pollination bag specialists

pbsinternational

research update 2016

Sorghum special

This update is primarily about sorghum and tackling the major issues faced by sorghum breeders.

We will take an in depth look at the most up to date research highlighting the performance values of various materials, and discuss our brand new product developed specifically to deal with bird damage and mold.

Read on to find out about the scary birds printed on our bags!

key findings

- **dura**web® SG1 (a new material developed by PBS International) has been shown to eliminate bird damage, prevent pollen contamination and results in much lower grain mold.
- Research confirmed that **dura**web® SG1 eliminates the need both for overplanting to allow for bird damage and for checking and replacing torn bags, making them extremely cost effective.
- For germplasm maintenance and crossing purposes, the use of carefully selected nonwoven bags instead of commonly used paper bags is recommended.

get in touch

To share your thoughts on any of the research in this update or to suggest ideas for future research contact us at **support@pbsinternational.com**

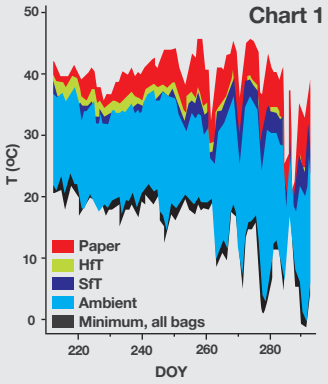
Sorghum focus:
nonwoven pollination bags eliminate bird damage, improve grain yield

Recent publications show that paper pollination bags are increasingly undesirable for sorghum breeding and germplasm maintenance, since newer materials reduce bird damage and improve seed quality. Here we take a look at four recent publications on the topic and highlight the key findings.

Most sorghum breeders (*Sorghum bicolor L.*) experience paper crossing bags damaged by bad weather or by birds. Applying the bags is a labour intensive and costly exercise, so minimising this damage make economic sense.

Source: ❶ **Gitz et al (2013)** used home-made bags from "Hard form" Tyvek® (HfT) (a protective polyethylene membrane, used in construction to keep water out of buildings). These all but eliminated bird damage however, **Gitz et al (2015)** Source: ❷ showed that the temperature inside the bags, although lower than inside paper bags, was still higher than ambient. They also found a non-significant trend towards lower grain yields.

High temperatures are known to affect pollen viability, while high temperatures plus high humidity inside traditional paper pollination bags increase grain mold, which can have a devastating impact on grain yields. In the second trial the researchers also tried "Soft form" Tyvek® (SfT), which is more air permeable, resulting in an internal environment more consistent with the ambient conditions (Chart 1), but this perforated material allowed pollen contamination (Chart 2).



Minimal and maximal ambient temperatures and those within pollination bags fabricated from different materials. Red = Paper, Green = HfT, Blue = SfT and Cyan = Ambient Low temperatures under all bag materials were indistinguishable and thus averaged and are represented in Black. n = 4.

Source: ❷

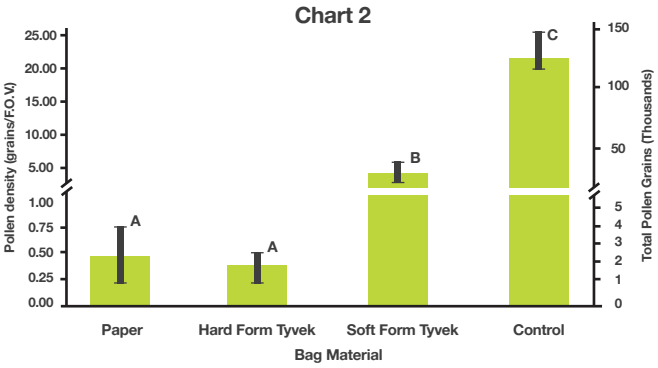
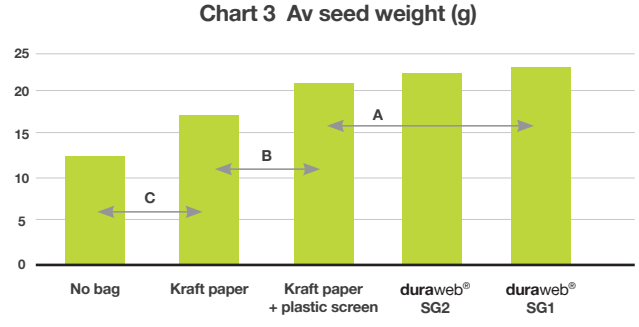


Chart 2: Pollen density on microscope slides coated with silicon stopcock grease as grains/field of view (left axis) and estimated total number of pollen grains within apparatus (right axis). Average ± SE are shown (n = 4).

Separately, PBS International had been working on this problem with Brazilian research organisation Embrapa and with a well known Indian research organisation, resulting in duraweb® SG1, a novel material which not only eliminates bird damage and prevents pollen contamination, but also results in much lower grain mold and higher seed yields.

Schaffert et al 2016 compared experimental materials for sorghum breeding against traditional paper bags and paper with a protective plastic screen.They assessed the impact on both protection against birds, and grain yields (Chart 3). The novel materials, known as **dura**web® SG1 and **dura**web®SG2, were found to be highly effective against bird damage and also demonstrated significantly higher mean grain weight per panicle than the traditional paper bags covered with a protective plastic mesh.

Source: ❸



Of course, all of these features are not helpful unless they make economic sense, so these researchers undertook a preliminary analysis highlighting:

a) The reduced risk of catastrophic bird damage

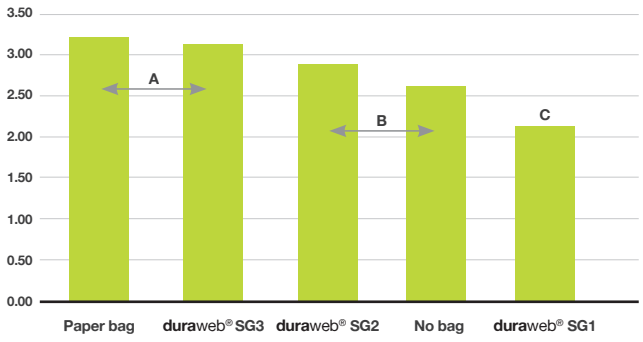
b) Avoiding the waste associated with over-planting to allow for bird damage

c) Reducing the labour cost and damage to genetic integrity associated with replacing damaged bags

d) The likelihood of re-using the bags for multiple seasons.

"The use of carefully selected nonwoven bags instead of commonly used paper bags for germplasm maintenance and crossing purposes is recommended" Schaffert et al 2016

Chart 4 Grain Mold Score (higher = worse mold)



Gaddameedi et al (2016) similarly found much lower bird damage among the experimental **dura**web® materials than the paper controls in their trials, which resulted in higher grain yields per panicle.

This trial was conducted during the rainy season in India, grain mold was a particular focus, a problem that particularly affects the paper bags. Here, the researchers found that not only did the **dura**web® SG1 significantly reduce grain mold, it reduced it to a significantly lower level than even the no-bag condition. (Chart 4).

They conclude, **"The use of carefully chosen nonwoven bags offers a number of economic benefits for replacing the traditionally used paper bags for germplasm maintenance, hybridization processes and generation advance in sorghum."**

Sorghum pollination bags made from the **dura**web® SG1 which has proven so successful will be available under the name **dura**web® Sentinel from October 2016.

Source: 4

so where do the eyes fit in?

Inspired by work done by an Australian-based ecologist painted eyes on the rear ends of cows to ward off attacks by lions, PBS International now even offers the option to have Sentinel bags printed with an Owl-type image which helps to deter birds from attacking crops!

While the research to date has not focused on the effect of visual deterrents, such bird scaring devices have a long history and researchers are optimistic.

Sources:

1 Gitz et al. (2013) American J. Plant Sci, 4, 571-574.

2 Gitz et al. (2015) American J. Plant Sci, 6, 265-274.

3 Schaffert et al (2016) J. Plant Breed. & Crop Sci. 8:126-137.

4 Gaddameedi et al (2016) In press.

news in brief

role of bag colour on seed development

In our last research update we highlighted receiving a prestigious Innovate UK Agritech Catalyst grant to develop a novel material for greenhouse breeding of sugar beet and other small-pollen crops. One early finding is that the colour of a pollination bag does have a substantial effect on the seed development.

Bags were made from materials that differed only in colour, and used on *Arabidopsis thaliana*. Despite all allowing substantial light penetration, some colours killed off the plant entirely, others attracted pests, and one colour in particular dramatically reduced the number of seeds although those that were produced were significantly heavier. Full results will be published by our collaborators at Aberystwyth University in the coming year.

We work with Innovate UK

BBSRC bioscience for the future

innovation in oil palm efficiency

Oil Palm controlled pollination is often done over 10m from the ground. PBS International recently trialled the "duraseal® tab", designed to give easy access to the inflorescence when pollination is desired, but maintain a protective barrier at other times. Feedback from customers is so far extremely positive; we hope for a launch when trials are complete in 2017.

Bags for oil palm pollination are large and expensive, so stock control is a major concern, as is traceability of the bunch, the worker and the dates of key activities. In response to these needs among cutting edge seed producers PBS International has begun to put barcodes on its oil palm pollination bags, a trend that is seeing rapid adoption world wide.

what are others up to?

If you're curious about the range of breeding programmes going on, take a look at pbsinternational.com/news which frequently features bulletins about our customers' work.

For more information go to **www.pbsinternational.com**

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forestry revisited

Better Bags = More Seeds = $14m more Revenue!

It can take a long time to get results in plant breeding, and the ongoing work with North Carolina State University's (NCSU) Tree Improvement Cooperative is no exception. It takes 18 months for loblolly pine seeds to develop from pollination to harvest; the first seeds from the trial in 2014 were collected in October 2015 and were still under analysis during 2016. It would seem the results are worth waiting for.

Two novel materials were tested; by June it was clear that Material A/B performed better than C/D in flower survival, while in seed count, Bag types A and B along with a paper bag with an additional wire support, significantly outperformed the other bag types tested.

The researchers calculated that the best performing bag, PBS type B produced on average 162 more seeds than the (industry standard) paper bag without a wire. Across the whole industry their rough calculation is that the extra revenue that these seeds could generate is in excess of $14m dollars!

Chart 5 Mean seeds per bag

These are estimated seed yield per bag based on a sample of seed yield for one healthy cone per bag multiplied by the number of cones per bag.