APPLICATION OF A TRACTION AID FOR TRANSPORTERS ON PEAT

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561

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The total area of peatland in Malaysia is approximately 2.42 million hectares, with 719 944 ha (30%) in Peninsular Malaysia, 121 514 ha (4.6%) in Sabah and 1 588 142 ha (65.4%) in Sarawak. Currently, the total area of oil palm planted on peat soil is about 666 038 ha (mainly in Sarawak).

Most of agriculture machines or vehicles are prone to being bogged down when working on peat. This is due to the 'very loose' and 'very soft' nature of peat (low bearing capacity), resulting in the machines not having sufficient traction and the ability to float. This restricts the machine from moving efficiently. A traction aid fitted to the wheels of a prime mover is needed to improve ground traction and its ability to manoeuvre on peat.

DESCRIPTION OF THE TECHNOLOGY

Innovation of Traction Aid

The technology called a 'cage wheel' helps a transporter to work on peat soil. The 'cage wheel' was designed to be fixed to the front wheels of a 45-hp 'crawler tractor' which was used in the study. The specifications of the tractor are given in *Table 1*.

Cage Wheel

The 'cage wheel' (*Figure 1*) which has a series of webbed fingers is meant to increase the surface contact area to provide a better grip for the tractor wheels to the soil, thus improving traction and floatation ability. The finger webs are 10 cm long and arranged at 90° to the axial of the wheel. To ensure smooth movement of the machine, a specially designed ground skid (*Figure 2*) is fixed under the machine.

Forklift-Type Bucket

Instead of pulling a normal trailer to carry loads, a forklift bucket (*Figure 3*) with a capacity of

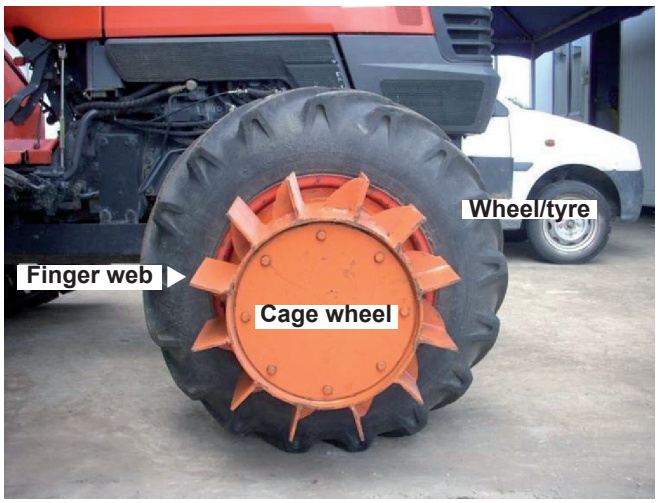

Figure 1. Cage wheel attached to the low ground pressure (LGP) tyre.

Figure 2. Ground skid to protect against obstructions for the smooth movement of the tractor.

500 kg is attached at the rear of the tractor. With this type of bucket, the advantage of having a single-chassis tractor is achieved. Hence, the tractor can be maneuvered much more easily, especially when reversing.

A counter-weight mechanism is fixed to the front of the tractor, aiming for a better weight distribution along the machine and thus providing better stability. This is important as the front tyres tend to

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TABLE 1. SPECIFICATIONS OF THE CRAWLER TRACTOR

Model	Crawler tractor L45PC 45hp
Length	3.25 m
Width	1.67 m
Weight	1 650 kg
Tyre/track	Front • Low Ground Pressure (LGP) tyre • Size : 160/55-17 @ 36 cm width • Tyre pressure: 10 psi Rear • Track • Ground pressure (track): 1.66 psi

Figure 3. Crawler tractor with a 500-kg forklift bucket.

lift off the ground when the bucket of the machine is fully loaded.

FUNCTIONAL TEST AND FIELD TRIAL

Several functional tests were carried out in a sago plantation in Mukah, Sarawak in 2008. The trial site was a peat soil which had just been planted with sago palms. It was observed that the machine fixed with cage wheels worked well without any incidence of being bogged down (*Figures 4* and *5*).

The machine was then tested at the MPOB Research Station Sessang, Sarawak. The trial site was a peat soil planted with oil palm of 10 years' age. The average bulk density of the soil was 0.2 g cm^{-3}. The machine was able to maneuver in the harvesting paths with ease. It was shown that the machine was able to evacuate 675 fresh fruit bunches (FFB)/day, or equivalent to 15 t day^{-1} or 7.5 t $manday^{-1}$, as compared to only about 1 t $manday^{-1}$ by manual collection using a wheelbarrow (*Table 2*).

ECONOMIC ANALYSIS

The costs of the machine and implements are shown in *Table 3*.

The estimated potential market of this technology (cage wheels) is about 3000 to 3500 units a year to cater for 30% of the 600 000 ha of oil palm plantations on peat. If the takers (manufacturers)

TABLE 2. FFB EVACUATION PRODUCTIVITY COMPARISON BETWEEN A CRAWLER TRACTOR (with cage wheels) *VS.* A WHEELBARROW

Method of FFB evacuation	No. of operators	Productivity	
		t day^{-1}	t manday^{-1}
Crawler tractor	2	15.1	7.5
Wheelbarrow	1	1.0	1.0

Figure 4. Crawler tractor with cage wheels and ground skid operating in peat soil.

Figure 5. The machine aided with cage wheels successfully maneuvering on peat soil.

TABLE 3. ESTIMATED COSTS OF MACHINE AND IMPLEMENTS

Part/component	Cost per unit (RM)	Units required	Total cost (RM)
Crawler tractor	85 000	1	85 000
Fork-lift bucket	5 000	1	5 000
Electrical winch	4 000	1	4 000
Ground skid	500	1	500
Traction aids (cage wheels)	250	2	500
Total			**95 000**

Figure 6. Forklift bucket fully laden with FFB.

Figure 7. Unloading FFB by the roadside.

of this technology already have basic workshop facilities, the operating cost is estimated at around RM 85 000.00 a year. Therefore, the potential revenue will be about RM 36 000.00 a year; with an internal rate of return (IRR), net present value (NPV @ 12%), benefit cost ratio (B:C @ 12%) and payback period of 45%, RM 12 821.00, 1.04 and two years, respectively.

CONCLUSION

The technology (cage wheels) will be very useful for many transporters on peat soil. Wheeled transporters like tractors have difficulty in working on peat as they are prone to being bogged down. This technology will increase the ground contact area of the wheels, thus reducing ground pressure which helps the transporter to 'float'. Also, the webbed fingers of the cage wheels help to increase traction. The cage wheels can be attached to the wheels of any transporter, thus its usage is not limited to only a specific transporter.

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