TECHNIQUE FOR MECHANICALLY FORCED UNIDIRECTIONAL LEANING OF OIL PALM ON PEAT

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The incidence of leaning palms is unavoidable for oil palm planted on peat, even with mechanical compaction of the peat and applying the 'hole-in-hole' planting technique. Palms leaning in a disorderly manner have apparently become a serious limiting factor in oil palm performance on peat (Mohd Tayeb *et al.*, 1996). Leaning poses difficulties in field operations and maintenance (*Figure 1*). Leaning palms have resulted in reductions in fresh fruit bunch (FFB) production, ranging from 9% to 26% compared to upright palms (Hasnol *et al.*, 2007). However, palms that lean progressively with age have little impact on the arrangement of the canopy, and this type of leaning does not seriously affect the FFB yield and field operations.

Figure 1. (a) Palms leaning towards the harvesting path; (b) palms leaning towards each other; (c) palms leaning towards the field drain; and (d) uprooted palms.

FIELD TRIAL

A trial on unidirectional leaning of young palms achieved by mechanical force was carried out in 2000 at MPOB Research Station, Sessang, Sarawak. The area was classified as deep peat with a depth between 350 and 400 cm. Mechanical compaction of the harvesting paths and the planting rows was carried out during land preparation. Twelve-month-old DxP materials were planted at a density of 160 palms ha^{-1} using the normal hole planting technique.

A 2 ha area consisting of 320 palms was used as the treatment plot. The work flow is shown in *Figure 2*. The steps involved were:

Step 1: When the palms reached 30 months old, they were forcibly pushed using an excavator to lean at 45° in one direction.
Step 2: Soil mounding of palms was conducted.
Step 3: The soil was compacted or levelled and cleared of any stumps or lumber along the harvesting paths.
Step 4: Pruning of damaged fronds was carried out.

In the same planting block, 2 ha of palms with normal planting practices were used as the control plot. Four years of FFB yields were recorded, starting from 36 months after planting. The progress of leaning by the palms was recorded at six-month intervals.

Figure 2. (a) Young palms being forced to lean in one direction; (b) soil mounding; (c) excavator compacting and levelling a harvesting path; and (d) pruning of damaged fronds.

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INCIDENCE OF LEANING PALMS

The progressive unidirectional leaning palms caused by mechanical force is shown in *Figure 3*. Mechanically forced palms leaned progressively and there was no occurrence of severe leaning or toppling over and uprooting of palms. In the control plot, palm leaning occurred in a disorderly manner with severe leaning and toppling over starting at seven years after planting.

Unidirectional leaning of young palms by mechanical force helped to alleviate haphazard leaning, and subsequently minimized FFB yield losses during harvesting. This technique also provided good in-field accessibility, thus helping to increase the efficiency of field operations such as harvesting and fruit evacuation (*Figure 4*).

Figure 3. Progress of palms leaning after treatment in the (a) first year; (b) third year; (c) fourth year; and (d) fifth year.

Figure 4. Good in-field accessibility in the treatment plot (a) compared with the control plot (b).

PALM HEIGHT

Palm height was measured from the ground to frond number 41. Palm height distribution of eight-year-old palms in the treatment (mechanically forced leaning) and control plots is summarized in *Figure 5*. Overall, the height of palms in the treatment plot was lower and more uniform compared to that of the control plot. Almost 98% of palms in the treatment plot had a height of less than 3 m compared to only 88% in the control plot. It was observed that the control plot had a low harvesting efficiency due to the variations in palm height. Two harvesters with different harvesting tools (chisel and sickle) were required to cut FFB in the same area. A chisel is used for palms that are less than 3 m tall, while palms more than 3 m require a sickle for harvesting (*Figure 6*).

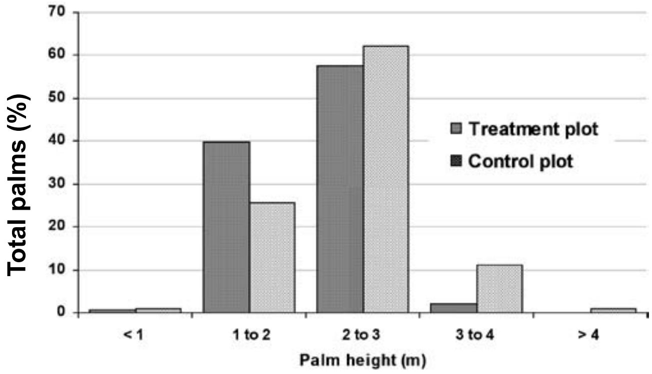

Figure 5. Distribution of height of eight-year-old palms.

Figure 6. Palm heights in (a) treatment plot were more uniform compared to (b) control plot that needed sickle (in foreground) and chisel (in background) for harvesting.

FFB YIELD PERFORMANCE

The effect of mechanically forced unidirectional leaning of young palms on early FFB yield is summarized in *Table 1*. Bunch yields for the first two years of harvesting in the treatment plot were significantly lower compared to the control plot. Yields of the treatment plot improved from year three onwards when they were significantly higher than those of the control plot. The cumulative FFB yield of the treatment plot, although higher than that of the control plot, showed a difference that was not significant. This result suggests that the treatment had a small adverse effect on early FFB yields. In later years, the technique is expected to give higher FFB yields due to the more uniform leaning direction and growth recovery of the palms.

TABLE 1. EFFECT OF UNIDIRECTIONAL LEANING OF YOUNG OIL PALMS BY MECHANICAL FORCE ON FFB YIELD AND YIELD COMPONENTS

Yield component	Treatment	Year of harvest				Cumulative mean
		1	2	3	4	
FFB ($t\ ha^{-1}$)	Unidirectional	13.9 ± 1.0	14.3 ± 1.6	28.6 ± 2.9	28.0 ± 2.6	21.2 ± 1.3
	Control	16.1 ± 1.4	18.9 ± 2.3	22.3 ± 2.3	26.1 ± 2.6	20.8 ± 1.3
	$LSD_{0.05}$	**0.64****	**1.70****	**2.67****	**2.03^{ns}**	**1.40^{ns}**
Bunch weight (kg)	Unidirectional	4.6 ± 0.2	6.6 ± 0.3	10.8 ± 0.9	10.7 ± 0.7	8.2 ± 0.5
	Control	5.1 ± 0.2	7.6 ± 0.2	9.7 ± 0.4	11.3 ± 0.5	8.4 ± 0.3
	$LSD_{0.05}$	**0.13****	**0.30****	**0.67****	**0.64^{ns}**	**0.36^{ns}**
Bunch production ($No.\ palm^{-1}$)	Unidirectional	19.0 ± 1.4	13.5 ± 1.1	16.6 ± 1.5	16.4 ± 1.4	16.4 ± 0.9
	Control	19.7 ± 1.9	15.5 ± 1.9	14.4 ± 1.7	14.4 ± 1.1	16.0 ± 1.3
	$LSD_{0.05}$	**0.83^{ns}**	**1.20****	**1.33****	**0.95****	**0.78^{ns}**

Notes: Values are mean ± standard deviations, where n = 12.
** Significant at p = 0.01.
* Significant at p = 0.05.
^{ns} Non-significant.

CONCLUSION

Work Productivity and Costing

TABLE 2. ESTIMATED COST OF THE FORCED UNIDIRECTIONAL LEANING TECHNIQUE IN TWO CONDITIONS OF HARVESTING PATH

Condition of harvesting path	Excavator work force		Estimated cost[1] ($RM\ ha^{-1}$)
	No. of palms day^{-1}	ha day^{-1}	
Poor accessibility[2]	160 – 240	1.0 – 1.5	250 - 400
Good accessibility[3]	320 – 400	2.0 – 2.5	200 - 150

Notes: [1] Based on excavator rental rate of RM 400 day^{-1}.
[2] Excavator moved along harvesting path with timber mat.
[3] Excavator moved along harvesting path without timber mat.

Benefits of the Forced Unidirectional Leaning

1. Minimizes FFB yield losses through:
   - avoidance of palm and yield losses due to incidences of uprooted palms, palms leaning towards each other, and palms leaning towards field drains and harvesting paths;
   - induction of early and progressive palm leaning that has a less negative effect on yield production; and
   - shortening the period of recovery from palm leaning (less than three years).
2. Increases the efficiency of harvesting operations through:
   - providing good in-field accessibility; and
   - having a more uniform palm height that minimizes the problem of having to use two harvesting tools (chisel and sickle) in the same area.

Recommendation

The technique of mechanically forced uni-directional leaning of young palms has good potential for minimizing the negative impact of leaning palms, such as lowering FFB yield and hampering field operations. It is recommended that this technique be adopted for oil palm planted on peat.

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