Objective

To evaluate productivity gains from improved ergonomics of a lighter and lower torque moment composite pole over the industry standard aluminum, and to evaluate the economic gains of converting YPJ 1 and YPJ 2 plantations to 100% composite poles.

Purpose

YPY 1 & 2 plantations were planted in 1988 and are due for replant. The prospect of developing the property for purposes other than agronomy make investments in replant less certain. In addition the Johor area is experienceing a labour shortage in the order of 20%. and crop losses are increasing.

Conclusion

Workers do accept the change in tools and do assimilate after approximately 3 months. Similarly breakage was seen to decrease to the level of aluminum after a period of learning the 'dos and don'ts' with composites. Composites, unlike alumium, are also repairable further reducing their cost. Prductivity was recorded to increase by 50% and cropping increased by 2% over comparive areas harvested by aluminum poles. *

These gains in productivity and reduced crop loss more than justify the high cost of composite tools over aluminum, and worker approval assists with retaining and attracting laboour.

Note:

- This conclusion is based on data taken over five months, of which three months was a learning curve. In addition, previously unreachable fuit and fronds had to be cleaned adding further burden to the workers and squing data. And some workers returned home for Ramadan leaving additional unharvested crop to be recovered. And Malaysia as a whole is experiencing low yields making it unsuitable to compare to previous years data.

- Despite the challenges, observations and data do support use of compoiste tools as a solution to tall palm recovery and labour shortages

Procedure

A manufacturer of composite tools was appraocehd with the problem in August 2010 and a proposal agreed on to manufacture a limited pre-production run of 20 sets 16 meters long (10 for YPY 1 and 10 for YPJ 2) along with spares and repares to last one year .

In addition, because breakage has been a concern in the top poles, the manufactuere encouraged YPY to purchase additional spare top tube in 1.75mm and 2.00mm wall, and additional 1.75 and 2.00 wallin the tape wond method as these are known to be substantially more durable. Experience with the four types would assist in determining their respective value to the estate in terms of capital vs tool life vs productivity

Equipment

The 20 set experimental tool order consisted of:

60 pcs 42mm x 1.75mm wall x 5.5 meters pultrusion colour orange
20 pcs 35mm x 1.75mm wall x 5.5 meters pultrusion colour yellow
20 pcs 35mm x 2.00mm wall x 5.5 meters pultrusion colour black
20 pcs 35mm x 1.75mm wall x 5.5 meters tape wind colour yellow
20 pcs 35mm x 2.00mm wall x 5.5 meters tape wind colour red

In addition

240 repair sleeves for 35mm x 1.75mm wall

240 repair sleeves for 35mm x 2.00mm wall

180 repair sleeves for 42mm x 1.75mm wall

30 extension PU collars with SS bands and handles

30 telescopic PU collars with SS bands and handles

\30 pcs 42mm PU end caps

30 35mm PU end plugs

Component weights

42mm x 1.75mm wall = 410 g/m x 5.5 meters = 2255 grams

35mm x 1.75mm wall = 331 g/m x 5.5 meters = 1820 grams

35 mm x 2.00mm wall = 370 g/m x 5.5 meters = 2035 grams

Complete telescopic collar (incl 3 SS clamps, handle and plug) = 277 grams

Complete coupling collar (incl 3 SS clamps handle, and end cap) = 295 grams

Black Graphite connector for above coupling = 193 gram

"WITHOUT BLADE"

Total Composite tool weight for 1.75mm wall 16 meter tool = 7.095 kg

* if one 35mm x2mm wall is substituted, the net weight increases to = 7.310 kg

Centre of gravity from base=

Torque moment = net weight x distance =

Total aluminum tool weight =

Centre of gravity from base=

Torque moment = net weight x distance =

DRAWING OF BALANCE AND WEIGHT

Method

Ten harvesters on each estate were issued complete tools and instructed in their use and assembly. They were furthermore instructed 'NOT' to change or modify anything in the tools. If there is a problem stop using the tool and notify the assitant.

This was done so that any problems with a tool or it's component can be attributed to the manufacturere and can be traced. The collars and clamps and plugs were all prototypes and the manufactuere is able to make design and material changes to enact corrections.

After a perod of approximately one month, the assiistants were trained in how to repair the composite tubing using approved reinforcing sleeves and a specific epoxy and procedure. The harvesters then began to learn one by one untill all were able to make their own repairs infield

Breakages and repairs were all recorded.

Observations

Early usage infield was attended by the manufacturers representative and the assitants. There were problems with collars slipping and the manufactuere had issued two different designs. One was more successfull than the other. The reasons for slipping were identified in the material and design. As these are an injected moulded component, the changes in the moulds will only me made for subsequent orders.

Some stainless steel bands and plastic handles also broke or the thread stripped early on. This was identified by the manufactuere as requiring a different size band and having the handle injection moulded over a brass insert in lieu of stainless on stainless. The handles issued were modified production handles from an outside sources as the order was only for 60 pieces. A temporary solution.

Breakage was also unacceptabel compared to aluminum. However the manufactuere did investigate

at source and confirm the tubing is of proper strength but as composites do not accept 'impingement' failure was more due to handling than material failure. Composites will not dent of bend but if the fibers are damaged they may fail later.

As is turned out, over the next few months the breakages subsided to the failure of alumium as workers learned how dufferently to treat them.

Data

Economic Calculations

Recommendations

There are minor problems with the PU collars which we have every reason to believe the manufactuere will rectify.

The difrence in durabilty between the 1.75 mm walll and the 2.00 mm wall was indecernable. Given the additional cost and weight it should not be considered. 1.75mm wall in adequate.

The tape winds were sent in 1.833 meter sections and assembled on location. This is more convenient for transport to the plantation and offers a harvester a choice of which combinations he would like to assemble. It does add a minor cost and weight by adding repair skeeves, but with the added durabilty of the tape winds, there is likely an overall advantage.

As the tape winds have not been in the field very long it is difficult to tell what the difference would be but it would be worth considering making a production order partially of tape winds to find the advantages over a longer period of time.

Harvesters may also combine pultrusions in any length using repair sleeves as well and do away with the extension coupling. For different applications and harvesters, this may be attractive. But not for all.

The coulr is not an issue but it shuld be bright and noticeable for safety. The manufactuere's colour is a red/orange RAL2002 but YPJ may want their own colour for company identification.