Application Note SC005: Measuring Rice Grain Dimensions with an Image Analyser

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Appearance is a critical quality attribute for both milled and brown rice. Rice buyers, Millers and Consumers judge the quality of rice on the uniformity of its size and shape as well as the pleasing appearance of its overall size-shape relationship. The measurement of grain length, breadth and width has traditionally been done manually using vernier callipers or by projection of an image of the grain onto a solid screen with an overhead projector and measuring the image with a transparent plastic ruler. These classic methods using manual measurement are slow, tedious and limit the number of samples and sub-samples that can be evaluated.

It is likely that fast, accurate measurement of the physical dimensions of rice would result in breeding lines showing greater uniformity. This may not only lead to rice with better appearance but also increase whole grain milling yields as more uniform grains polish more evenly in rice mills.

Image analysis using a camera system is currently used in the rice-breeding programme at Yanco Agricultural institute (Martin et al 1997). The method requires careful placement of grains sampled with a vacuum based positioning funnel and only makes measurements in two dimensions. In addition the available software uses algorithms that do not measure the real length and breadth but a diagonal approximation.

Rice grain size and shape is critical in breeding new varieties as each variety must fit an existing market class. We report on the use of a specially developed imaging tray for use with a SeedCount image analyser that allows easier collection of data from large numbers of grains. The tray also allows direct measurement of kernel thickness (Armstrong et al 2003).

Materials and Methods

Rice samples were from pure seed samples provided by SunRice through the Rice Appraisals Laboratory in Leeton NSW. Samples were taken from all currently grown varieties from locations throughout the rice growing area in 2003. We report here on samples of Amaroo, Koshi, Illabong, Jarrah, Millin, Opus and Quest; all medium grained varieties that make up the majority of the Australian rice crop. Both brown and milled data is presented.
Kernels were hand measured with callipers and then placed in the medium grain rice tray and scanned and analysed with a SeedCount 324 DIA (Digital Image Analysis) system (Figures 1 and 2). The results of both methods were then compared. The DIA system was then used to examine large samples (Figure 3: up to 1350 kernels can be examined per trayful), allowing the dimensional distributions within and between grain lots to be compared.

Figure 1: SeedCount Tray in Scanner Cabinet


Figure 2. SeedCount Tray

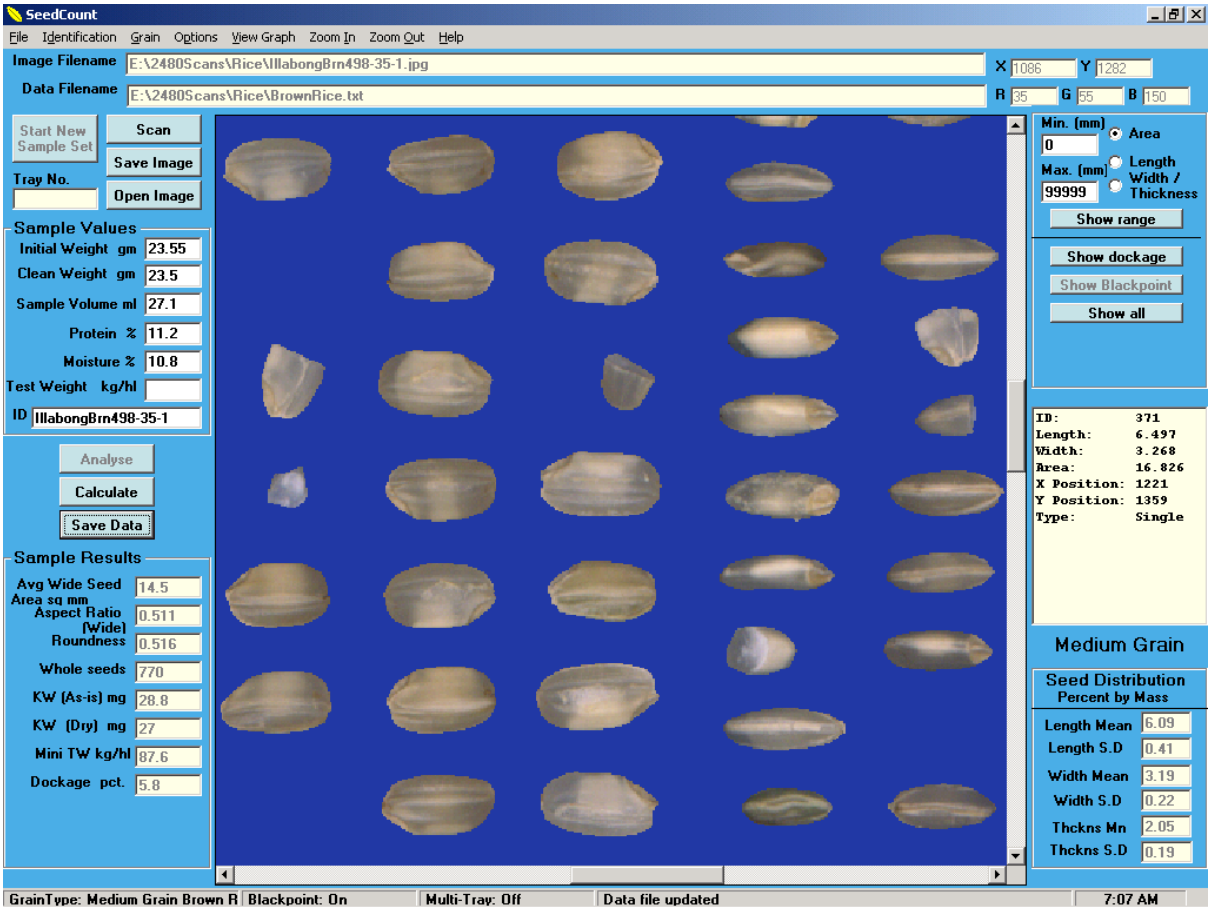

Figure 3. SeedCount screen showing Rice Module

Results

A comparison of the calliper and DIA thickness (width) estimate for 200 brown rice kernels from ten different samples are shown in Figure 4. Each diagonal series represents one of the sample sets. The kernels were selected for the maximum range for each sample. The accuracy of the length, breadth and width for brown and white rice are detailed in Table 1.

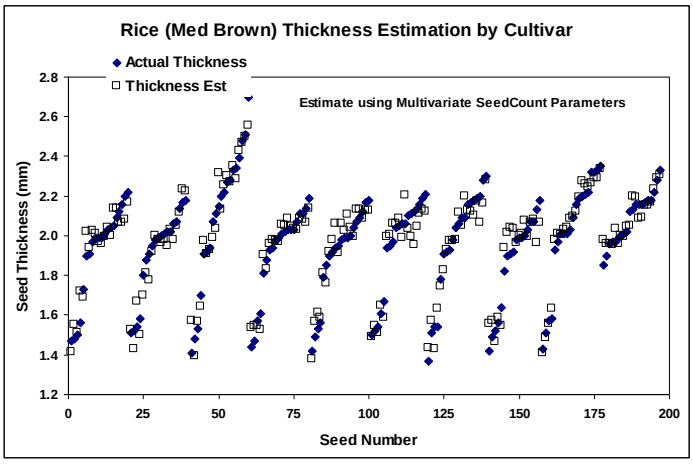

Figure 4. Estimates of Brown Rice Thickness

	Length	Breadth	Thickness	Roundness
Brown Std Error	0.086	0.085	0.063	0.018
Brown Correlation (r)	0.99	0.94	0.97	0.92
White Std Error	0.089	0.109	0.078	0.021
White Correlation (r)	0.98	0.91	0.95	0.87

Table1: Comparison of Manual and DIA Dimensional Measurements

Table 2 displays the DIA result for full-tray Samples of various varieties. It can be seen that there are distinct differences in the different varieties. The high deviations are due to the inclusion of husks on some of the kernels. The husks appear as the longer kernels in the Amaroo graph below.

SampleID	Length Mean	Length StdDev	Width Mean	Width StdDev	Thickns Mean
Amaroo1958-11-1-Brn	5.76	0.29	2.79	0.14	1.75
IllabongBrn498-35-1	6.09	0.41	3.19	0.22	2.05
Jarrah7167-31-9Brn	5.91	0.30	2.81	0.13	1.82
Koshi8427-34-6-Brn	5.01	0.25	2.76	0.18	1.78
Opus8071-38-3-Brn	5.23	0.30	2.90	0.17	1.82
Quest183-21-7Brn	6.21	0.38	2.82	0.19	1.85

Table1: Comparison of Various Australian Brown Rice Varieties

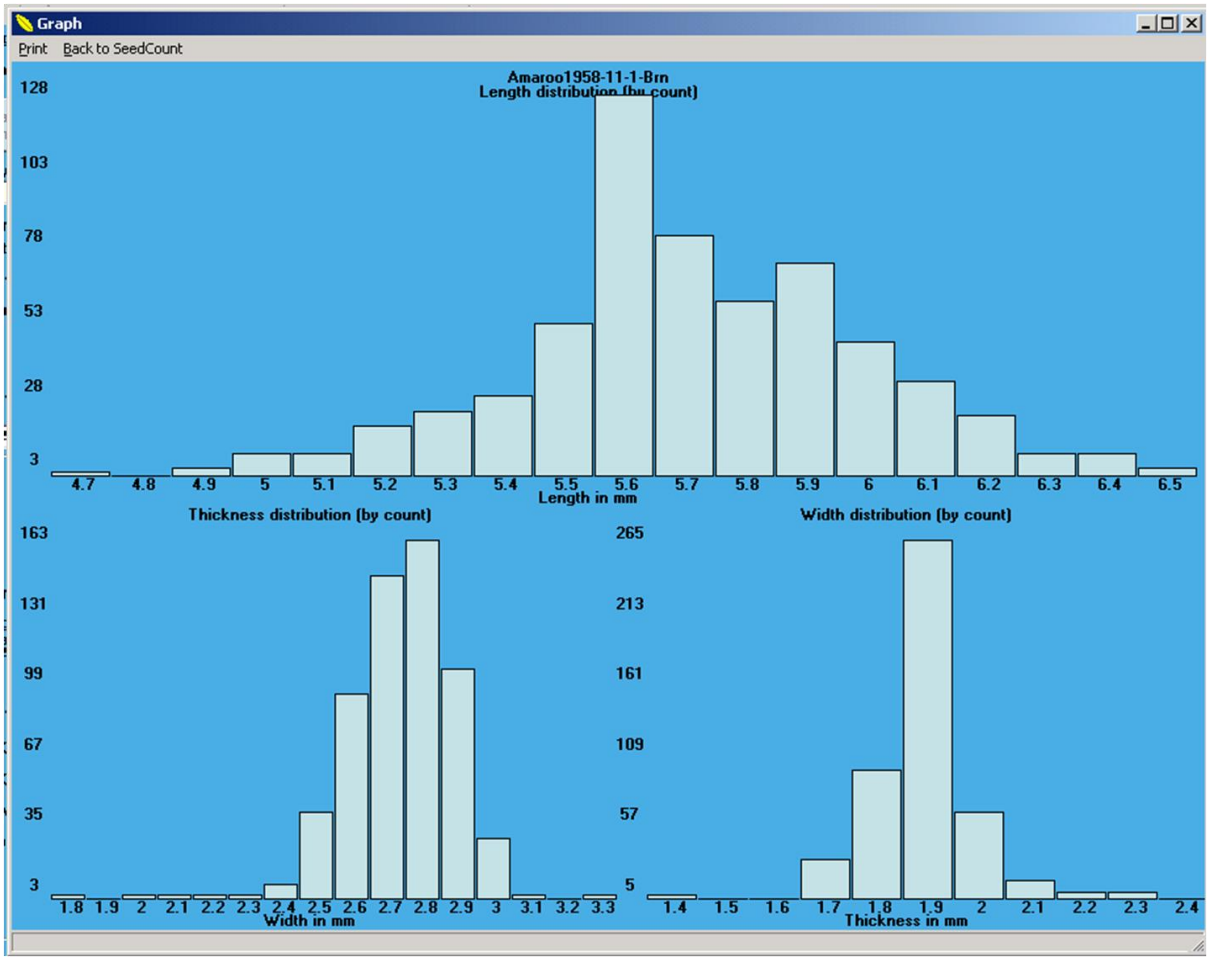

Figure 5: Dimensional Distributions of Amaroo Brown Rice

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References
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Martin, M. Hart, K.R. Blakeney, A.B. and Lewin L.G.(1997) Image Analysis To Assess Dimensions of Rice Grains. Proceedings of the 47th Australian Cereal Chemistry Conference, Perth 332-335.