Sampling Pools of Seeds for the LibertyLink Trait in Rice

The test method being used for the LibertyLink trait in rice (LLRICE) provides a qualitative result. That is, if the method detects the presence of LLRICE in the sample, the result is positive; if none is detected, the result is negative. Theoretically, if a sample contains one kernel of LLRICE, the test result will be positive. The probability that a sample will have one or more kernels of LLRICE depends on two things – the concentration of LLRICE in the lot, and the size of the sample (number of kernels tested).

The sampling plan recommended by the rice industry for the 2007 planting season calls for testing 30,000-kernel samples per seed lot. If a lot actually contains 0.01 percent LLRICE seed kernels, the probability is 95 percent that a 30,000-kernel sample will contain at least one LLRICE kernel and test positive. (Conversely, the probability is 5 percent that the sample will *not* contain a LLRICE kernel, and test negative.)

The current testing technology cannot reliably detect a LLRICE kernel in samples larger than 10,000 kernels. (One in 10,000 kernels equals 0.01 percent, but this analytical level of detection is not related to the 0.01 statistical sampling probability discussed earlier.) Consequently, to conform with the rice industry recommended sample size of 30,000 kernels, the laboratory testing the sample must subdivide the 30,000 kernels into smaller test samples (pools or groups), each no larger than 10,000 kernels (Laboratories determine the optimum pool size based on their own internal quality assurance process). **The objective of the rice industry guidance, regardless of how many pools are tested, is to determine whether the 30,000 kernels contain a single kernel of LLRICE.** A positive result on any of the individual pools means that at least one LLRICE kernel was present in the original 30,000-kernel sample, and the 30,000-kernel sample was positive for the LLRICE trait.

When multiple pools are tested, additional quantitative information becomes available. To further understand how multiple sampling plans (more than one pool tested) may offer quantitative information, refer to the multiple sampling plan of a seed calculator such as this one: http://archive.gipsa.usda.gov/biotech/samplingplan1.xls. If you test six 5,000-kernel pools, and one is positive, the probability that it contains 0.01 percent (or less) is 76 percent (1 minus the 0.2436 probability of rejection from the chart). If two of the 5,000 kernel pools test positive, the probability that seed lot contains 0.01 percent or less LLRICE is further reduced to 44 percent. These confidence levels are both below the stated rice industry objective of 95 percent at the 0.01 percent level.

Statistically, we can conclude that when testing samples of 30,000 kernels, regardless of the number of pools, no positives can be allowed to achieve a 95 confidence that the lot represented by the sample contains less than 0.01 percent LLRICE.