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Susceptibility of Chickpea Varieties to Impact Damage

Chickpea production across the prairies has increased dramatically over the past number of years. Seed costs involved in growing the crop are substantial compared to other crops due to the high seeding rates required. Chickpea has been observed to be susceptible to damage through the metering and distribution systems of air seeders, as well as augers and combine cylinders. In addition, it is thought that some types and varieties of chickpea are more susceptible to damage compared to other types and varieties.

The objective of the impact work was to test various varieties of desi and kabuli chickpea for damage due to impact. Varieties selected for testing included current popular varieties plus newer varieties with good market potential. This information will be used so that the most susceptible varieties can be selected for chickpea damage testing in various types of equipment. The tests were ***not designed to duplicate air seeder performance*** but to compare the relative susceptibility to damage among the chickpea varieties.

Figure 1. Impact Test Stand.

Project Procedure

Impact Test Methodology

Four varieties of large kabuli (CDC Yuma, CDC Xena, CDC Diva, Sanford), three varieties of small kabuli (Verano, CDC Chico, B-90), and three varieties of desi (Anna, Desirary, Myles) chickpeas were obtained for the tests. The chickpea varieties were placed in a humid environment for one week to standardize moisture content.

At a Glance

- Impact tests confirmed that desi chickpea are more susceptible to damage than kabulis.
- CDC Yuma, a large kabuli, was more than twice as susceptible to impact damage compared to other large kabulis.
- Verana, small kabuli, was more than twice as susceptible to impact damage compared to other small kabulis.
- Anna and Desiray, desi varieties, were most susceptible to impact damage of all tested varieties.
- Damage to chickpea with these tests was much higher than actual damage with air seeders.

A number of impact protocols were developed to differentiate impact damage among chickpea varieties. Gravity impact, using gravity to accelerate seeds at heights as high as 6 m (20 ft), was not successful in providing enough impact velocity to generate physical damage differences among the varieties. As a result, impact velocity was increased by using compressed air to increase impact damage. The test set-up successfully used for the experiment consisted of a vertical 2.4 m (8 ft), 51 mm (2 in) inside diameter PVC pipe (**Figure 1**). At the top of the pipe a Y was installed with a 45 cm (18 in) PVC pipe angled at 45 ° to the vertical. A funnel was attached to the top of the pipe to direct seeds into the system. A compressed air discharge nozzle was attached to the top of the vertical pipe to provide a high velocity air stream within the pipe. Air velocity at the discharge end of the vertical pipe was measured at 29 m/sec (95 ft/sec). Just below the bottom (discharge end) of the pipe, a steel impact plate was mounted at 50° from horizontal. The steel plate was mounted inside a plastic rectangular tub with most of the surface covered to prevent escape of the impacted seed. Seeds were poured into the funnel, and flowed into the vertical pipe, where they were accelerated with the compressed air blast until they impacted the steel plate. The 500 g (1.1 lb) test samples were evenly poured into the funnel over a 20 to 25 second interval. To increase the

damage, each sample was run through the test twice. Following the second impact run, seeds were collected from the plastic tub and subjected to cracking and germination analysis. Cracks were removed by hand screens and then samples were hand-cleaned to remove all cracked or broken seeds. The remaining clean sample was sent to an accredited seed lab for germination testing.

Seed Damage Assessment

Chickpea damage was evaluated using two different methods. The first method was by visual inspection of physical seed damage including splits, cracks, or any seed coat penetration. Physical seed damage was quantified by removing damaged seeds from the sample and expressing this weight as a percent of the original sample weight. The second assessment method was to quantify hidden damage to the seed. Hidden damage was determined by sending the undamaged seeds to an accredited seed lab for germination tests. Total damage was calculated as the sum of percent physical damage plus the percent reduction in germination.

Results and Discussion

Impact Test Results and Conclusions

Impact results confirmed observations that desi chickpea are more susceptible to damage then kabuli chickpea (**Table 1**).

Desi varieties, Anna and Desiray, had the highest level of damage at approximately 29.5%, while Myles was much lower at 14.1% damage. The small kabuli variety, Verano, had 19.1% damage, while the other small kabuli varieties, CDC Chico and B-90, were 8.6 and 6.9%, respectively. All of the large kabuli varieties, except CDC Yuma, averaged less than 5% impact damage. CDC Yuma had 10.4% damage, which was more than double the damage level of the other large kabulis.

The levels of damage were much higher in the impact test compared to the actual air tank/air distribution tests. Refer to Research Update #756 (Bourgault Air Seeder), #757 (Case IH Air Seeder), #758 (Flexi-Coil Air Seeder), #759 (Morris Air Seeder)for actual chickpea damage from air seeders. The impact test was deliberately set up to produce high damage levels in order to show differentiation among varieties. As a result, the high levels of damage in some of the impact tests should not be interpreted as a problem when using air tanks/ air distribution systems in the field.

Overall results indicate that there are large differences in damage due to high velocity impact among chickpea types and varieties. Generally, desi chickpea has much higher damage levels compared to kabuli chickpea.

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Table 1. Effect of Impact on Chickpea Damage.

Type	Variety	Moisture Content (%)	Check Germination (%)	Germination Loss (%)	Physical Cracks (%)	Total Damage (%)
Large Kabuli	CDC Yuma	12.2	95	1.3	9.1	10.4
	CDC Xena	12.4	92	1.3	3.3	4.6
	CDC Diva	12.4	98	2.0	2.7	4.7
	Sanford	12.3	99	2.3	2.0	4.3
Small Kabuli	Verano	12.4	72	4.7	14.4	19.1
	CDC Chico	12.6	96	3.7	4.9	8.6
	B-90	11.9	96	3.7	3.2	6.9
Desi	Anna	12.1	88	5.7	23.7	29.4
	Desiray	12.0	65	0.0	29.8	29.8
	Myles	11.9	92	0.3	13.8	14.1

Sorting seeds after impact test.

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