing by 10. Quality Score does NOT include trash, pearled grain or green grain.

$$\text{Quality Score} = \frac{100 - (\% \text{ cracked} + \% \text{ immature})}{10}$$



Cracked grain are the most important quality defect that reduces WGY, as they break when milled and lead to 'broken' grains. Very chalky immature grains turn to powder when milled and therefore reduce WGY. Immature grains are different to green, but mature, grains that dry down normally and mill out to whole white rice.

Figure 2 Quality types detected by the PaddyVision®. Shown here are individual grains illuminated with LEDs from below (left column) and above (right column). Note defined lines (cracks) in the cracked grain example.

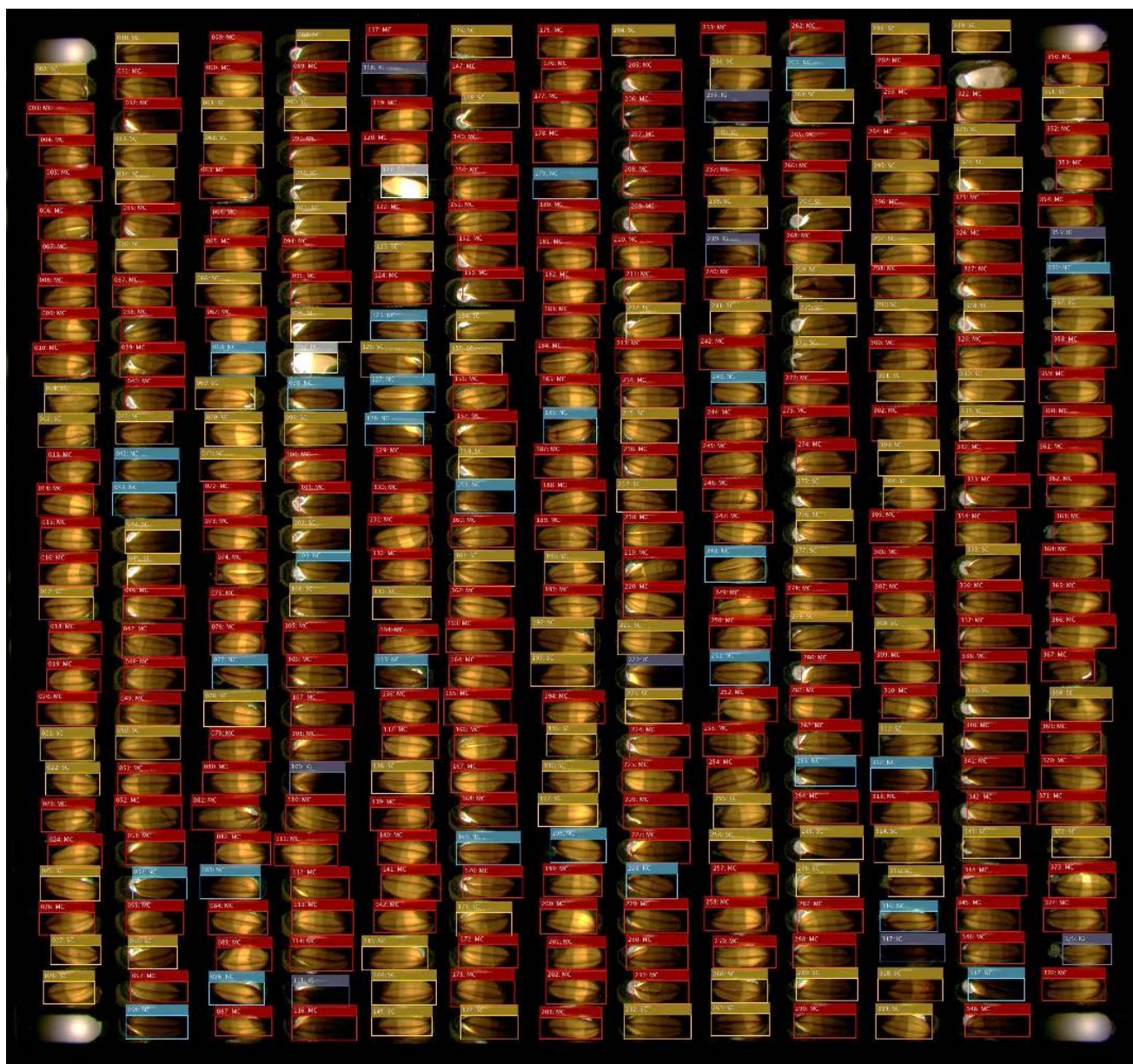


Figure 3 A PaddyVision® analysis from the 2024 harvest with 89% cracked grain.

Examples of PaddyVision® analysis

Figure 3 above is an example of a PaddyVision result from a delivery (2024 harvest) with 89% cracked grain, and therefore very low Quality Score. The red boxes indicate grain detected with more than one crack, while the yellow boxes indicate grains with single cracks. Purple boxes highlight detected immature and chalky grain, while light blue boxes show non-cracked grain and white boxes pearled grain. Figure 4 shows an example delivery with 2% cracked grain and low immature grain, and therefore high Quality Score, from the 2024 harvest.

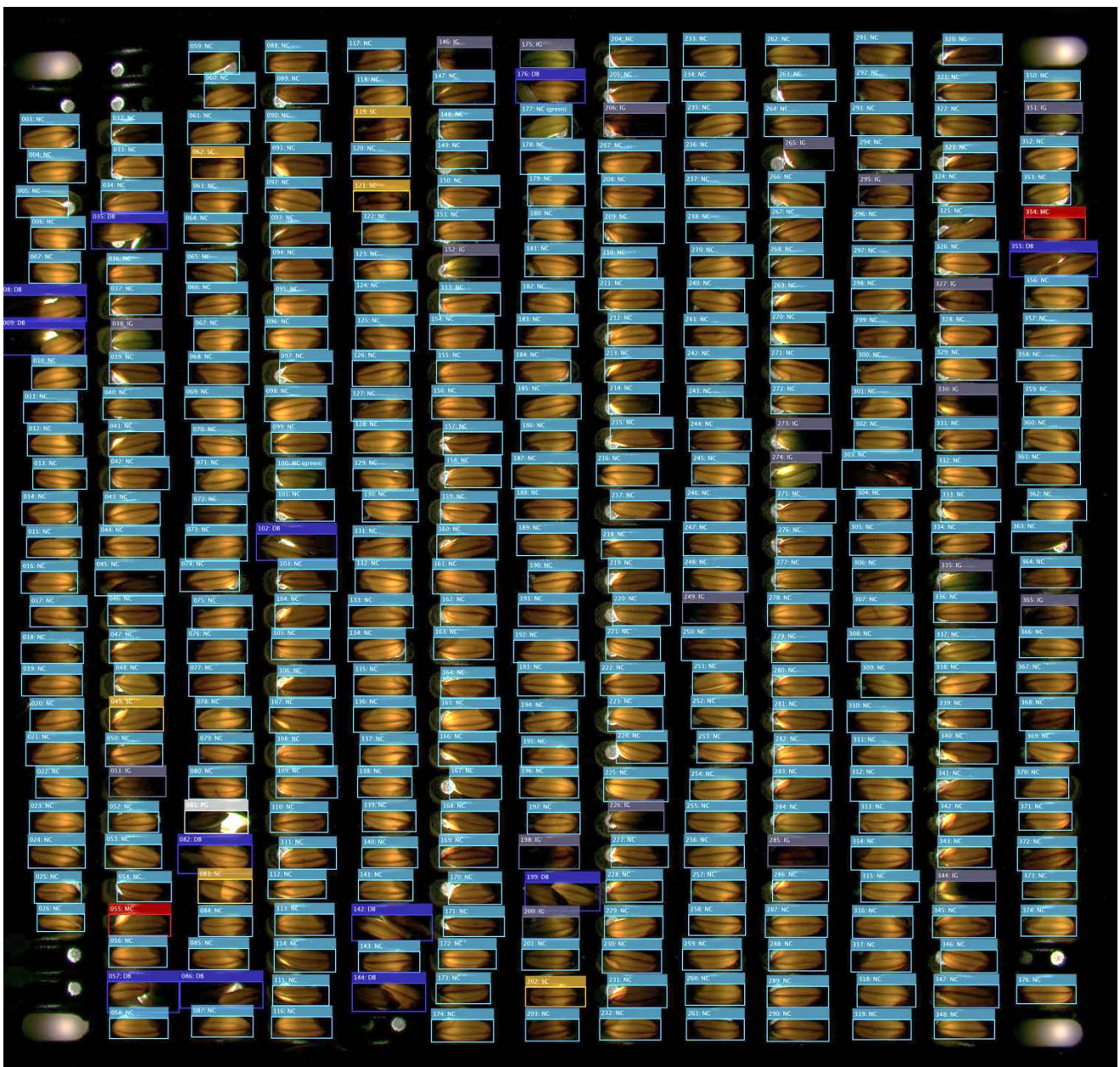


Figure 4 A PaddyVision® analysis from the 2024 harvest with 2% cracked grain.

How does the Quality Score relate to Whole Grain Yield (WGY)?

WGY is a measure of whole (unbroken) grain that is left after the milling process. While this figure varies slightly between grain type and variety, roughly 100kg of paddy rice will produce 17-20kg of husk, 10-13kg of bran and around 70kg of white rice. WGY is calculated by removing the broken after milling and expressing the weight of whole white rice as a percentage of the original paddy rice weight. In this example 5% broken will give a WGY of 65%.

While the maximum achievable WGY is around 70%, the Quality Score is out of 10. A very poor score (high percentage of cracked and/or immature grain) would be below 3, while a very good score (low percentage of cracked and/or immature grain) would be above 9. The approximate relationship between them is shown below for medium grain varieties:

Quality Score	WGY (approx.)
1	9
2	16
3	23
4	30
5	37
6	43
7	50
8	57
9	64
10	71

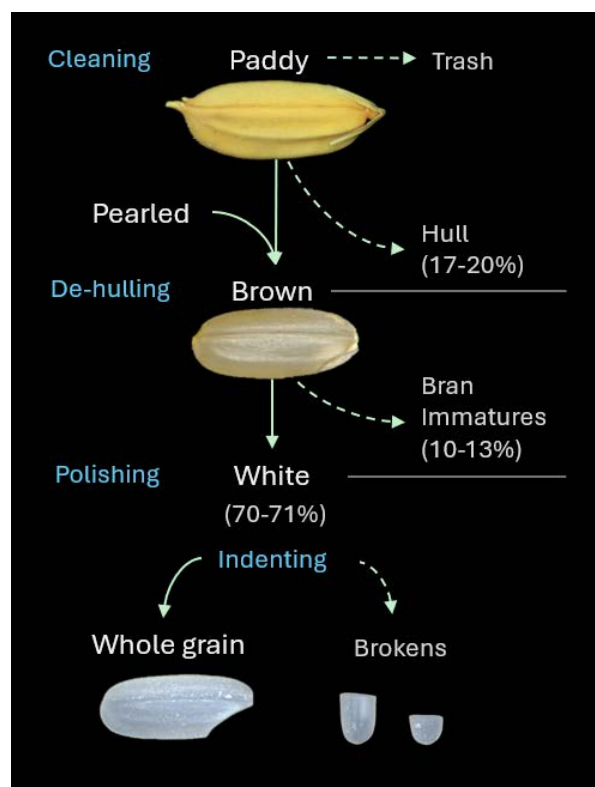


Figure 5 Process to calculate Whole Grain Yield

What affects the Quality Score?

As the Quality Score is a measure of cracked and immature grains, the score will be affected by adverse conditions leading to these quality defects. Immature grains likely ran out of moisture prior to maturity, such as in very late tillers and ‘hayed off’ sections of the crop. High temperatures during the grain fill period are known to affect chalkiness and level of immature grains, as well as cracked grain. In addition to this, the main factors leading to cracked grain include:

- Very rapid dry down at maturity (>1%/day).
- Drying and wetting of mature, low moisture grain.

What is the relationship between Grain Moisture and Quality Score?

It is generally accepted that higher grain moistures will lead to higher Quality Scores and WGY. Usually this is true when growing conditions are ideal and harvest moisture is between 18 - 22%. However, rice is highly hygroscopic, meaning it readily absorbs water, especially when it is dry. When low moisture grain (below 15%) absorbs atmospheric moisture through rainfall or a heavy dew, grain moisture rises again and will cause internal stress within the grain leading to cracks. Cracks will get worse when grains go through cycles of drying and wetting, particularly drying out in the sun/heat during the day and reabsorbing moisture with dew overnight or during rain. This re-wetting has minimal affect when grain moisture is above 18% but gets rapidly worse as grain moisture drops.

Conversely, high Quality Scores can be achieved at relatively low grain moisture, however only if the grain had a mild and steady dry down without re-wetting.

Why are we seeing some low Quality Scores in the 2024 harvest?

The previous two seasons (2022 and 2023 harvests) had very mild dry down conditions, with subsequent high Quality Scores and very few brokens through the mill. Conversely, the 2024 harvest had a variable start with some very low Quality Scores (at the time of writing we are 30% into harvest). These low Quality Scores are attributed to mostly cracked grain rather than immature grain.

As can be seen in the below charts, both maximum and minimum temperatures were well above average during the early to mid-March period (circled), coinciding with grain fill and dry down.

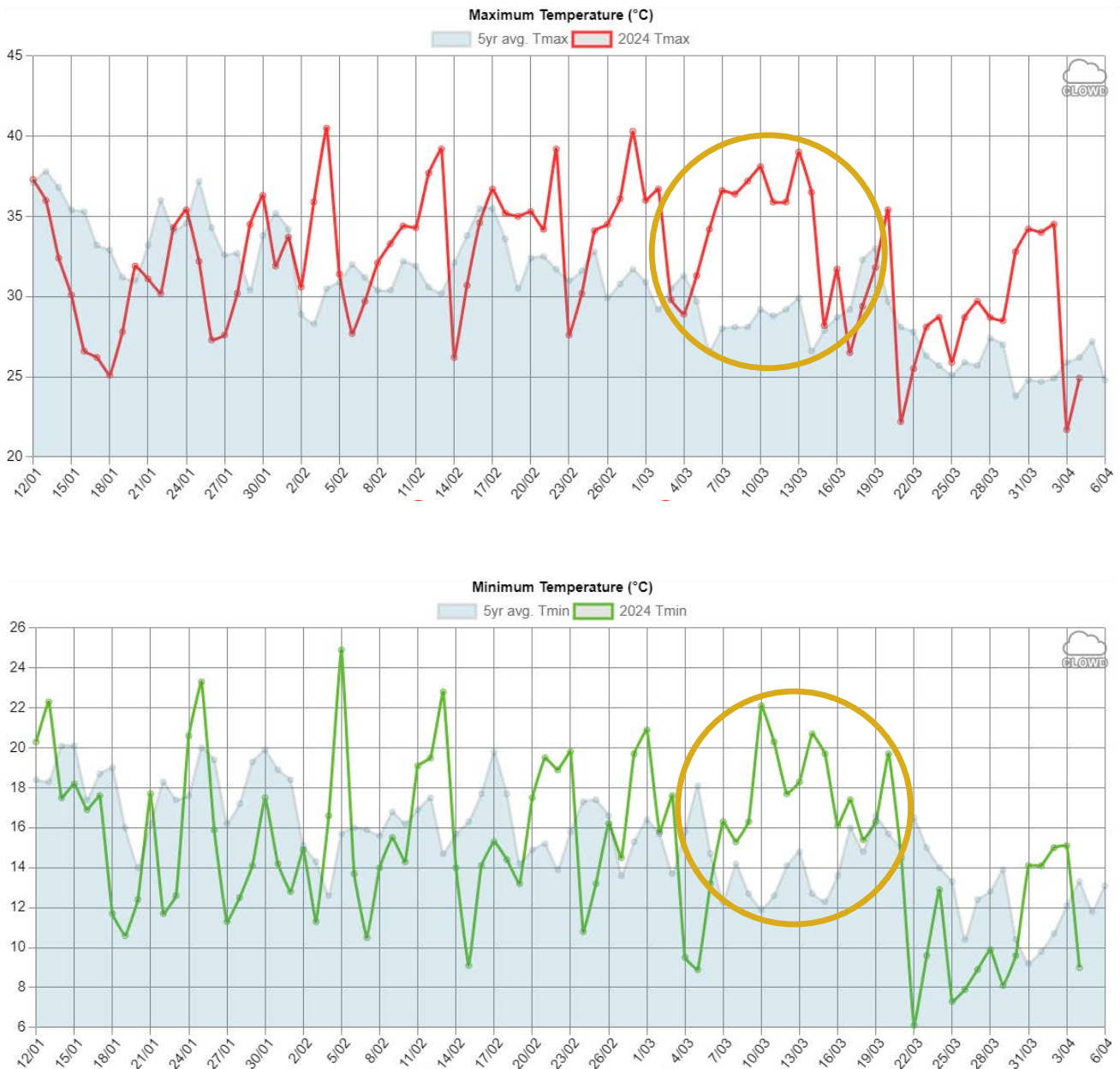


Figure 6 Weather data from CLOWD platform available on the Rice Extension website for your immediate area. These charts are (randomly) for an area west of Jerilderie but is similar across the rice growing area.

Very rapid dry down also makes the drainage decision much more difficult. Often the water is left on longer to ‘offset’ the heat. However once mature the grain will dry down regardless of whether it is standing in water or not. This means by the time the ground is trafficable the grain is already at lower moisture. Last season at this stage the average moisture was 21.9%, this season it was 17.2% prior to the Easter heat and rainfall.

What role does my Header have in the Quality Score?

The lower the moisture the more prone the grain is to mechanical damage. However, if you have minimal pearled grains in the sample then it is unlikely the header contributes to a poor Quality Score.

Are the low Quality Scores a Characteristic of V071?

While we are still learning how to grow V071 to its potential, the last two years have been some of the best whole grain years we have had. The foliage of V071 does stay green compared to Sherpa or Reiziq even though the grain itself may be a lot drier than the green foliage may indicate. V071 is often harvested at lower moisture because of this. The dry down conditions for this season have been comparatively extreme and at this stage there is nothing to suggest this is a characteristic of V071.

Will we continue to see low Quality Scores for the 2024 Harvest?

At this stage it is too early to tell. Later crops that experienced dry down in a cooler period and those crops that are at higher moisture prior to rainfall events may not be affected as much. Rice Extension will be doing a thorough analysis of the season post-harvest and will ensure you have access to all results, discussion and conclusions.

If you have any queries or want more information on PaddyVision®, Quality Scores or the progression of harvest please call Grower Services or any of us at Rice Extension. More information on Quality Specifications can be found on the SunRice website [SunRice](#).

[CY 24 Quality Specifications and Discounts Rice Blast update cac7332f72.pdf \(amazonaws.com\)](#)