Application Note SC007: Assessment of SeedCount Image Analysis System.

Denise Pleming, Technical Officer, Wheat Cereal Chemistry, Wagga Wagga Agricultural Institute. 22nd December 2003

A total of 30 samples were evaluated on the SeedCount instrument at Wagga Wagga Agricultural Institute in December 2003. These covered a range of blackpoint, seed size and screenings values, and included both clean and dirty samples. SeedCount instructions were followed for sample presentation, although ensuring grains were "firmly seated" in the tray wells proved impossible.

SeedCount offered little advantage over WWAI routine laboratory test time, although some savings may be made at the data entry stage. At completion of testing on SeedCount, the sample is not suitable for further analysis (NIR scanning, SKCS evaluation, grinding), as opposed to current testing procedure which produces a clean sample ready for any further analyses required.

Presentation to the SeedCount instrument involves taking a sub sample of set volume (30.7ml), and distributing over the tray so that a proportion of the grains are presented crease up or down in wide slots, and a similar proportion presented sideways in narrow slots. Of this total (routinely between 20 and 25 grams), SeedCount typically relied on between 500 and 850 whole grains to perform calculations and make predictions for this sample set.

Laboratory values for screenings percent were generated from a 300g sample using 40 shakes over a 2mm screen on the Agtator instrument. Kernel weight, mini test weight and blackpoint percent values were all generated using only that portion of the sample that remained above the 2mm screen, in keeping with routine testing procedure at WWAI. Large-scale test weights were performed on clean samples only, without prior preparation on Agtator.

In summary, SeedCount kernel weight was the only parameter to have an acceptable correlation to laboratory values ($R^2 > 0.9$). Screenings % correlation was below acceptable range ($R^2 = 0.53$ to 0.70), while test weight correlation was totally unacceptable ($R^2 < 0.31$). SeedCount was also unable to accurately identify blackpoint-affected grains. Detailed discussion of each of these parameters follows.

Screenings %

SeedCount generates "Virtual Seed data" to estimate seed thickness, and to then assign seeds to one of a number of screenings groups: >2.8mm, 2.5 – 2.8mm, <2.5 – 2.2mm, <2.2 – 1.6mm, and <1.6mm. Only whole grains that are properly aligned in the wide and narrow sections of the tray are used to generate virtual seeds.
A dockage weight is also generated, representing the mass of sample made up of broken seed fragments, awns, and weed seeds identified by SeedCount. Further to this, in the case of dirty samples, the difference between the original weight and the (operator manually) cleaned weight of the sample is also added to the dockage figure.

The total dockage weight is added to the screenings equivalent data, presumably in the <1.6mm set.

The correlation (R^2) between SeedCount screenings (<1.6mm plus 1.6 to 2mm seed groups) and manual screenings was found to be no greater than 0.70. A number of comparisons were carried out, using combinations of samples (clean, dirty, or all) and screenings data (including or excluding dockage), giving a range of correlations between 0.53 and 0.70 R^2. Clean samples gave better correlations than dirty samples, but the pattern was not consistent, with SeedCount giving both higher and lower estimations than the laboratory value across all sub-sets. Laboratory values for screenings ranged from 0.6 to 11.3%, while SeedCount values ranged from 0.9 to 17.2% including dockage and 0.3 to 11.3% excluding dockage.

SeedCount's own documentation states that the screenings equivalents generated by the system "are not accurate enough to be used for commercial quality assessments such as determining the percentage of wheat sample in the less than 2.0mm screen group".

Test Weight kg/hl

The correlation for test weight was very poor ($R^2 < 0.31$). Lab values were generated using the mini-test weight for all 30 samples, and the clean samples were also tested on the full-scale chrondrometer (correlation between mini and full-scale test weight results was good at $R^2 = 0.91$).
Mini test weight values ranged from 73.9 to 85.9 kg/hl, while SeedCount estimations ranged from 69.8 to 84.6 kg/hl. The SeedCount test weight value was lower than the laboratory value in 20 of the 30 samples, although the difference was not consistent ranging from 0.2 to 11.2 units.

The methodology for determining test weight is not documented, but presumably SeedCount uses the volume of grain presented (30.7ml) and the total weight of grain less dockage and screenings. On the results for this selection of samples, the SeedCount instrument could not be viewed as capable of generating useful test weight data.

1000k weight

SeedCount prediction for 1000k weight (Kwt) correlated well with laboratory values (R^2= 0.93). Laboratory values for Kwt weight ranged from 25.4 to 46.8g, while SeedCount Kwt values ranged from 24.6 to 45.7g. In all but 8 of the 30 samples, SeedCount gave a lower Kwt than the laboratory test, with the difference ranging from 0.1 to 4.2g. Across all samples, only 2 gave a difference of greater than 2g between SeedCount and laboratory values.

Blackpoint %

SeedCount was unable to accurately identify blackpoint-affected seeds.
Blackpoint incidence is calculated on the basis of only those whole grains that are presented crease down in the wide slot section of the tray, routinely between 100 and 250 seeds.
Of the 30 samples tested, 12 were visually determined to have some degree of blackpoint incidence, ranging from 0.4 to 14%. Of these 12 samples, SeedCount identified only 4 as containing blackpoint-affected grain, with values ranging from 0.4 to 1.2%, and did not identify the 14% sample as containing any blackpoint. Furthermore, SeedCount falsely identified 3 samples as containing blackpoint, which were in fact canola seeds lodged in the well near the germ end of the grain.