



## John Innes Centre Testing Confirms Pod Shatter Resistance in Modern OSR Hybrids

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Carefully-controlled testing by the John Innes Centre in Norwich has shown significant differences in the pod shatter resistance of commercial oilseed rape varieties as well as the specialist breeding lines developed in its five-year Innovate BBSRC-funded Crop Improvement Research Club (CIRC) project into the subject coming to an end this autumn.

The testing carried out on five popular winter OSR varieties using a standardised Random Impact technique showed pods of hybrids, DK Extrovert and Excalibur to be on average nearly three times as resistant to shattering as those of a pure line and non-DEKALB OGURA and MSL hybrids.

“Solved by cereal breeding thousands of years ago, the problem of pre-mature seed shedding remains a serious issue in oilseed rape,” stresses head of crop genetics, Professor Lars Østergaard who leads JIC’s pod shatter research.



“Averaging 15-20% per year, winter OSR yield losses can exceed 70% after adverse weather or where harvesting is unduly delayed. Quite apart from the loss of revenue, this has major implications for volunteer control in subsequent crops.

“Following on from our work establishing the genetics of pod shattering in the model plant, Arabidopsis, our CIRC research has identified clear genetic differences in artificially-produced oilseed rape lines that could be exploited to reduce such problems. This has been done using a testing protocol first developed by my colleague, Dr Colin Morgan a couple of decades ago.”

The Random Impact Testing (RIT) regime employed by JIC involves automated shaking of pods in a cylindrical container with metal ball bearings at a standard intensity. After each eight second interval, the percentage of broken pods is assessed, allowing a ‘decay’ curve to be plotted from which the time taken to break half the pods is calculated.



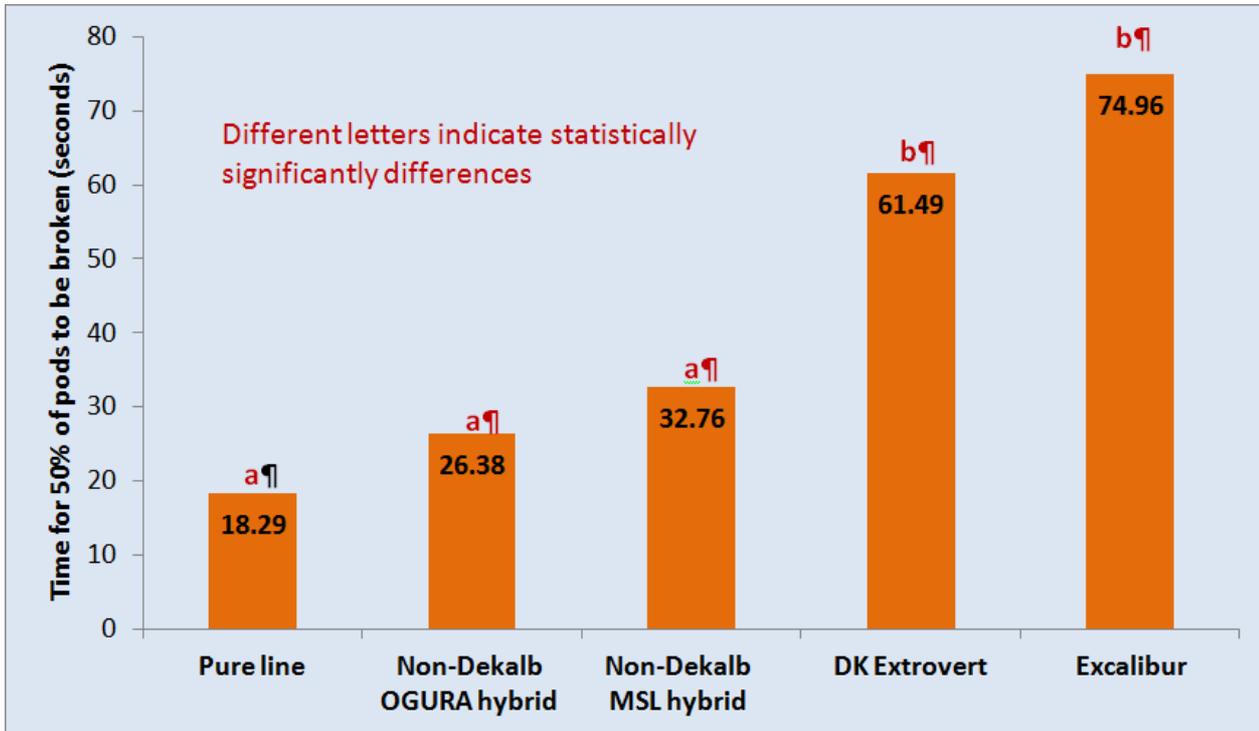
“Employing this process, we took 40 dry, well-developed, disease-free pods from the primary and secondary branches of three plants each of five winter OSR varieties in trial plots near Cambridge just ahead of harvesting,” explained PhD student, Marie Brüser who undertook the variety testing.



“We placed them in a calibration chamber at 23°C and 50% relative humidity for five days to eliminate any interference from differential pod drying, then split each plant sample into two lots of 20 for testing. This gave us six samples per variety. We also weighed the pods and recorded their length so we could account for any variations from these factors in our analysis.”

The JIC team’s extensive Random Impact Testing work over the years has shown such a close correlation between pods from the same plant and such marked differences between shatter resistant and susceptible lines that six samples have been found to be quite sufficient for scientific accuracy. And so it proved on this occasion, with DK Extrovert and Excalibur showing average pod ‘half lives’ of 61.5 and 75.0 seconds respectively against 18.3, 26.4 and 32.8 seconds for the other three varieties (Figure).

Figure: Pod ‘half lives’ of commercial OSR varieties in JIC testing



“DK Extrovert and Excalibur pods stood out as being significantly stronger and more resistant to shattering than those of the other three varieties,” reported Marie Brüser. “And this despite the inclusion of one plant from the Excalibur plot that was so obviously different from the other two in its short pod half-life as well as pod length and 1000 seed weight that it had to be volunteer or a seed contaminant from another variety.

“We did find a weak correlation between pod ‘half-life’ and pod length, but this was insufficient to make any difference to the statistical significance of our results. So we can be certain the DEKALB hybrids are inherently less prone to seed shedding than the others.”

“It’s really encouraging to see our testing revealing such clear pod shatter resistance in commercial varieties,” said Professor Lars Østergaard. “We know how important the character is and, after more than 10 years exploring its genetics, see it as potentially very valuable in reducing seed losses in the run-up to and at harvesting, helping to make OSR yields more predictable and OSR volunteers less troublesome.

“The fact they are expressed in hybrids means the precise genes involved in this resistance must be different from the recessive ones identified in our investigations which we look forward to seeing in commercial varieties in due course. However, they have a similarly substantial effect and almost certainly act on the same pod valve margin-binding mechanism we’ve shown to be responsible for seed shedding in both Arabidopsis and oilseed rape.

“Having validated our carefully-controlled Random Impact Testing on modern varieties as well as our own shatter resistant and susceptible pre-breeding lines we also look forward to seeing the technique used as a standard pod shatter resistance evaluation in future OSR variety breeding and testing.”