VARIETAL RESPONSE OF DRY BEAN (NAVY) SEED TO MECHANICAL DAMAGE CAUSED BY DIRECT COMBINING PRACTISES. C.L. Gillard¹ and S.J. Park².
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Approximately 75% of Ontario bean growers practice direct combine harvest of navy beans, using conventional field combines with either a conventional cylinder or rotary type threshing system. This harvesting method has made navy bean seed coat damage become more of a concern in Ontario. Damaged seed coats leads to processing problems and poor canned bean quality, as well as lower emergence and vigour in a seed crop. This study was initiated to evaluate the varietal response to mechanical damaged caused by direct combine harvest in Ontario.

Materials and Methods

Varieties: All (n=24) recommended Ontario white bean varieties were evaluated for mechanical damage in an agronomic study from 1997-1999. Two sites, located approximately 270 km apart in southwestern Ontario, were used in each year of the study. The first site was the Huron Research Station, E.R. #1 Exeter ON (2950 crop heat units - Brown and Bootsma 1993, Gleysolic order imperfectly drained Huron clay loam) and the second site was the AAFC Greenhouse and Processing Crops Research Centre, Harrow ON (3500 chu, Luvisolic well drained Fox sandy loam).

Methods: Plants were pulled as they approached maturity, when the seed moisture was approximately 25%. They were carried into a building to be dried slowly down to 18% moisture. All experimental units were threshed at 18% moisture, +/- 0.5%. The plants were threshed using a Hege model 140 small plot combine, using cylinder speeds of 350, 700 and 1000 rpm to create the damage to the seed coats. The damaged seed was analyzed using four tests:

i) Stain test: 100 randomly selected seed were dyed with an iodine or erythrosine solution, and then placed into 5 groups: Group 1 = no visible seed coat damage, Group 2 = one or two minor cracks in the seed coat, Group 3 = several minor cracks or one major crack in the seed coat, Group 4 = more than 1 major crack, but the seed is intact, and Group 5 = a split seed.

ii) Drop test: 100 randomly selected seed were dropped individually from a height of 2.6 m onto a steel plate set at a 15° angle. Seed were then separated into 5 groups, as in the stain test.

iii) Canning test: as per Agriculture and Agri-Food Canada - Harrow (S.J. Park) methods. After 14 days, canned samples were analyzed using organoleptic methods (texture, flavour and appearance) and instrumental methods (texture, water uptake and clumping).

iv) Germination test: using environmental conditions of 25 oC, +/- 95% humidity and 8 h light and 16 h dark. A total of 100 randomly selected seed were used for each experimental unit, with the split seed being separated out and counted before the test was started.

Data analysis: A weighted average index was calculated for each sample placed in the staining test. The weighted average was simply the number of beans that were placed into each of the 5 groups, multiplied by the number of that group, as shown in the formula below. The scores for each group were added together, and then divided by 100. The possible range of weighted average index was from 1.0 (100 seed with no damage) to 5.0 (100 split seed), although the weighted average index typically ranged from a low of 1.1 to a high of 2.0.
((Group 1 x 1) + (Group 2 x 2) + (Group 3 x 3) + (Group 4 x 4) + (Group 5 x 5)) ÷ 100

**Results and Discussion**

Results of the stain test indexes from the combine threshed white bean samples are summarized in Table 1. The staining test, using combine cylinder speeds of 350 and 700 rpm, was found to provide good separation between cultivars. The drop test could be effective, however the seed needed to be dried to 12% moisture, and dropped several times to provide a sufficient amount of damage to differentiate between the treatments. The canning and germination tests were unable to differentiate between the treatments. Using the weighted average indexes, the varieties were clearly delineated into three distinct groups, based on seed coat damage. There were significant location (within year) and year to year effects (data not shown). However, these effects did not result in any variety moving from one grouping to another, and therefore had very little impact. This study led to further studies investigating the genetic control of mechanical damage in white bean varieties, it impacted the varieties selected by the dry bean industry for identity preserved contract production, and it led to the removal of at least one variety from the list of varieties recommended to growers.
References

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