Application Note 009: Thai White Long Rice Study: Whole grain and class measurements

Introduction:

9 images provided by the customer were used to calibrate the Thai white long rice module of SeedCount equipment. The new program is based also on the Thai standards for white rice. The objective is to adjust to software regarding length measurements, categorisation of the classes and recognition of head and broken kernels.

Procedure

All images were analysed and compared several times with the manual measurements, provided also by the customer, in order to tune as best as possible the software to match the standards.

Results

Table 1 shows the results of the parameters regarding classes and whole grain measurements for each image:

Name	File	% Total seeds				% Whole Grain			
		Whole Grain	Head Grain	Large Broken	Small Broken	Class 1	Class 2	Class 3	Shorts
20/10/2552	8	91.7	7.0	1.2	0.1	70.3	21.0	7.3	1.4
21/10/2552	8	87.6	9.0	3.4	0.0	67.0	22.1	8.0	2.9
21/10/2552	12	81.7	16.1	2.2	0.0	67.7	20.9	9.3	2.1
26/09/2552	10	75.3	20.7	4.0	0.0	59.1	23.0	11.0	6.9
20/10/2552	10	68.1	14.0	17.8	0.1	62.0	20.9	11.0	6.2
14/10/2552	8	81.1	15.6	3.3	0.0	82.1	12.4	4.2	1.3
16/10/2552	8	85.8	12.4	1.8	0.1	79.2	14.8	4.8	1.3
20/10/2552	cpram	84.6	15.1	0.4	0.0	10.8	31.8	37.7	19.6
20/10/2552	-	75.8	18.5	5.6	0.1	33.2	31.6	22.1	13.2

Table 1 – Results for white long rice images

Discussion:

The SeedCount results showed in table 1 have been compared with the manual measurements, presenting a noticeable improvement detecting head and class 1 grains. Table 2 presents the comparison between the manual and SeedCount measurements for the first image 20/10/2552-8. M1, M2 and M3 are the 3 manual measurements.

Name		% Total seeds				% Whole Grain			
		Whole Grain	Head Grain	Large Broken	Small Broken	Class 1	Class 2	Class 3	Shorts
20/10/2552 - 8	M1	91.2	8.0	0.8	0.0	69.4	23.9	6.7	0.0
	M2	90.4	8.4	1.2	0.0	71.3	23.3	5.4	0.0
	M3	90.0	9.2	0.8	0.0	70.9	23.9	5.2	0.0
Average		**90.5**	**8.5**	**0.9**	**0.0**	**70.5**	**23.7**	**5.8**	**0.0**
Standard Deviation		0.6	0.6	0.2	0.0	1.0	0.3	0.8	0.0
SeedCount values		**91.7**	**7.0**	**1.2**	**0.1**	**70.3**	**21.0**	**7.3**	**1.4**

Table 2 – Comparison Image 20/10/2552 - 8

It can be seen in figure 1 the differences tabled above on a histogram.
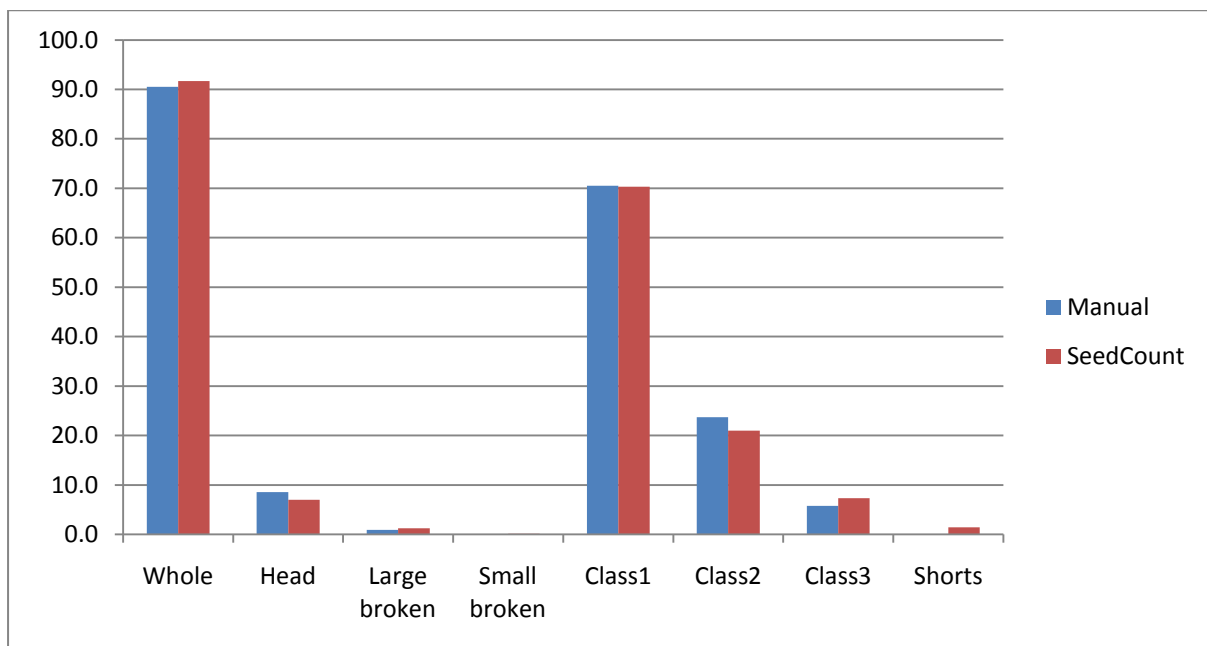

Figure 1 – Histogram Image 20/10/2552 – 8

Mainly, the discrepancies are attached to the accuracy of the equipment, which is 0.1 mm, and the human eye appreciation. When a certain seed is too close to the threshold between classes (7.0 mm for class 1, 6.6 mm for class 2 and 6.2 mm for class 3) the decision to categorise it into a particular class may vary between the software and manual procedure.

Table 3 illustrates the data of the image 20/10/2552 – cpram and here it is clearly seen the difference in class 1 categorisation because a representative percentage of the sample has its length around 7.0 mm and therefore, the software produces different values, which are also scaled to classes 2 and 3 as well.

Also, the software detects head and broken seeds but it is not counted as broken if any other seed is in the same indent. In other words, for a better accuracy it is important to avoid too many double seeds on each indent, whole or broken.

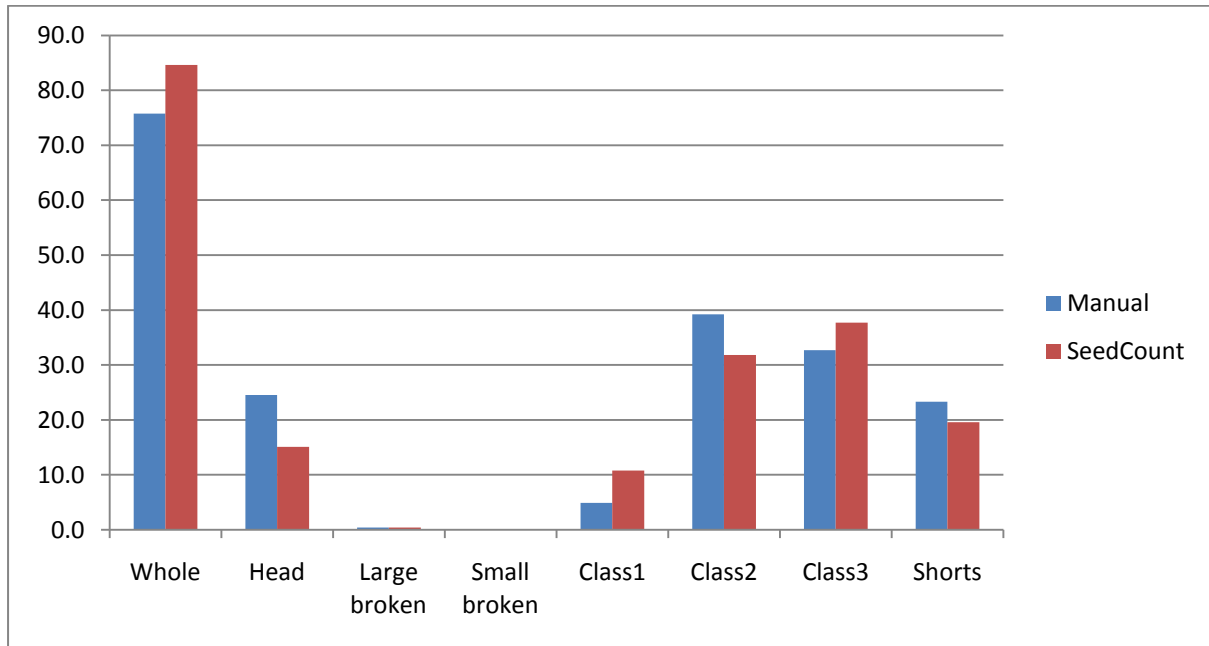| Name		% Total seeds				% Whole Grain			
		Whole Grain	Head Grain	Large Broken	Small Broken	Class 1	Class 2	Class 3	Shorts
20/10/2552 –cpram	M1	75.2	26.4	0.4	0.0	3.9	39.2	35.3	21.6
	M2	79.6	20.0	0.4	0.0	5.7	36.8	33.0	24.5
	M3	72.4	27.2	0.4	0.0	5.0	41.6	29.7	23.8
Average		**75.7**	**24.5**	**0.4**	**0.0**	**4.9**	**39.2**	**32.7**	**23.3**
Standard Deviation		3.6	3.9	0.0	0.0	0.9	2.4	2.8	1.5
SeedCount values		**84.6**	**15.1**	**0.4**	**0.0**	**10.8**	**31.8**	**37.7**	**19.6**

Table 3 - Comparison Image 20/10/2552 – cpram

Figure 2 – Histogram Image 20/10/2552 - cpram

On table 4 and figure 3, which represents the data of the image 21/10/2552 – 12, the same pattern can be observed, although in a better way than the image 20/10/2552 - cpram.

Name		% Total seeds				% Whole Grain			
		Whole Grain	Head Grain	Large Broken	Small Broken	Class 1	Class 2	Class 3	Shorts
21/10/2552 -12	M1	80.4	16.8	2.8	0.0	59.5	32.1	4.6	3.8
	M2	82.8	14.0	3.2	0.0	62.8	29.5	4.7	3.1
	M3	81.1	15.2	3.6	0.1	65.4	28.5	4.6	1.5
Average		**81.4**	**15.3**	**3.2**	**0.0**	**62.6**	**30.0**	**4.6**	**2.8**
Standard Deviation		1.2	1.4	0.4	0.0	3.0	1.9	0.1	1.2
SeedCount values		**81.7**	**16.1**	**2.2**	**0.0**	**67.7**	**20.9**	**9.3**	**2.1**

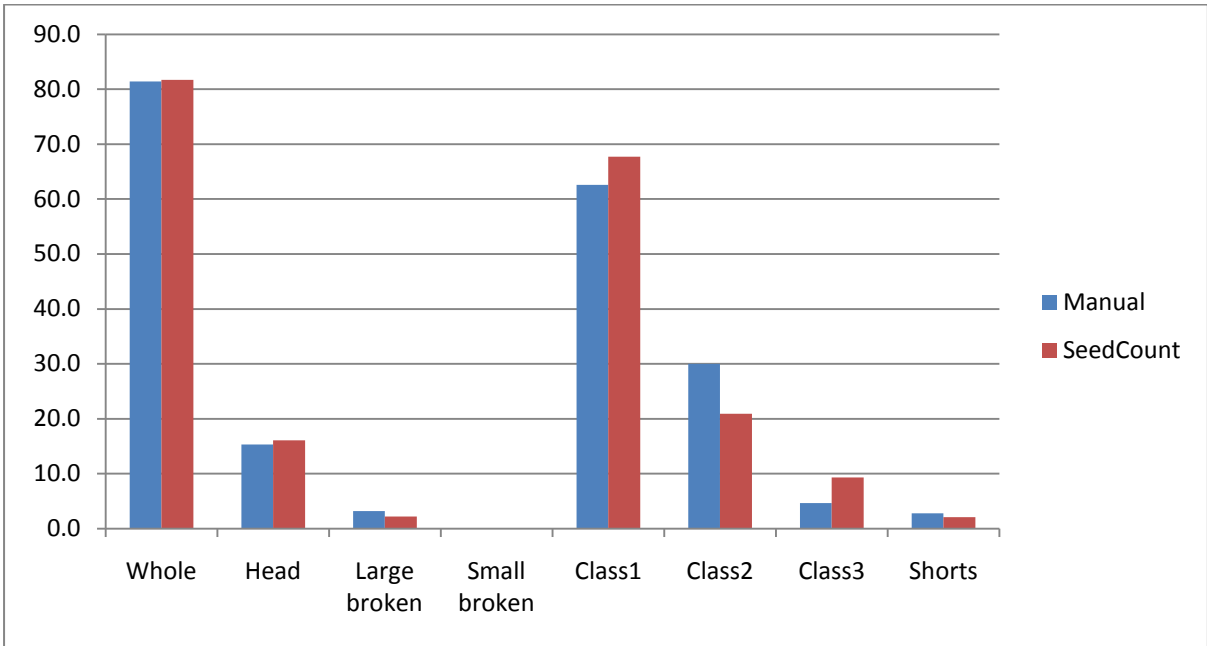Table 4 - Comparison Image 21/10/2552 – 12

Figure 3 – Histogram Image 21/10/2552 - 12

Find attached a spreadsheet with a histogram for each of the 9 images.

Conclusion:

It can be concluded that when the grain sample includes with a high percentage of whole seeds (more than 80%), the measurements are more accurate, and therefore, the results should match quite well for extra well milled rice. However for low percentage of whole seeds (less than 75%) the differences between the SeedCount analysis and the manual assessment increase. The question is if these differences are acceptable for the Thai white long grain rice and if not, what are the acceptable limit of difference. Also which parameters (eg, Head grains, long grains, broken etc.) need adjustment, what are the recommended maximum tolerance of each parameter.