

# Grain quality assessment in the new age

## GRAMS-M10 mobile app for accurate grain analysis

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**W**e are in the age of artificial intelligence, the internet of things, and cloud computing. Yet until a few years ago, all trade decisions of a farmer was dependent on manual analysis (done by supposedly skilled and trustworthy personnel). Let it be selling their grain produce of certain quality to a trader, government agency, food company or a grain warehouse monitoring grain quality at regular intervals, input and output or an agri commodity trader price negotiation based on quality – took half an hour, was error-prone, with no visibility or accountability into the whole process.

The grain agri-trade is driven by two factors; Commodity exchanges, that govern market conditions of supply and demand and the next is Quality grade and variety of the grain, governed by physical and chemical testing. In this article, we will talk more about the process of physical testing of grains and how new technologies like machine learning and cloud computing are disrupting it.

There have been recent investments in the agriculture space (called agritech). Most start-ups aim to connect to farmers through the web and help them with farm inputs procurement, information, and advisory. These start-ups also claim to get the farmer's produce sold at a better price. The vision of digitizing the agri supply chain needs automated and digital grain quality assessment.

Enter 2022, a five-year-old agritech start-up in India, INWEON, has launched a new product called GRAMS-M10, a scanner and

IoT-based AI-enabled cloud platform to assess physical grain quality in a few minutes using machine learning and computer vision algorithms. INWEON has been helping more than 300 rice milling units worldwide to optimize milling yield, reduce losses and improve output rice quality.

Traditional quality assessment methods are subjective and delayed. GRAMS™ solves this problem by providing accurate, repeatable, consistent, reliable grain quality assessment results on the field in a matter of seconds.

GRAMS™ combines the 'Sense of People' and the 'Science of Labs' into a mathematical model with a scientific approach.

GRAMS-M10 supports physical quality refractions for multiple commodities, including rice, wheat, soybean, corn, all types of pulses, etc. The process of operating and measuring quality is straightforward and can be done in three easy steps:

- Random sampling to make a 20 to 100 grams sample
- Spread the sample on a flatbed scanner
- Open the GRAMS-M10 mobile app and click 'Scan.'

### How does the system work?

The system comprises of three components:

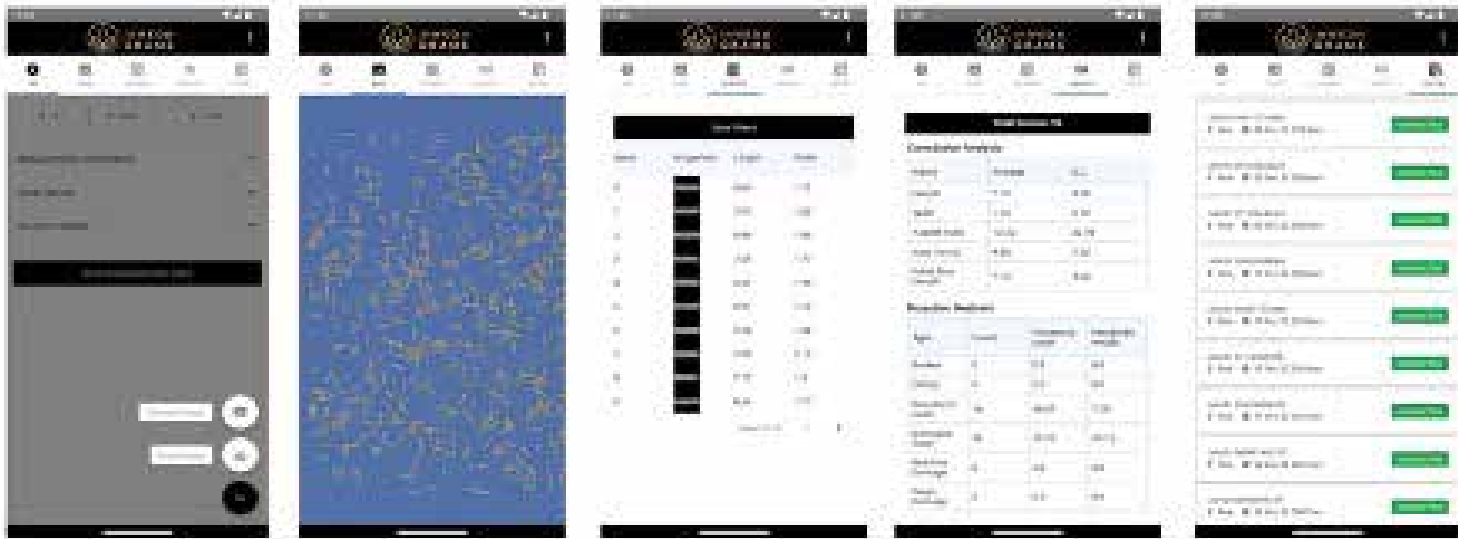
GRAMS-M10 flatbed A4 size colour scanner

GRAMS-M10 custom-built smart IOT device with WIFI and Bluetooth connectivity support

GRAMS-M10 mobile android app

The first step in measuring is to make a sample of 20 to 100 grams using the random sampling process and spread it evenly across the flatbed scanner glass.

Second step, the 'GRAMS-M10 mobile app' connects and communicates with the 'GRAM-M10 IOT device', and enters sample details like batch number, variety, etc.



Third step, the user clicks the 'Scan' button to scan from the GRAMS-M10 scanner.

After the scan, the image is automatically uploaded to the cloud by the GRAMS-M10 IoT device. The cutting-edge AI algorithm on the cloud processes the image to calculate all physical quality parameters of every grain in the sample. It generates a quality grade and metric for each grain particle.

The results are sent in the fourth step and displayed on the mobile app to make instant buy, sell, or other decisions. The whole process takes up to 2 minutes.

All the results are saved on a cloud database and available to the user through an online dashboard accessible from anywhere around the world.

The whole process is non-intrusive, easy to operate, and super-fast. It mitigates any chances of quality manipulation or error, provides visibility, and enables real-time decision-making. The data on the cloud makes it audit-friendly and possible for future analysis.

The GRAMS-M10 is also available in another variant called GRAMS-W10. The GRAMS-W10 enables the same GRAMS™ application to be run on a PC or a laptop without needing the GRAMS™ IoT device and mobile app. The GRAMS-W10 enables better visualization of the analysis on a bigger screen.

**Who is it aimed for?**

The target customers for the GRAMS products are farmers,

grain storage, grain processors, grain traders, exporter, or importer. The GRAMS™ technology should be used at every instance of grain transaction, including:

- A farmer selling to a trader or a food processor
- A grain trader purchasing or selling grains
- A food processor who buys grain of certain quality to achieve a certain quality of finished goods
- A grain storage warehouse to ensure grain quality at entry and exit of grain stock
- Government agencies purchasing for national schemes and emergency storage

GRAMS™ can also be used by industry disruptors and agritech start-ups trying to help farmers sell their produce at better prices. Fast and genuine grain trade can be facilitated if the quality is assessed in real-time using an automated and digital method like that of GRAMS™.

A prominent use case of GRAMS™ is to enable end-to-end mapping of quality in the food supply chain for supermarket corporations. It can be used to ensure consistency of quality from farmer to grain mill to packaging centre to the reseller to the warehouse to the supermarket and tracking the same for every grain batch or lot. Multiple people performing different analyses at every node will never ensure consistency and will be an operational nightmare with no clear insights for the decision-makers.

The applications and uses of this technology are many and beyond the scope of this article.

### What analysis does the system provide?

Many types of analysis and instruments determine the quality grade of grain. Moisture is measured using a moisture meter. Chemical analysis like oil and fat or protein content is determined either through chemical reactions in a lab or non-intrusive manner using NIR or far infrared spectrophotometers. The physical analysis is done using visual checks manually. Across the world, physical analysis is the critical analysis of quality grade for first level buying or selling.

The GRAMS™ platform measures the physical and morphological parameters of the grains and is the only engineering alternative to the visual analysis or checks to determine grain quality grade.

Physical analysis can be further divided into two types:

- **Dimensional properties of grain:** These include the measurement of the size and shape of a grain particle using parameters like count, length, width, aspect ratio, surface area, etc.

- **Colour or morphological properties of grain:** These properties govern if a grain is safe and fit for human consumption and segregates good grain from bad grain particles.

The good grain percentage is calculated after removing all damaged and broken grains. There are various types of damage classes that are characteristic for each grain commodity like heat damage, fungus damage, karnal bunt damage, weevilled grain, immature or shrivelled grain, etc. More detailed information on the damage types of various grains is also available at the product website - [www.inweongrams.com](http://www.inweongrams.com).

The GRAMS™ platform measures these parameters for various grains with high accuracy.

GRAMS™ unique segmentation algorithms separate each grain particle from the image and calculate all dimensional parameters with an accuracy of 99 percent for each grain particle.

GRAMS™ classification algorithms can detect all damage types of all supported commodities using unique pixel processing filters with an accuracy of 95 percent. More detailed information on the various

### Is the system calibrated and reflects similar results for similar grains from various locations?

The GRAMS™ platform works in a controlled ambient environment and a specific image sensor quality to capture the image with minimum deviation across the installations.

The hardware is tested and pre-calibrated for colour and histogram variance.

Moreover, the GRAMS™ algorithms are inherently designed to filter noise and minor colour deviations that may come across the scanners during manufacturing. This has been ensured through rigorous multi-hardware, multi-sample testing done in-house.

### Way Forward

There is tremendous potential and scope for more innovation and application of the latest technologies in the agriculture domain. One big area in quality analysis that needs disruption is a cost effective and handheld instrument for non-intrusive chemical analysis on the field. Team Inweon is in constant pursuit of finding pain points for the stakeholders in the agri supply chain and investing to come out with new innovative products and services. The immediate goal is to include more food grains into the gamut of GRAMS platform. We are open for suggestions and feedback and tailoring or customizing the product for specific needs.