ATTACHMENT4

WEATHER DAMAGE IN DESI CHICKPEA

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INTRODUCTION

A summer dominant rainfall in northern NSW and QLD increases the probability of experiencing pre-harvest rainfall events in winter cropping systems. Many farmers on mixed cropping properties often harvest their cereals first, leaving pulse crops in the field for extended periods after reaching maturity. This increases the risk of the pulse crops being subjected to pre-harvest rainfall. Excessive rain in November 2000 resulted in heavy losses throughout northern NSW.

Weather damage in desi chickpea is dependent on water absorption though the pod and into the seed. The visual symptoms of weather damage are pod drop, seed loss from shattered pods, vivipary (sprouting of seed within the pod on the plant), and seed shattering during harvest and handling. Farmers lose money from reduced yields through seed loss in the paddock and reduced seed quality. Current receival standards allow for only 2-8% defective material, which includes both visually sprouted and shattered chickpeas; consignments with a higher percentage are diverted to stockfeed at substantially lower prices.

The aim of this initial study was twofold;

1. To develop a prototype chamber to simulate weathering
2. To evaluate the relative weathering susceptibility of Australian desi chickpea cultivars

MATERIALS AND METHODS

Replicated pots of eight desi chickpea cultivars (Amethyst, Barwon, Desavic, Gully, Howzat, Lasseter, Semsen and Tyson) were grown in a glasshouse. Plants were deprived of water at optimum pod fill to avoid any confounding effects from differences in maturity. The weathering test was not applied to the plants until they had been dried to senescence. A reference group was evaluated at this stage (not weathered) to act as controls for each particular cultivar.

A prototype weathering chamber was constructed from an irrigation system fitted with mist spray nozzles. High humidity (90-100 % RH) and constant temperature (17.5-19.5 °C) were maintained. Plants were placed into the weathering chamber and subjected to an initial thirty minutes of misting followed by two minutes of misting every two hours over five days. A temperature and humidity datalogger was used for verification of the conditions. The plants were then allowed to dry thoroughly before assessment.

Evaluation of the weather damage was by visual assessment of pod splitting and seed sprouting. Seed colour was characterised as parameters CIE L*, CIE a* and CIE b* using a Minolta chroma meter CR-310 (Minolta Camera Co., Osaka, Japan). The total colour differences between weathered samples and the controls were then calculated as ΔE^*_{ab} for each cultivar. The propensity of seed shattering was simulated using a Steinlite CK2-M Corn Breakage Tester with an impeller speed of 1725 RPM. Seed (50.0 g) was subjected to this test for thirty seconds and the amount of shattered seed was recorded as a percentage and compared to the control group for each cultivar.

RESULTS AND DISCUSSION

A controlled environment weathering test was developed that could distinguish differences between cultivars for susceptibility to weather damage. Visual assessment confirmed that the chamber had replicated the symptoms of weather damage observed in the field after substantial pre-harvest rainfall.

The findings from the weathering chamber test are outlined in Table 1.

Table 1. Cultivar performance after simulated pre-harvest rainfall.

Cultivar	% Pods Split	% Shot Seed	% Shattered Seed
Amethyst	27	26	11
Barwon	52	21	19
Desavic	37	28	14
Gully	56	21	27
Howzat	55	15	13
Lasseter	82	41	52
Semsen	59	47	16
Tyson	31	24	11

Lasseter was clearly most susceptible to weather damage followed by Gully, Semsen, Barwon, Desavic, Howzat, with Tyson and Amethyst displaying the most resistance.

Colour deterioration in the weathered samples, measured as ΔE, was not significantly different from the control group for any cultivar. This may be explained by the absence of light in the weathering chamber. Colour deterioration probably needs the involvement of not only moisture but also light.

These findings are differ considerably from those of Knights (1993) who evaluated naturally weathered chickpea from the field. He concluded that Semsen showed the least damage (measured as cracked seed coats and split seeds) from pre-harvest rainfall, followed by Tyson, Desavic, Amethyst and Barwon. However, Amethyst and Tyson contained a smaller percentage of shot seeds than Semsen, Desavic and Barwon. The values for shot seed from the weathering chamber are much higher than the results collected from the field trial (Knights, 1993), indicating we induced more severe weather damage in the simulated test.

Initial attempts at using the Rapid Visco Analyser (RVA-4, Newport Scientific) Stirring Number method failed to show any difference between weathered and non-weathered chickpea seed. Further investigation into this has begun and will involve enzymatic analysis to measure α-amylase levels and possible modifications to RVA methodology.

CONCLUSION

Results have shown that the weathering chamber can identify differences in genotypic susceptibility to weather damage. The method will now be refined to optimise these differences, if possible, by altering the amount of weathering applied. Selection for improved resistance will then be conducted under these controlled conditions in the weathering chamber. Validation of the techniques and results from the weathering chamber will be attempted with field weathering experiments later this year. Further supporting research into α-amylase and other methods to measure weather damage in chickpea will be conducted. The long-term aim of this study is to develop a controlled environment weathering test that can identify lines possessing weathering resistance.

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REFERENCES
Knights, E.J.(1993) International Chickpea Newsletter 29, 25-27.