GRAINPRO® & IRRI RICE QUALITY TEST KIT

INSTRUCTION MANUAL

MA4076RAD0919

GRAINPRO
STORING THE FUTURE

"A GREEN, NOT ONLY FOR PROFIT COMPANY"

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1. INTRODUCTION

The **GrainPro® & IRRI Rice Quality Test Kit** consists of a collection of tools that can be used by postharvest trainers, extension workers and postharvest practitioners to easily and quickly quantify quality traits of paddy, brown rice, milled rice and seeds. This is to better understand the rice quality traits and factors in rice production and processing. It helps farmers and processors to quantify rice quality so that they can identify problems and make the necessary adjustments to minimize quality loss along the rice value chain.

The tools that are included in the Rice Quality Test Kit are grain moisture meter (for paddy, brown rice, polished rice), palm husker, infrared thermometer with hygrometer, graduated cylinder, caliper, indent sheet grader, magnifier, mini scale, EMC table and psychrometric chart.

1.1. FEATURES & BENEFITS:

1.1.1. Better understand the different aspects of grain quality
1.1.2. Make better decisions in post harvest management
1.1.3. Portable
1.1.4. Easy to use

1.2. PRODUCT GUARANTEE:

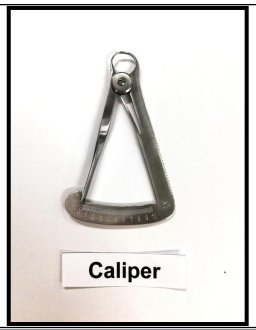
1.2.1. In accordance with the terms and conditions herewith, GrainPro Inc. fully guarantees the quality of this product provided it is used according to the instructions in this manual.
1.2.2. Please read and understand the manual thoroughly before using the GrainPro & IRRI Rice Quality Test Kit.

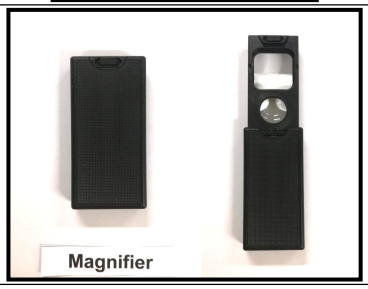
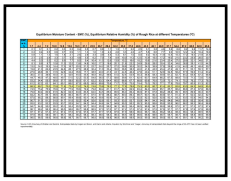
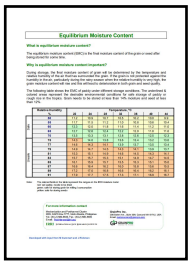
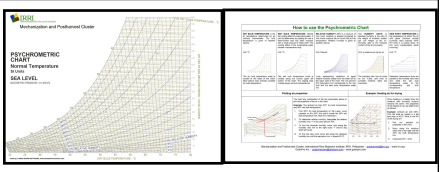
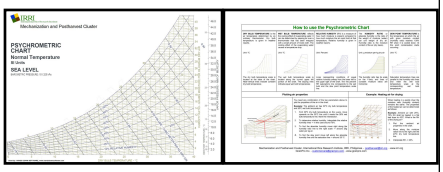
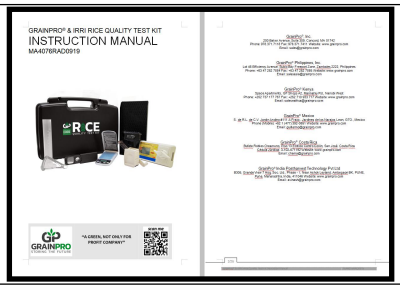
1.3. COMMENTS, COMPLAINTS, AND/OR CLARIFICATIONS:

1.3.1. Please contact customercare@grainpro.com.
We shall be glad to answer any of your questions.

2. CHECKLIST

Please inspect your GrainPro® & IRRI Rice Quality Test Kit package to ensure it includes the following items:

PART NAME	DESCRIPTION	IMAGE
2.1 **Graduated Cylinder (Flask)**	2.1.1 This cylinder for volumetric measurements is calibrated and is easy-to-read. Raised graduation allows precise measuring of the volume of grain samples.	
2.2 **Infrared Thermometer w/ Hygrometer**	2.2.1 This non-contact thermometer can be used for monitoring grain temperature in postharvest processes like rice milling and drying.	
2.3 **Mini Scale**	2.3.1 Mini scale weighs paddy and rice samples in different modes: grams, carat, teraliter, pounds, ounces, and kilograms.	
2.4 **Caliper**	2.4.1 The caliper can be used to measure the length and width of the grain.	
2.5 **Moisture Meter w/ Palm Husker**	2.5.1 Used for checking the moisture content of grains in the field. 2.5.2 Measures commodities such as Paddy, Brown Rice, Polished Rice, Barley, Wheat, Naked Barley. 2.5.3 Includes Husker/Huller, Sample Saucer, Brush, Pincette, Spoon.	

2.6 **Indent Sheet Grader**	2.6.1 These trays are used to separate the broken rice (large and small) from the whole kernel. By oscillating the trays, broken rice remains in the indents while the head rice falls off the grader.	 Indent Sheet Grader
2.7 **Magnifier**	2.7.1 A lighted pop-out/retractable pocket magnifier can double the magnification of the size of the item being viewed. 2.7.2 Used for observing cracks and insects in the grain.	 Magnifier
2.8 **EMC Table**	2.8.1 Laminated EMC description and table	 
2.9 **Psychrometric Chart (Drying)**	2.9.1 Laminated psychrometric chart for drying	
2.10 **Psychrometric Chart (Ambient Air)**	2.10.1 Laminated psychrometric chart for ambient air	
2.11 **Plastic Hard Case**	2.11.1 Case for GrainPro & IRRI Rice Quality Test Kit	
2.12. **Instruction Manual**	2.12.1 GrainPro & IRRI Rice Quality Test Kit Instruction Manual	

3. COMPONENTS

 **Moisture Meter with Palm Husker**	 **Indent Sheet Grader**	 **Graduated Cylinder**
 **Caliper**	 **Mini Scale**	 **Magnifier**
 **Thermometer with Hygrometer**	 **EMC Table, Psychrometric Chart (Drying), Psychrometric Chart (Ambient Air)**	 **Plastic Hard Case**

4. SPECIFICATIONS

PARAMETERS		STANDARD
Moisture Meter	Application	Paddy, Brown Rice, Polished Rice, Barley, Wheat, Naked Barley
	Measuring Range	Paddy, Brown Rice, Polished Rice: 10% ~ 40% Barley, Wheat, Naked Barley: 10% ~ 35%
	Accuracy, %	±0.5
	Temperature Range, °C	0 ~ 40
	Temperature Compensation	Automatic
	Display	LCD
	Battery	1.5V (R6) x 4AA
	Dimension, cm (inch)	17.5 x 10 x 7.2 (7 x 4 x 3)
	Weight, g (lbs)	480 (1)
	Accessories	Sample Saucer, Huller,Brush, Pincette, Spoon

Indent Sheet Grader	Material	Aluminum with anti corrosive coating
	Dimension, cm (inch)	30 x 15 x 2 (11.8 x 6 x 0.8)
	Indent diameter,mm (inch)	5.5 (0.2)
	Color	Black
	Weight, g (lbs)	400 (0.9)
Graduated Cylinder	Material	Plastic
	Measuring Range, ml	0 - 100
	Resolution, ml	1
	Color	Transparent
	Weight, g (lbs)	40 (0.09)
Caliper	Material	Chrome plated metal
	Measuring Range, mm (inch)	0 - 10 (0-0.4)
	Color	Silver
	Weight, g (lbs)	23 (0.05)
Mini Scale	Capacity, g	300
	Accuracy, g	0.1
	Display	LCD
	Dimension, cm (inch)	11.8 x 8 x 2.3 (4.6 x 3 x 0.9)
	Weight, g (lbs)	110 (0.2)
	Battery	1.5V x 2 AAA
Magnifier	Primary lens	5X (Times-30mmx 30mm)
	Secondary lens	45X (Times-21mm)
	Dimension, cm (inch)	9 x 5 x 1.3 (3.5 x 2 x 0.5)
	Battery	3 x LR1130 coin bat
	Color	Black
	Weight, g (lbs)	62 (0.14)
Thermometer with hygrometer	Temperature Range, °C	-50 to 550
	Ambient Temperature, °C	-10 to 60
	Ambient Humidity, %RH	0 to 100
	Accuracy	0.1
	Emissivity	0.1 to 1 adjustable
	Response Spectrum, μ	8 to 14
	Laser Positioning	12 point ring
	Laser	<1mW/630-670nm level 2
	Response Time, s	<0.5
	Service Temperature, °C	0 to 40
	Storage Temperature, °C	-10 to 60
	Battery	1.5V x 2AAA
	Color	Black
	Weight, g (lbs)	120 (0.26)
Packed Weight (including case), kg (lbs)		2.3 (5)
Packed Dimension (L x W x H), cm (inch)		43 x 32 x 12 (17 x 13 x 5)
Warranty, year		1
Product Life (based on moisture meter), years		10

5. QUALITY TRAITS THAT CAN BE MEASURED USING THE RICE QUALITY TEST KIT

5.1. Direct Measurements

5.1.1. Grain length, width
5.1.2. 1000 grain weight
5.1.3. Sample weights < 250g
5.1.4. Volume < 100ml
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5.1.6. Grain moisture content
5.1.7. Grain temperature
5.1.8. Air temperature
5.1.9. Air relative humidity

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5.2.1. Insects, cracks, damage
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5.3. Calculated Parameters

5.3.1. Length/width ratio
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5.3.9. Drying air properties
5.3.10. Equilibrium moisture content
5.3.11. Drying air temperature
5.3.12. Others

6. USAGE AND OPERATING PROCEDURES

6.1. Moisture Meter with Palm Husker

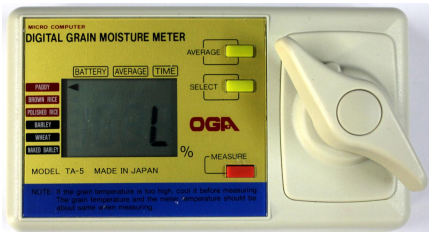
6.1.1. **Usage for Moisture Content**

Moisture content (MC) is the quantity of water contained in paddy or rice expressed in percent. It has a significant influence on all aspects of paddy and rice quality.

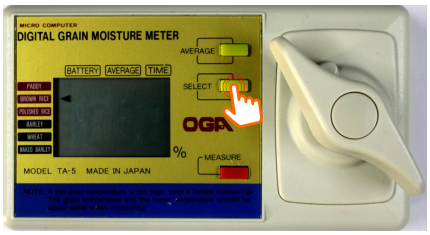
a. The optimal stage to **harvest** grain is between 20-25% grain moisture.
b. Paddy grain should be **dried** to 14% MC as soon as possible after threshing.
c. Paddy is at its optimum **milling** potential at an MC of 14%. Grains with higher MC are too soft and may be pulverized. Grain that is too dry becomes brittle and has greater possibility of breakage.
d. If grain is to be **stored** safely for extended periods it must have less than 13-14% moisture.

6.1.2. **Operating Procedure of Moisture Meter**

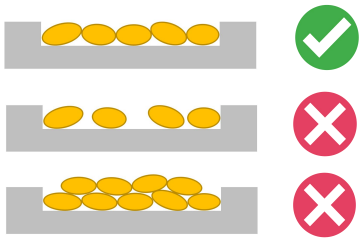
6.1.2.1. Push the measuring button, then the mark ◄ that indicates PADDY and the letter L will appear (L means that no sample is inserted). The meter is ready for measurement.



6.1.2.2. Push the grain selector button according to your sample. Be careful not to make any mistake during selection.



6.1.2.3. Put a spoonful of grain or other commodity on the saucer by using spoon and pincette.



6.1.2.4. Insert the saucer into the body and tighten the handle until it comes across the stopper.

6.1.2.5. Push the measuring button and the moisture content will be indicated.

6.1.2.6. Repeat step 3 to 5 for multiple sampling.

- Average: After several measurements, push the “averaging button.” An averaged moisture content of 2 to 9 times will be indicated, and at the same time the recorded data will be deleted.
- Deletion: For measuring two kinds of samples successively, push the averaging button to delete the recorded data.

Note: If the button is not pushed for the next measurement within 1.5 minutes, the power (display) will automatically turn off. At that time, the recorded data will be erased.

6.1.3. **Operating Procedure of Palm Husker**

6.1.3.1. Put 5 spoonful of grain inside the palm husker.

6.1.3.2. Rotate the handle until all the grains are at the bottom.

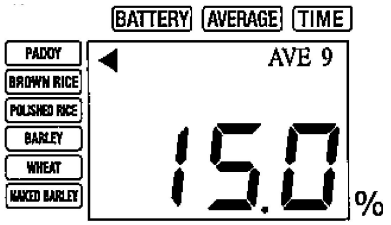
6.1.3.3. Flip the husker, so that the bottom is now the top.

6.1.3.4. Repeat procedure 6.1.3.2. and 6.1.3.3. three times.

6.1.4. **Indication**

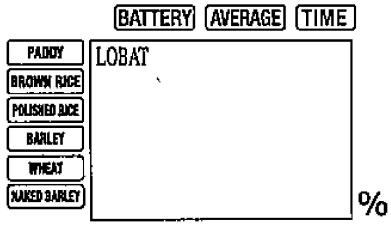
6.1.4.1. Average

"AVE" is displayed at the top for average value and the digital figures flicker. The display automatically disappears in 1.5 minutes. The value means the average value of 2 to 9 measurement.



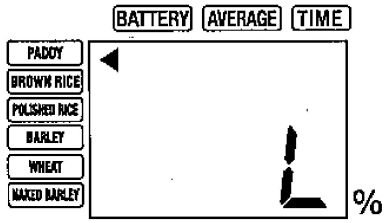
6.1.4.2. Battery replacement

"LOBAT" appears when battery is exhausted. Replace all the dry cells with new ones. (Place them correctly in + - positions.)



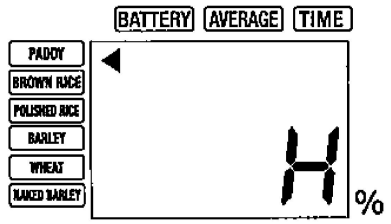
6.1.4.3. Low moisture content

"L" appears when the moisture content of the sample is as low as 10% or less. ("L" also appears when no sample is inserted.)



6.1.4.4. High moisture content

"H" appears when the moisture content of the sample is as high as 40% or more. (In case of PADDY, BROWN RICE)



6.2. Mini Scale

6.2.1. Usage for the Degree of purity (dockage)

Purity is related to the presence of **dockage** in the grain. **Dockage** refers to material other than paddy and includes chaff, stones, weed seeds, soil, rice straw, stalks, etc. These impurities generally come from the field or from the drying floor.

Unclean paddy increases the time taken to clean and process the grain. Foreign matter in the grain reduces milling recoveries and the quality of rice, and increases the wear and tear on milling machinery.

6.2.2. How to Measure Dockage with the help of the Scale

6.2.2.1. Take a sample of 100 grams by using the scale from the kit.

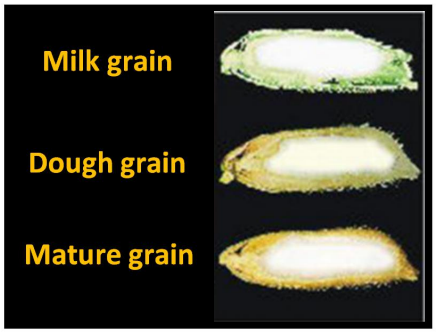
6.2.2.2. Remove light foreign matter, stones, weed and seeds from the samples.

6.2.2.3. Obtain the total weight then compute the dockage percentage as follows:

$$\%\ Dockage = \frac{Wt\ of\ dockage}{Total\ wt\ of\ sample}\ x\ 100$$

Note: See appendix for quality standards (Philippines)

6.2.3. Usage for Immature Grains



The amount of immature paddy grains in a sample has a major affect on head rice yield and quality.

The immature rice kernels are very slender and chalky and this results in excessive production of bran, broken grains and brewer's rice.

6.2.4. How to Measure the amount of immature grains with the help of the scale

6.2.4.1. Get a 25 grams grain sample.

6.2.4.2. Select, segregate and weigh the immature grains in sample.

6.2.4.3. Calculate the percentage immature grains in the sample using the formula:

$$\%\ \mathrm{Im}mature\ grains = \frac{Wt\ of\ immature\ grains}{Total\ weight\ of\ sample}\ x\ 100$$

Note: See appendix for quality standards (Philippines)

6.2.5. **Operating Procedure**

6.2.5.1. Place the Scale on a horizontal flat surface, then press the ON/OFF switch.

6.2.5.2. Wait until “0.00” is displayed.

6.2.5.3. Press Mode Cal to choose the unit of measure.

6.2.5.4. Put the object(s) on the weighing platform.

6.2.6. **Tare Weighing**

6.2.6.1. Place the “tare item” on the platform

6.2.6.2. Press TARE and wait until “0.00” is displayed

6.2.6.3. Add the “net-weight-item”

6.3. Caliper

6.3.1. **Usage for the Variety purity/ Grain dimensions**

A mixture of varieties causes difficulties at milling and usually results in reduced capacity, excessive breakage, lower milled rice recovery and reduced head rice.

Different sizes and shaped grains make it more difficult to adjust the hullers and polishers to produce whole grains. This results in low initial de-hulling efficiencies, a higher percentage of re-circulated paddy, non-uniform whitening, and a lower grade of milled rice.

Grain dimensions or grain size and shape (length-width ratio) are a very stable varietal property. Long slender grains normally have greater breakage than short, bold grains and consequently have a lower mill rice recovery. The grain dimensions will also dictate to some degree the type of milling equipment needed. As an example, the Japanese designed milling equipment may be better suited to short-bold grains.

Mixed paddy

Pure paddy

6.3.2. **How to Measure grain dimensions with the caliper**

6.3.2.1. Collect 20 paddy samples at random from each replicate.

6.3.2.2. Use the caliper or photographic enlarger to measure the dimensions to obtain the average length and width of the paddy grains.

6.3.2.3. Obtain the paddy shape, by using the following equation:

$$Length\ to\ width\ ratio\ (L/W) = \frac{Average\ paddy\ length, mm}{Average\ paddy\ width, mm}$$

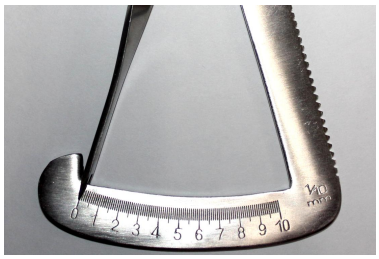
Paddy can be classified based on the International Organization for Standardization (ISO) for paddy.

Scale	Shape	L/W ratio
1	Slender	Over 3.0
3	Medium	2.1 – 3.0
5	Bold	1.1 – 2.0
9	Round	1.0 or less

6.3.3. **Operating Procedure**

6.3.3.1. Open the jaws and place the grain or commodity between the jaws.

6.3.3.2. Read the dimension in millimeters from the scale.



6.4. Magnifier

6.4.1. **Usage for Cracked grain**

Overexposure of mature paddy to fluctuating temperature and moisture conditions leads to development of fissures and cracks in individual grain. Cracks in the grain are the most important factor contributing to rice breakage during milling. This results in reduced milled rice recovery and head rice yields.

Cracks in grain as seen through a red light filter

6.4.2. **How to Measure the amount of cracked grains with the Magnifier**

6.4.2.1. Take a random sample of 100 grains.

6.4.2.2. Using the magnifier, count the number of cracked grains in this 100-grain sample.

6.4.2.3. Then compute the % cracked grains using the equation:

$$\%\ Cracked\ grains = \frac{No.of\ cracked\ grains}{100 grains}\ x\ 100$$

Note: See appendix for quality standards (Philippines)

6.4.3. **Operating Procedure**

6.4.3.1. Retract the magnifier until it showed the two magnification lenses

6.4.3.2. Retract it fully until the LED lights up for better magnification.

FRONT SIDE

BACK SIDE

6.4.3.3. Use the magnifier to check for insects and cracked grains.

Note: Be careful on retracting the magnifier fully for the LED. Do it slowly and with care to avoid damage.

6.5. Indent Sheet Grader

6.5.1. **Usage for Head rice/ Broken grain percentage after milling**

The **head rice percentage** is the volume or weight of head grain or whole kernel in the rice lot. **Head rice** normally includes broken kernels that are 75-80% of the whole kernel. High head rice yield is one of the most important criteria for measuring milled rice quality.

Broken grain has normally only half the value of head rice. To a large extent, the characteristics of the paddy determine the potential head rice yield although the milling process is responsible for some losses and damage to the grain.

Amount of whole kernels after milling

6.5.2. **How to Measure the amount of broken grains with the help of the Indent Sheet Grader**

6.5.2.1. Select a 25 gram random sample of grains. [A]

6.5.2.2. Using an indent sheet grader, separate the broken grain from the whole grains. For the calculation of the percentage of 'brokens' and the percentage of head rice recovery, a grain is considered to be a whole grain if it is 75% or larger of the grain.

6.5.2.3. Weigh the 'brokens' separated from the sample. [B]

6.5.2.4. Compute the percentage of the 'brokens' using the following equation:

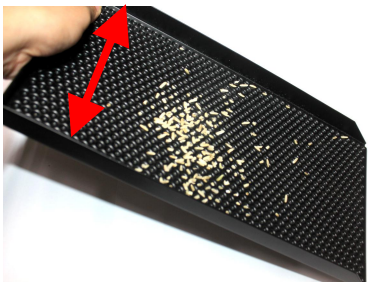
$$\%\ Brokens[C] = \frac{Wt\ of\ broken\ grains[B]}{Wt\ of\ milled\ sample[A]}\ x\ 100$$

Note: (Given the percentage of 'brokens', the percentage of whole grains can be calculated by subtracting the percentage of 'brokens' [C] from 100%. This is the percentage of head rice recovery.)

See appendix for quality standards (Philippines)

6.5.3. **Operating Procedures**

6.5.3.1. Pour the random sample of grain or other commodity on the indent sheet grader.



6.5.3.2. Tilt the indent sheet grader and oscillate (left to right) until the whole kernels fall off and the broken kernels remain.

6.6. IR Thermometer with Hygrometer

6.6.1. **Usage for Post Harvest Operations**

Temperature measurements are important in post harvest operations.

Non-contact thermometer is used for monitoring grain temperature in rice milling and drying.

6.6.2. **Operating Procedures**

6.6.2.1. Insert (2) AAA 1.5V batteries into the thermometer.

6.6.2.2. Pull the trigger on the thermometer to measure surface temperature. The unit is equipped with a laser which is used for aiming only.

6.6.3. **The Mode Button**

6.6.3.1. The MODE button is used to access the emissivity, hold, laser, temperature unit, high limit and low limit alarm features.

6.6.4. **Setting Temperature Unit (Switching between °C and °F)**

6.6.4.1. Press and hold MODE for 2 seconds.

6.6.4.2. Press MODE until °C and °F is showing on the LCD screen.

6.6.4.3. Press ▲/▼ to switch between desired temperature unit.

6.6.4.4. Press trigger or press and hold MODE to set selection.

6.6.5. **Exiting Mode Settings**

6.6.5.1. Press trigger or press and hold MODE.

6.6.6. **Turning the Laser On/Off**

6.6.6.1. Press MODE button to turn laser on or off.

6.6.6.2. The  laser symbol will appear on the LCD screen when it is enabled.

6.6.7. **Measuring Non-Contact Temperature**

6.6.7.1. Aim thermometer at the surface of the object and hold in the trigger to read continuous temperature measurements.

6.6.7.2. Release the trigger when desired measurement is obtained and result will stay displayed on the LCD screen.

6.7. Graduated Cylinder

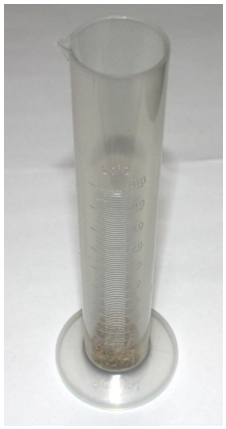
6.7.1. Usage for Bulk Density and Sampling of Grains

Taking volumetric determination of fractions of a sample.

Calculate bulk density of paddy, milled rice, husk, and bran. The bulk density is the weight of an object or material divided by its volume, including the volume of its pore spaces.

6.7.2. Operating Procedures

6.7.2.1. Measure samples using the graduated cylinder. Determine the measurement with the raised graduations.



7. Correction Factors and Calibration Procedure

7.1. Correction factor for Moisture Meter

Commodity	Reading Range	Correction Range	Correction Factor Formula
Paddy	10%~40%	10.9%~16.4%	(-) **y** = -0.1486**x**^{2} + 4.1709**x** - 27.558
		16.5%~35%	(-) **y** = 0.3664**x** - 5.7407

The correction factor, **y, must be added (+) or subtracted (-) to the measured value, **x**, at the stated correction range.*

7.2. Correction factor for IR Temperature with Hygrometer

Parameter	Reading Range	Correction Range	Correction Factor Formula
Surface Temperature	-18°C to 275°C	0°C to 100°C	(+) **y** = -0.0157**x** + 3.3465
Ambient Humidity	-	22.8°C to 28.8°C (ambient temperature)	(+) **y** = -0.0411**x**^{2} + 3.9585**x** - 104.35

The correction factor, **y, must be added (+) or subtracted (-) to the measured value, **x**, at the stated correction range.*

7.3. Calibration for Mini Scale

7.3.1. Standard Calibration (If LCD displays 0.00 after you turn on the scale)

7.3.1.1. Prepare 200g and 100g calibration weight. (Other items with equivalent weight can also be used)

7.3.1.2. Turn on the scale by pressing ON/OFF key and 0.00 will appear after.

7.3.1.3. Press and hold MODE key until LCD displays CAL.

7.3.1.4. After CAL, 200g will appear on the display.

7.3.1.5. Place 200g weight at the weighing platform.

7.3.1.6. 300g will now appear on the LCD display.

7.3.1.7. Add 100g weight with the 200g weight.

7.3.1.8. Wait for about 3-4 seconds until PASS appears on the display.

7.3.1.9. Turn off scale after.

8. Worksheet for Quality Determination

This sheet can help when testing the quality of paddy.

Collect two samples of approximately 500 grams of fresh paddy, and determine with the help of the tools the following characteristics by following the procedures as described above. Use the sheet to record your findings on:

- Moisture content
- Grain dimensions (L/W ratio)
- Dockage
- Cracked grains
- Unfilled or immature grains
- Discolored or damaged grains

8.1. Quality of Paddy Worksheet

Parameters	Sample 1			Sample 2		
	No. grains (start)	**No. grains (finish)**	**(%)**	**No. grains (start)**	**No. grains (finish)**	**(%)**
Moisture (oven)						
Moisture (meter)						
L/W ratio						
Dockage						
Cracked grains						
Immature grains						
Discolored/ damaged						

9. Appendix: Tables and Graphs

9.1. Table 1: Quality standards for milled rice in the Philippines (National Food Authority)

Grade Specifications	GRADE			
	Premium	Grade 1	Grade 2	Grade 3
Head rice (min %)	95.00	80.00	65.00	50.00
Brokens (max %)	4.90	19.75	34.50	49.00
Brewers (max %)	0.10	0.25	0.50	1.00
Defectives:				
■ Damaged grains, max %	0	0.25	0.50	2.00
■ Discolored grains, max %	0.50	2.00	4.00	8.00
■ Chalky and immature grains, max %	2.00	5.00	10.00	15.00
■ Red grains, max %	0	0.25	0.50	2.00
■ Red streaked grains, max %	1.00	3.00	5.00	10.00
Foreign matter (max 5)	0	0.10	0.20	0.50
Paddy (max no./kg)	1	8	10	15
Moisture content (max %)	14.00	14.00	14.00	14.00

9.2. Equilibrium moisture content

In storage, the final moisture content of seed depends on the temperature and relative humidity of the air that surrounds the grain. The final grain moisture content resulting from storage is called the 'equilibrium moisture content' or EMC.

The following table shows the EMC of paddy under different storage conditions. The marked areas represent the desirable environmental conditions for storage of paddy for food purposes in the tropics. If grain is not protected against humidity in the air, grain moisture content will rise leading to quality deterioration.

	Storage Temperature (°Celcius)						
Relative Humidity	22°C	24°C	28°C	32°C	36°C	40°C	44°C
50%	11.2	10.9	10.7	10.5	10.2	10.0	9.9
55%	11.7	11.5	11.2	11.0	10.8	10.6	10.4
60%	12.3	12.0	11.8	11.6	11.4	11.2	11.0
65%	12.7	12.6	12.4	12.2	12.0	11.8	11.6
70%	13.5	13.3	13.1	12.8	12.6	12.5	12.3
75%	14.3	14.0	13.8	13.6	13.4	13.2	13.0
77%	14.6	14.3	14.1	13.9	13.7	13.5	13.4
79%	14.9	14.7	14.5	14.3	14.1	13.9	13.7
81%	15.3	15.1	14.9	14.6	14.5	14.3	14.1
83%	15.7	15.7	15.3	15.1	14.9	14.7	14.5
85%	16.1	15.9	15.7	15.5	15.3	15.1	15.0
87%	16.6	16.4	16.2	16.0	15.8	15.6	15.5
89%	17.2	17.0	16.8	16.6	16.4	16.2	16.1
91%	17.9	17.7	17.5	17.3	17.1	16.9	16.7

9.3. International Standards (ISO 7301) Rice – Specification

9.3.1. Scope

This International Standard lays down the minimum specifications for rice (*Oryza sativa L.)* of the following types: husked rice, husked parboiled rice, milled rice and milled parboiled rice, suitable for human consumption, directly or after reconditioning, and which is the subject of international trade.

9.3.2. Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 712: 1985, Cereals and cereal products – Determination of moisture content (Routine reference method).

ISO 950: 1979, Cereals – Sampling (as grain).

9.3.3. Definitions

For the purposes of this International Standard, the following definitions apply.

9.3.3.1. Paddy: paddy rice: rough rice: Rice retaining its husk after threshing.

9.3.3.2. Husked rice: cargo rice[1]: Paddy from which the husk only has been removed.

The processes of husking and handling, particularly of parboiled rice, may result in some loss of bran.

9.3.3.3. Milled rice: Rice obtained after milling which involves removing all or part of the bran and germ from the husked rice.

It could further be classified into the following degrees of milling.

a) Under-milled rice: Rice obtained by milling husked rice but not to the degree necessary to meet the requirements of well-milled rice.

b) Well-milled rice: Rice obtained by milling husked rice in such a way that some of the germ, and all the external layers and most of the internal layers of the bran have been removed.

c) extra-well-milled rice: Rice obtained by milling husked rice in such a way that almost all the germ, and all the external layers and the largest part of the internal layers of the bran, and some of the endosperm, have been removed.

9.3.3.4. Parboiled rice: Rice, the starch of which has been fully gelatinized by soaking paddy or husked rice in water followed by a heat treatment and a drying process.

9.3.3.5. Glutinous rice: waxy rice: Special varieties of rice (*Oryza sativa* L. *glutinosa*) the kernels of which have a white and opaque appearance. The starch of glutinous rice consists almost entirely of amylopectin. It has a tendency to stick together after cooking.

9.3.3.6. Size of kernels, broken kernels and chips

9.3.3.6.1. Whole kernel: Kernel without any broken part.

9.3.3.6.2. Head rice: Kernel, the length of which is greater than or equal to three quarters of the average length of the corresponding whole kernel.

[1] The term “brown rice” is sometimes used as a synonym.

9.3.3.6.3. Large broken kernel: Fragment of kernel, the length of which is less than three-quarters but greater than one-half of the average length of the corresponding whole kernel.

9.3.3.6.4. Medium broken kernel: Fragment of kernel, the length of which is less than or equal to one-half but greater than one-quarter of the average length of the corresponding whole kernel.

9.3.3.6.5. Small broken kernel: Fragment of kernel, the length of which is less than or equal to one-quarter of the average length of the corresponding whole kernel but which does not pass through a metal sieve with round perforations 1.4 mm in diameter.

9.3.3.6.6. Chip: Fragment of kernel which passes through a metal sieve with round perforations 1.4 mm in diameter.

9.3.3.7. Extraneous matter: Organic and inorganic components other than kernels of rice, whole or broken

9.3.3.8. Heat-damaged kernels: Kernels, whole or broken , that have changed their normal color as a result of heating. This category includes whole or broken kernels that are yellow due to alteration. Parboiled rice in a batch of non-parboiled rice is also included in this category.

9.3.3.9. Damaged kernels: Kernels, whole or broken, showing obvious deterioration due to moisture, pests, disease or other causes, but excluding heat-damaged kernels (9.3.3.8.).

9.3.3.10. Immature kernels: Kernels, whole or broken, which are unripe and/or underdeveloped.

9.3.3.11. Chalky kernels: Kernels, whole or broken, except for glutinous rice, of which at least three-quarters of the surface has an opaque and floury appearance.

9.3.3.12. Red kernels: Kernels, whole or broken, having a re coloration covering more than one-quarter of their surface, but excluding heat-damaged kernels (9.3.3.8.).

9.3.3.13. Red-streaked kernels: Kernels, whole or broken, with red streaks, the lengths of which are greater than or equal to one-half of that of the whole kernel, but where the surface covered by these red streaks is less than one-quarter of the total surface.

9.3.3.14. Pecks: Kernels, whole or broken, of parboiled rice of which more than one-quarter of the surface is dark brown or black in color.

9.3.3.15. Other kinds of rice

9.3.3.15.1. Paddy in husked rice, in husked parboiled rice, in milled rice and in milled parboiled rice.

9.3.3.15.2. Husked rice in husked parboiled rice, in milled rice and in milled parboiled rice.

9.3.3.15.3. Milled rice in husked parboiled rice and in milled parboiled rice.

9.3.3.15.4. Glutinous in non-glutinous rice.

9.3.4. Specification

9.3.4.1. General, organoleptic and health characteristics

Kernels of rice, whether or not parboiled, husked or milled, and whether or not whole or broken, shall be sound, clean and free from foreign odors or odor which indicates deterioration.
The levels of additives and pesticide residues and other contaminants shall not exceed the maximum limits permitted by the national regulations of the country of destination or, in their absence, by the joint FAO/WHO Commission of Codes Alimentarius.

The presence of living insects, which are visible to the naked eye, is not permitted.

9.3.4.2. Physical and chemical characteristics

9.3.4.2.1. The moisture content, determined in accordance with ISO 712, shall be not greater than 15% (m/m)

Note: Lower moisture contents may be required for certain destinations depending on the climate, duration of transport and storage. For further details, see ISO 6322, parts 1, 2 and 3.

9.3.4.2.2. The maximum contents of extraneous matter, defective kernels and other kinds of rice in husked and milled rice, whether or not parboiled, and determined in accordance with the method described in annex A, shall be not greater than the values specified in table 1.

9.3.4.2.3. All commercial contracts should be clearly the total percentage of broken kernels permitted, classified according to the agreed categories, and the relative proportions of each category, and the total percentage of extraneous matter and of defective kernels, determined in accordance with the method described in Annex A.

The proportion of chips shall not exceed 0.1%.

Table 1

Defect	Reference to the definition	Husked rice	Milled rice (non-glutinous)	Husked parboiled rice	Milled parboiled rice
Extraneous matter	3.7				
a) organic		1.5	0.5	1.5	0.5
b) inorganic		0.5	0.5	0.5	0.5
Paddy	3.1	2.5	0.3	2.5	0.3
Husked rice	3.2	-	1.0	-	1.0
Milled rice	3.3	-	-	2.0	2.0
Heat-damaged kernels	3.8	4.0	3.0	8.0	6.0
Damaged kernels	3.9	4.0	3.0	4.0	3.0
Immature kernels	3.10	12.0	2.0	12.0	2.0
Chalky kernels	3.11	11.0	11.0	-	-
Red kernels	3.12	12.0	4.0	12.0	4.0
Red-streaked kernels	3.13	-	8.0	0	8.0
Glutinous rice	3.5	1.0	1.0	1.0	1.0
Pecks	3.14	-	-	4.0	2.0
After milling					

10. FREQUENTLY ASKED QUESTIONS

10.1. What are the typical applications of the GrainPro & IRRI Moisture Meter?

- Checking whether paddy in a dryer or in sun-drying is dry enough to stop the drying process
- Checking whether paddy intended for milling can be stored safely
- Checking whether rice seeds are dry enough to be stored safely. Especially when storing seeds in the hermetic storage systems it is recommended to use either this or any other moisture tester to determine the seed moisture content before sealing the storage container

10.2. Why is there a high temperature difference between the meter and the paddy?

- The meter has has an automatic temperature compensation. Should there be much temperature difference between the meter and the samples, errors may sometimes occur in measurement. Leave the meter intact over 40 minutes. During this period, the meter automatically detects the ambient temperature and be ready for normal operations.

10.3. What needs to be done in case of errors and unreliable measuring of moisture meter?

- Clean the electrode, sample saucer and handle top end port by using pincette or brush provided, especially after measuring moisture content of highly moist grains.

10.4. What alternative can be used If calibration weight is not available for mini scale?

- Items with the same weight value as the 2 calibration weights. (Refer to step **7.3.1.1.** of **7.3.1. Standard Calibration**)

10.5. What to do when the mini Scale is not showing 0.00 initially?

- Make sure that it is placed on an evenly, horizontal flat surface. (Refer to step **6.2.5.1** of **6.2.5. Operating Procedure**)

10.6. What to do when the IR Thermometer's laser is not working?

- Push the mode button and make sure the laser symbol is present. (Refer to procedure **6.6.6. Turning the Laser On/Off**)

11. WARRANTY CLAUSE

GrainPro® hereby warrants that products sold to Buyers shall be free of defects in workmanship and materials, for a period as follows, starting from the date of shipment (B/L): One year for the GrainPro® & IRRI Rice Quality Test Kit.

The warranty liability is limited to replacement of defective products within the warranty period at GrainPro's plant in accordance with the provisions specifically and expressly set forth herein.

The Buyer will pay for Products which need to be replaced under warranty, a percentage of the full list price according to the ratio between the period, which has passed until replacement, and the full warranty period.

The Buyer shall bear shipping costs for shipment of defective Products to GrainPro, and GrainPro shall bear shipping costs of returning good Products to Buyer.
The Warranty does not cover the cost of any service, work, or material required for the replacement of defective Products at the site of installation.

GrainPro shall have no obligation under the warranty to replace defective Products or parts thereof if the defect is a result of any of the following: normal wear and tear; damages occurring after delivery, accidents, acts of God, or catastrophes, fault or negligence, or improper storage installation, maintenance of the Products.

Replacement costs and shipping charges for Products found not to be under warranty as specified above would be paid in full by the Buyer before new/refurbished Products are shipped.

Notwithstanding the above, if the Products include main parts or sub-assemblies purchased by GrainPro from other vendors ("Additional Equipment"), then the period and terms of warranty for Additional Equipment are limited to the period and terms offered by the vendors of such equipment.

The Buyer agrees that the warranty liabilities of GrainPro shall be and are limited to the express foregoing terms: THE EXPRESS WARRANTIES AND OBLIGATIONS SET FORTH ABOVE, ARE AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES AND OBLIGATIONS OF GRAINPRO, and EXPRESSED OR IMPLIED. EXCEPT TO THE EXTENT HEREIN PROVIDED, GRAINPRO DOES NOT MAKE AND SHALL NOT BE DEEMED TO MAKE ANY WARRANTY WHATSOEVER, TO ANY END USER OR TO ANY OTHER PERSON OR PARTY, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR USE OR PURPOSE. GRAINPRO SHALL NOT BE LIABLE FOR ANY LOSS OF USE, SALES OR PROFIT OR FOR ANY INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES CAUSED BY OR SUFFERED AS A RESULT OF THE SALE OR USE OF THE PRODUCTS.

For further information and clarifications, visit our website at www.grainpro.com; email our Technical Support team: customercare@grainpro.com or call: (+6347) 252-7884.