MECHANICAL DAMAGE OF COTTON SEED

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The introduction and rapid adoption of mechanisation in industrialised countries producing cotton was primarily driven by the increase in acreage and yield as well as the shortage, unsuitability, inefficiency, and cost of labour. This change has also led to the occurrence of mechanical damage of cotton seed.

This is of some concern as this can make the seed more susceptible to damage during chemical treatment, and from soil organisms which can lead to a significant decrease in germination and seedling vigour, reduction in storage life and could result in seed-coat fragments which is a major issue for cotton spinners.

There is no doubt that the incidence and severity of mechanical damage of cotton seed varies among varieties, locations, seasons, and growers. Anecdotal information suggests that damage levels of 10 to 15% are commonplace, with instances of even higher damage levels (≥30) not uncommon.

Seed damage is mainly caused in the harvest and post harvest areas and to a lesser extent during planting, with anecdotal information suggesting that 44% is caused during harvesting, 44% during ginning and 12% due to drying, seed cotton cleaning, and transportation. There are essentially three types of mechanical damage; Abrasion, Cuts, and Impact.

Abrasion is caused by rubbing or scraping of the seed on the surface of transport ducts etc. For the most part, abrasion results in very little actual damage, with the main issue resulting from abrasion being the generation of dust.

Cuts are caused by sharp objects such a gin saw etc. Impact on the other hand is the major cause of mechanical damage, seed which is fragile is constantly striking either stationary or moving objects.

MEASUREMENT

Randomly collect 200 to 400 seed samples from a gin run for acid delinting. These seeds are then evaluated visually by a trained and experienced operator using some type of magnification under good light. Seeds are then classified as to the severity of damage as a percentage and reported as VMD%.

- No damage: seeds with completely intact seed coats.
- Pinhole damage: seeds with only one or two small (pinhole) punctures in seed coats.
- Minor damage: seeds cracked or cut but not severely.
- Major damage: seeds with large cuts or cracks, or part of the seed coat missing.

See image examples on last page of fact sheet

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SOURCES OF MECHANICAL DAMAGE

Three factors influence the extent and severity of mechanical damage to seed: characteristics of the seed, operator, and mechanical operations.

Seed

Genetics and the morphological and structural characteristics of a seed may contribute to its susceptibility to mechanical damage if not considered.

For example, over the last decade there has been a gradual decrease in seed size, expressed as seed index in order to increase yield. Most of the varieties available in Australia have a small seed index (< 9 g), and this together with the low density seed types where the embryo does not fill the entire seedcoat can make them more susceptible to mechanical damage if adjustments are not made.

Seed with high moisture content can become soft making them more vulnerable to damage during processing.

Operator

Incorrect use, timing, and adjustment of equipment often have the greatest influence on the extent and severity of mechanical damage to seed. Operators should be appropriately trained for the required job.

Mechanical Operation

- Harvesting

Severe weathering resulting in a delay in harvesting can result in increased seed damage, with seed damage more prevalent in arid areas and dryer/hotter years as the seed coat becomes brittle resulting in increased mechanical damage.

Harvesting at high, ≥ 10%, moisture content will require the gin to dry the cotton to remove the trash which can result in the seed becoming very dry and susceptible to damage during the ginning process.

Spindle harvesters have rotating tapered, barbed spindles that pull seed cotton from opened bolls into the machine which can cause severe damage to the seed. Limited studies have shown that stripper harvesters do not cause as severe damage due to the fact that it uses brushes and bats to harvest the seed cotton.

Studies have shown that the following can contribute to VMD%:

- Fan speed
- Conveying seed cotton into the accumulator
- Ground speed
- Doffing of seed cotton from spindle
- Compressor plate pressure setting
- Maintenance and adjustment

- Ginning

The principal function of the cotton gin is to remove trash, separate lint from the seed and produce a bale for export and use in spinning mills.

Previous studies have shown that seed cotton cleaning, drying, and transporting of seed cotton can increase damage by 1% and the actual ginning process, i.e. the separation of the lint from the seed by a saw an additional 5%. Factors contributing are the feed and production rate and maintenance and adjustment of the gin stand.

<< VMD% in cotton refers to Visible Mechanical damage and it is a measure of the amount of damaged seed in cotton lint >>

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IN CONCLUSION

Although, determining VMD% can be tedious is subjective and can be expensive, it is a good indicator of the severity and cause of seed damage.

This is important quality measure as high levels of VMD% can result in decreased germination and seedling vigour, reduction in storage life and creation of seed-coat fragments.

Examples of damage

Pinhole damage: seeds with only one or two small (pinhole) punctures in seed coats.

Minor damage: seeds cracked or cut but not severely.

Major damage: seeds with large cuts or cracks, or part of the seed coat missing.

For further information:

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