Evaluation of PBS Forestry Bag by Embrapa, Brazil

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Summary

Embrapa, Brazil, a leading research centre within the forest management and reforestation arena, is presently using an in-house made pollination bag for the purposes of isolating female strobili on Pinus elliottii so that a controlled cross pollination programme can be assessed.

They are experiencing high losses caused by direct damage during the bagging operation including the covering, fastening, removal and the bag material itself. In addition heat and moisture build up inside the bag make the micro climate less than ideal.

Since seeds can be almost 2 years in the making and with up to 4 years between good seed crops these losses, in terms of project time frame, are not acceptable for a research programme nor indeed would they be in the commercial arena.

PBS International have a range of specifically designed pollination bags already widely used within the forestry sector, in this instance 3D.65 bags were selected.

Embrapa evaluated both bags side by side in a controlled experiment.

The commercial 3D.65 bag supplied by PBS International greatly reduced the number of damages and improved the survival rate of the seed cone, thus greatly improving the programme efficiency and potentially increasing seed yield in a commercial arena.

Introduction

Embrapa, Brazil are currently conducting a programme of hybridisation i.e. looking at the effect of deliberate cross pollination of species based around Pinus elliotii and two species of Pinus caribaea; Pinus Honduresis and Pinus Bahamensis. Their aim is the reforestation of land and the production of a commercially viable tree for use in the construction industry.

In order to control the pollination process they isolate the female strobili using their own in-house produced pollination bags. Due to high losses of cones caused by damage from the bagging operation and un-pollinated strobili they were open to evaluating pollination bags which are already commercially available from PBS International, UK. In this instance a 3D.65 bag which is widely used within the forestry sector was evaluated.

Background information:

Embrapa Florestal, Brazil (1) is a well recognised Centre of Investigation. As an organisation they have 38 Research Centres and employ 2113 researchers. They are responsible for evaluating new technologies, services and products for all activities associated with forest management and reforestation. They have a modern research facility based in Parana State, with 54 dedicated forest researchers.

PBS International Ltd, UK (2) PBS are the worlds leading supplier and manufacturer of pollination bags and tents with more than 40 years experience of developing high quality, high specification products for use in plant breeding projects. Their products use the unique **dura**web® material which halts unwanted pollen whilst providing a micro-climate that is as natural as possible as well as being breathable, weather resistant, durable and flexible. In addition the bags use an ultra strong **dura**weld® welding process that fuses the material together. In this instance a 3D.65 pollination bag was recommended.

Pinus elliottii, (3) The species is divided into 2 varieties based on geographic location and morphological differences namely Pinus elliottii var. Densa Dorman (South Florida slash pine) and Pinus elliottii var. Elliottii Englem. (Honduras pine). For the purpose of this experiment the Pinus elliotii; (Honduras pine) was used as the ovule source i.e. the female strobili.

Wood from the Pinus elliotii is durable and hard with a thick, plate-like bark, a high resin content an extensive root system which is intolerant of salt water, and a moderate taproot. They typical grow to heights of 18 - 30.5 m (60-100 feet) and trunks average 61 cm (24 inches) in width. They can live for up to 200 years.

Pinus elliotii is an important source of timber especially in construction so have a good commercial value.

Naturally, Pinus elliotii are monoecious i.e. they have both male and female flowers. They naturally hybridize with other pines such as Loblolly Pine (P.taeda), Sand Pine (P. clausa) and Longleaf Pine (P. palustris) so are an ideal tree onto which to cross pollinate. For the purposes of this experiment the female strobili was deliberately cross pollinated with pollen from two varieties of Pinus caribaea, Bahamensis and Hondurensis.

In general, Pinus elliotti starts to produce cones at approximately 10-15 years of age. Typically good cone crops are produced every 3 to 4 years with 90% of the winged seeds falling within 50m of the parent tree.

Pinus caribaea (4), commonly known as Caribbean Pine. This is a hard pine, native to Central America. It inhabits tropical and subtropical coniferous forests, which include both lowland savannas and mountain forests. This tree regenerates quickly and aggressively in areas prone to fires and in zones not subject to periodic fires and the succession continues a tropical forest thrives. The Pinus Caribaea produces a hard wood used in construction.

The species has three distinct varieties: Pinus caribaea var. Caribaea, Pinus caribaea, var. Bahamensis and Pinus caribaea var. Hondurensis. For the purposes of this trial the later two species were used as the pollen donors.

Various trials of cross pollination of these species have been carried out around the globe, the main aim being to produce a very tall straight trunk in as short a time as possible.

Experimental Method

In a standard experimental design five trees from the Pinus elliotii species were cross pollinated with 6 varieties of pollen from 5 Pinus Caribaea Hondurensis trees and one Pinus caribaea Bahamensis in a controlled pollination exercise.

To ensure generic integrity female strobili (or ovulate cone) of the Pinus elliottii were isolated on all 5 trees to be fertilised, as it began to develop but before becoming receptive. This was achieved by fully covering the female flower with a pollination bag and padding out the base with cotton wool before tying the bottom of the bag as tightly as possible to ensure no unwanted pollen could enter. Great care had to be taken during this operation as not to damage the strobili, otherwise no cone would form and hence no seeds produced.

For the purposes of this trial 2 pollination bag types were evaluated; an in-house produced bag by Embrapa and a 3D.65 pollination bag made by PBS International from their **dura**web® material.

Fig 1a In-house bag by Embrapa.

Fig 1b Purpose designed bag by PBS

On each tree female strobili were isolated with either an in-house Embrapa bag or a PBS 3D.65 Pollination Bag, in some cases more than one female strobilus was isolated and both pollination bags were used on the same branch/tree.

Once the female flower became receptive, some 9 weeks after isolation, pollen previously taken from 5 Pinus caribaea Hondurensis and one Pinus caribaea Bahamensi was used to deliberately pollinate each of the female strobili in a controlled recorded manner, so that each tree was pollinated with pollen from each pollen source, plus one repeat.

Pollen was added via the standard method of using a puffer bottle. A small hole was made in the pollination bag and the nozzle of the puffer bottle put into the hole, the pollen was then puffed into the bag.

Fig. 2 Puffer bottle in operation (not P.elliottii)

The pollination bags were carefully removed one month after pollination.

For each cross the number of healthy cones was counted and the number of damaged/ dead/un-pollinated ones noted.

Fig. 3a Healthy fertilised cone

Fig. 3b damaged/dead undeveloped cone

Summary of results				
	PBS Bags		Embrapa	
	Survived	Died	Survived	Died
Tree 1	2	2	18	17
Tree 2	5	1	15	13
Tree 3	6	0	5	6
Tree 4	2	5	5	1
Tree 5	7	1	19	5
Totals	22	9	62	42

Fig. 4

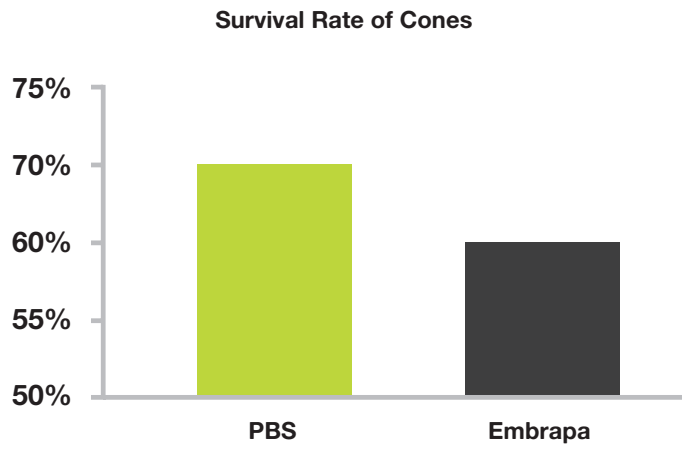

Fig. 5

A 19% improvement in survival rate is seen when a PBS bag is used; 11% more cones survived.

Conclusion

The number of damaged female strobili was much lower with the commercially available 3D.65 PBS Pollination Bag than with the in-house Embrapa bag.

This is due to the **dura**web® being a more suitable material for the bag construction, it allowed in more light, prevented moisture and heat build up and was easier to tie at the base.

Although this is a small scale trial, it shows an increase in the number of surviving cones. By changing bags from the in-house design to PBS International's products, the odds of a cone's survival improves by 19%.

This not only saves labour (fewer bags to install, pollinate & moniter for the same final volume of cones), it also reduces the risk that a particular cross may be lost, or seeds produced on an inadequate scale for a programme's requirements.

A higher survival rate enables the time frame of the programme to be greatly reduced and hence funding to be saved. In a commercial arena the increase in cones would translate into an increase in seeds available for sale and would directly give an increase in income and profits.

Sources of information:

(1) www.embrapa.br
(2) www.pbsinternational.com
(3) www.sms.si.edu/irlspec/Pinus_elliot.htm
(4) www.wikipedia.com

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