

REDUCING RISK OF *Ganoderma* IN SUPPLY PALMS

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The importance of basal stem rot (BSR) infected stumps as foci of new infection is of considerable relevance to planting point sanitation. This was shown by results of a trial in which bait seedlings were planted at different levels of BSR points (Khairudin, 1990; Flood *et al.*, 2000). Idris *et al.* (2004) reported that 87.5% of seedlings planted around diseased stumps (60 cm distance) left in the field became infected within two years. In contrast, only 37.5% of seedlings planted around sites, which has been excavated (1x1x1 m pit) to remove diseased stumps, became infected and none when diseased stumps have been excavated to a size of 1.5x1.5x1.5 m, 2x2x2 m and 2.5x2.5x2.5 m. Since tissues of the former stand of oil palms are the primary source of infection at replanting (Hasan and Turner, 1998), disease avoidance through sanitation is important. This paper reports the technique for reducing risk of *Ganoderma* infection in supply palms in areas with BSR incidence.

LONG-TERM EFFECTS OF EXCAVATING SOIL AND DISEASED STUMP ON INFECTION OF SUPPLY PALMS WITH *Ganoderma*

The study was started in 1983 (first year of planting) on flat and coastal alluvium soil at Batu Pahat, Johor. The areas were mapped and BSR census was carried out at six-month intervals. The planting density was 148 palms ha⁻¹ and previous crop was coconut. Two trials were involved in this study. Trial 1 was conducted in 1989 when palm was six years old with two treatments as follows: T1 - diseased palm was not removed and a supply palm was planted at a distance of 60 cm (smallholder practices), and T2 - diseased palms was removed by pushing followed by shredding,

stacking in the frond piles and excavating soil and the diseased stumps by digging a pit of 1 m width x 1 m length x 1 m depth and refilling with nearby soil, then planted with a supply palm. Each treatment was replicated six times.

Trial 2 was conducted in 1995 when the stand was 12 years old with four treatments as follows: T1-diseased palm was not removed and a supply palm was planted at a distance of 60 cm (smallholder practices); T2 - diseased palms was removed by pushing followed by shredding, stacking in the frond piles and excavating soil and the diseased stumps by digging a pit of 1 m width x 1 m length x 1 m depth and refilling with nearby soil; T3 - same as T2 but the size of pit was 2 m width x 2 m length x 1.5 m depth; and T4 - same as T2 but the size of pit was 2.5 m width x 2.5 m length x 1.5 m depth. Each of the treatment was replicated 30 times. Data were analysed by Chi-square analysis of SAS.

Disease assessment on supply palms was recorded based on visual symptoms at six-month intervals including progressive yellowing or desiccation of oldest to youngest fronds and death of supply palms with or without *Ganoderma* fructifications. By end of the trial, all supply palms were drilled at the base to examine the internal symptoms of the *Ganoderma* infection in roots and stem tissues, and also confirming the presence of *Ganoderma* by plating samples on the *Ganoderma* Selective Medium (GSM) (Ariffin and Idris, 1991). Results are summarized in *Tables 1* and *2*. Without removal of diseased palm, 83.3% of supply palms had become infected with *Ganoderma* within nine years from planting (*Tables 1* and *2*). Infection of *Ganoderma* in supply palms was only 3.3%, where soil and diseased stump had been excavated to 2 x 2 x 1.5 m and 2.5 x 2.5 x 1.5 m (*Table 2*).

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TABLE 1. EFFECTS OF REMOVING DISEASED PALM FOLLOWED BY PLANTING WITH SUPPLY PALM, THREE, SIX, NINE AND 12 YEARS AFTER PLANTING (Trial 1)*

Treatment	Supply palms infected (%)			
	3 years**	6 years**	9 years**	12 years**
T1 - Diseased stump not excavated (smallholder practices, <i>Figure 1</i>)	16.7	50.0	83.3	100
T2 - Diseased stump excavated to 1 x 1 x 1 m	0	0	33.3	100

Notes: *Study was conducted in 1989 when palm was six years old.
 No. of supply palms/treatment: six.
 **Chi-square analysis: not significant different.

TABLE 2. EFFECTS OF REMOVING DISEASED PALM FOLLOWED BY PLANTING WITH SUPPLY PALM, THREE, SIX AND NINE YEARS AFTER PLANTING (Trial 2)*

Treatment	Supply palms infected (%)		
	3 years**	6 years**	9 years**
T1 -Diseased stump not excavated (smallholder practices, <i>Figure 1</i>)	23.3	50.0	83.3
T2 -Diseased stump excavated to 1 x 1 x 1 m	0	13.3	30.0
T3 -Diseased stump excavated to 2 x 2 x 1.5 m	0	0	3.3
T4 -Diseased stump excavated to 2.5 x 2.5 x 1.5 m	0	0	3.3

Notes: *Study was conducted in 1995 when palm was 12 years old.
 No. of supply palms/treatment: 30.
 **Chi-square analysis: significant different at $p < 0.01$.



Figure 1. Diseased stump not excavated and planting supply palm (Note: *Ganoderma* infection in supply palm, two years after planting).

TECHNIQUE OF REDUCING RISK OF *Ganoderma* INFECTION IN SUPPLY PALM

Based on these two trials, the following technique is recommended for reducing risk of *Ganoderma* infection in supply palm, especially in areas with history of BSR incidence:

- Step 1 - BSR census to identify diseased palm.
- Step 2 - Mechanical pushing of the diseased palm (Figure 2a).
- Step 2 - Excavating soil and the diseased stumps by digging a pit of 2 m width x 2 m length x 1.5 m depth, measuring the size and refilling with nearby soil (Figure 2b).
- Step 3 - Destroying the diseased palm by shredding the trunk, stump and root masses into small fragments (Figure 2c), later stacking them in the frond piles to decompose.
- Step 4 - Planting with a supply palm (Figure 2d).



Figure 2. Pushing, excavating, destroying and supply palm.

CONCLUSION

The inoculum of *Ganoderma* can be reduced significantly in *Ganoderma* areas by destroying the diseased palm. Removal of diseased palm by excavating the soil, stump and root masses with a size of 2 m length x 2 m width x 1.5 m depth, and refilling with nearby soil and followed by planting with a supply palm is recommended. By adopting this technology, it can improve productivity by reducing risk of *Ganoderma* infection in supply palms in areas with BSR incidence.

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