The OPRAtive Word

Technical Note 16
November 2009

An alternative method for palm plugging during targeted trunk injection (TTI): Saving costs – observations using old palm nuts.

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OBJECTIVE

To identify an alternative material to plugging treated palms with hardwood plugs that is durable, cost effective & environmentally acceptable.

INTRODUCTION

Targeted trunk injection (TTI) is the term coined when trunk injection is used for the control of leaf-eating pests of oil palm or to poison unwanted or aged palms. This technique is used in oil palm plantations in Papua New Guinea (PNG). The holes in trunk-drilled oil palms are currently plugged with wooden plugs primarily to prevent water ingress and to prevent the subsequent invasion of the wound by insects and possibly fungi, when the insecticide effect has worn off after about 60 days.

OPRAtive Word Technical Note 3 (2004) addresses issues concerning the safe handling of the systemic insecticide methamidophos, while OPRAtive Word Technical Note 9 (2006) provides recommendations for the trunk drilling procedure as TTI.

Current recommendations for the control of leaf-eating pests of oil palm in PNG are that once the insecticide is injected, the drilled hole is plugged with a 20mm x 20mm square piece of hardwood cut to 10cm lengths, which is tapped into the hole in the trunk of the palm. Large sacks of plugs are taken into the field and "pluggers" need to replenish their carry packs regularly from a central area. They are also heavy and awkward to carry around and only a part of the wooden plug is tapped into the drill hole in the trunk, while most part sticks out. The plugs are sometimes maliciously removed, or fall out naturally as the drill hole edges rot back exposing people to potentially dangerous chemicals and leaving the hole in the palm at risk from contamination.

There are alternatives to wooden plugs for use in TTI. These include sand and water as used in Colombia and clay and petroleum tar as used in Malaysia. Petroleum tar is not readily biodegradable, may be toxic to the palms and it is heavy and awkward to carry. It is unlikely to be accepted by the palm oil industry in PNG due to the ISO-14001EMS and RSPO environmental standards. Clay is often used for plugging poisoned palms at replanting time in PNG, and although it is locally available, it is heavy and cumbersome to carry. Currently, in oil palm plantations in New Ireland and in some parts of WNB, wild shrubs are cut to make plugs. Although they are readily cut from the bush, plugs are usually not uniform in thickness, and most have to be sharpened to fit tightly into the hole in the palm. Preparing the plugs takes time, and is environmentally unacceptable. When forest shrubs are used, the wood is usually soft and rapidly breaks down. The sharpened plug also increases the risk of insecticide splash back to the operator when hammered into the drill hole. On mainland PNG, rotten fruits are often used to plug drill holes.

TRIAL 1: INITIAL INVESTIGATION ON NEW IRELAND

Methods:

On Poliamba plantation, New Ireland Province, a small trial using 3 palms was set up, where the palms were drilled using the currently recommended trunk drilling procedure for TTI.

Each palm was plugged using either (1) native forest wood, (2) oil palm nut and (3) not plugged after drilling, leaving the hole exposed. These palms were felled after 12 months using a chainsaw, and checked to assess the fate of the plug options (Figs. 1-3 below). The felled palms were sectioned and photographed in July 2008 by one of us (DNW), with assistance of the field staff at Poliamba (CTP).

Results:

One palm had the wooden plug removed by person or persons unknown, while the nut remained intact and in place in the second palm. Extensive rot was observed around the drilled area in the palm that had not been plugged (Fig. 1), and in the palm where the wooden plug had been removed (Fig.2). The palm which had been plugged with the nut showed minimal comparable rot damage (Fig. 3). There were no data available on the comparative efficiency of uptake of insecticide in any of the palms.

Figure 1: Section of cut palm to show tissue rotting in an unplugged drill hole.

Figure 2: Section of palm to show drill hole plugged with forest cut plug (removed) to show decay.

Figure 3: Drill hole plugged with palm nut (nut removed to show minimal decay).
Note - the drill angle is incorrect in this photo as the section of palm has been removed for photography.

TRIAL 2: FIELD TRIAL AT NUMUNDO, WEST NEW BRITAIN

Oil palms approximately 15 years old that were suffering from an infestation of *S. decoratus* ("sexava") were drilled, injected with methamidophos and plugged using standard TTI procedures on 18 November 2008. Drilled palms were checked again on 28 May 2009, 191 days later.

Methods:

Two rows of adjacent palms (with 32 palms/row), were plugged using palm nuts while two subsequent rows (32 palms/row), were plugged after insecticide injection using the standard wooden plugs. After six months, all palms (64 palms) were checked, and the effectiveness of the plugs assessed.

A standard treatment team was used (driller, injector, plugger and supervisor). The time taken to drill, inject & plug a row (32 palms) was recorded for the four rows (128 palms), when either the palm nuts or hardwood plugs had been used.

Results:

There was no significant difference between the time taken to complete the palm treatment process using the wooden plugs or the palm nuts. Both rows taking about 20 minutes, although one of the rows plugged with nuts was completed in 19 minutes.

The nuts and plugs were checked six months later (May 2009), and their condition assessed. Of those palms plugged with nuts, only two nuts were missing (2/32), while from the palms plugged with the square pegs, in seven palms (7/32), the plugs were very loose and easily dislodged, and were barely serving a hole-plugging function.

Economic considerations:

Although the cost of the hardwood plugs might seem insignificant, with the number of palms being treated during pest management operations by plantation teams and Smallholder Affairs (SHA) teams in PNG, the cost becomes significant (Table 1).

Cost Implications:

New Britain Palm Oil Ltd. (NBPOL) plantations and smallholder growers (through SHA) in West New Britain treated more than 20,000ha of oil palm between 2005 and 2008 using wooden plugs made from sawn 10 x 2cm hardwood timber at a plug average cost of K0.15, (K0.15 in 2006, K0.14 in 2007, K0.16 in 2008). The current (2008) price for one linear metre of hardwood 2cm x 2cm is one plug is K1.60, this equates to K0.16 for each plug (we have calculated costs on the three year average cost of plugs).

Palm kernels tested as possible alternatives for palm plugging are those that are rejected and normally disposed of by NBPOL Seed Production Unit, so do not have any saleable value. We have given a nominal value (see calculations below in Table 1, based on the cost of nut oil) to a nut which is estimated to be worth about K0.0006. This is an equivalent value of some 250 nuts for the cost of one hardwood plug (average over three years is K0.15), which equates to 250 palms that may be plugged for the cost of one hardwood plug.

A 2ha block will therefore cost K40.96 using hardwood plugs, while with nuts the cost will be K0.14 (a saving of K40.82 per block.

For plantations, the cost of hardwood plugs required for a 30ha field will be K614.40 while using nuts will cost K2.15, a saving of K612.25 per field.

These costs do not however take into account the additional costs of labour, transport, fuel, or maintenance.

Table 1: Cost estimates for smallholder blocks. (NB. these totals will change as exchange rates and operating costs vary: the entire calculation is available if required).

Plug cost estimates per smallholder 2ha block		
Cost of one hardwood plug	0.16	Kina
1 FFB	25	kg
Bunches per tonne	40	bunches/t
Kernels per bunch	1500	kernels/bunch
Total kernels in 1 tonne FFB	60000	kernels/tonne
Value kernel oil (Kimbe)	370	US$
KOER (kernel oil extraction rate)	3	%
Value kernel oil in 1 tonne FFB in US$	11.1	US$
Exchange rate $ to Kina	0.33	
Value kernel oil in 1 tonne FFB in Kina	34	Kina
Cost of one kernel as plug	0.0006	kina
Size of field	2	ha
Palms per ha	128	p/ha
Field of size	2	ha
Cost for hardwood plugs	40.96	Kina
Cost of kernel plugs	0.14	Kina

Table 2: Cost estimates for plantation field. (NB. these totals will change as exchange rates and operating costs vary & the entire calculation is available if required).

Plug cost estimates per 30ha plantation field		
Cost of one hardwood plug	0.16	Kina
1 FFB	25	kg
Bunches per tonne	40	bunches/t
Kernels per bunch	1500	kernels/bunch
Total kernels in 1 tonne FFB	60000	kernels/tonne
Value kernel oil (Kimbe)	370	US$
KOER (kernel oil extraction rate)	3	%
Value kernel oil in 1 tonne FFB in US$	11.1	US$
Exchange rate $ to Kina	0.33	
Value kernel oil in 1 tonne FFB in kina	34	Kina
Cost of one kernel as plug	0.0006	kina
Size of field	30	ha
Palms per ha	128	p/ha
Field of size	30	ha
Cost for hardwood plugs	614.40	Kina
Cost of kernel plugs	2.15	Kina

RECOMMENDATIONS AND CONCLUSIONS

These calculations (Table 1) show that for the cost of one hardwood plug, 250 palms may be plugged by nuts as opposed to a single (1) palm using the standard wooden plugs. The drill sizes are smaller and cheaper, and the interior surface area within the drill hole will be better covered with insecticide for the same volume of insecticide injected.

Although only a very small sample of palms was used for the preliminary trial in New Ireland, the larger trial at Numundo showed that it will be worth using nut plugging using the tougher "Dura" palm nuts for plugging palms that are also available for the same cost estimate. These palm nuts for distribution will be washed in bleach (not costed) and then dried in a hot room at 39-42^{0}C for a month before being used as plugs, as a precaution against possible germination and fungal contamination, however nuts from the mill which will have already been sterilised could also be used.

It is recommended that the supervisor be given the task of making sure that the drill site are clear of epiphytic growth (using a chisel to remove vegetation or obstructing frond bases) before hole drilling takes place, and that drill holes are all made on the same side of the palm. This will speed up the process of checking that TTI was effectively carried out. If needs be, the plug might be sprayed using white marker paint, however if supervision is effective, this should not be necessary.

It is also recommended that a smaller size drill bit (14mm) be used when the current drill bits are replaced. This is to ensure a tight fit of the nut into the hole to take into account peripheral tissue breakdown that occurs with time.

ACKNOWLEDGEMENTS

We are very grateful to all who read this note and gave constructive criticism, especially T K Lim, NBPOL, Dr Harm van Rees, PNGOPRA, David Mather, then GM, Hargy Oil Palms and Roger Benzie, Hargy Oil Palms and Mr Philip Vovola, Manager, Seed Production Unit, NBPOL, Dami.

Ruud Engbers, then GM, CTP Poliamba is also thanked for his support.

The CTP Poliamba Technical Services Department (TSD), NBPOL Smallholder Affairs (SHA) treatment team and Jim Kombuk, NBPOL Numundo Plantation Manager, are all gratefully acknowledged for their help.

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