

## Technologies for ground vehicle operating on peat and soft ground area.

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### ABSTRACT

The Malaysian plantation sector is dominated by the oil palm industry, and this sector needs innovative in-house technologies to improve the productivity as well as reducing costs. The current oil palm area stands at 5.85 million ha, which are planted on various ground soil conditions. This wide range of topography will definitely require diverse technical specifications of capabilities of machines to accommodate it. A tracked machine is known for its ability to work under wet and soggy ground conditions but it is costly to maintain. MPOB has developed a new transporter where it can be run either with all four (4) wheels or a combination of front axle with conventional tyre while rear axle mounted with track. With this innovation the durability of track can be extended as it only be fitted to the machine when the ground condition is demanding it. The triangular track system fitted standard 4 x 4 transporter works well in areas that inaccessible to the conventional wheel type transporter and reduces the problem of uncollected bunches. With this machine it is envisaged that the recovery of fresh fruit bunches will be greatly improved.

### INTRODUCTION

The oil palm planted area as in 2018 is 5.85 million ha with 2.73 million ha (50.1%) in Peninsular Malaysia, 1.56 million ha (24.95 %) in Sabah and 1.56 million ha (24.95%) in Sarawak. Out of this area about 666 038 ha are on peat (mainly in Sarawak). Oil palm planted on peat or swampy area is facing challenging task when it comes to crop evacuation. This is due to the 'very loose' and 'very soft' nature of peat where the machines do not have sufficient traction and ability to float that restricts the machine to move efficiently. Apart from bearing capacity of the peat, the present of undecomposed or semi-decomposed log along the harvesting path required a special design vehicle to tackle this problem. The new concept of transporter/vehicle is specifically built for infield collection of FFB on peat and soft condition where a reliable transporter is considered crucial as it is the key activity to ensure harvested crop can be taken out from the field.

MPOB has recently redesigned the standard articulated tractor to get the optimum mobility on soft textured soils and peat area. With the blend concepts of articulated - halftrack and a cage wheeled, this transporter prototype is showing some potential to operate on the soft and peat area. For full track transporters/machines, since 1980 many fabricators/importers have tested/evaluated their units and among comments that are gathered from this exercise the maintenance cost particularly on the track and transmission system are high. With that in mind, MPOB has developed a new track transporter where compactness of the transporter design and material selection has been emphasized during fabrication with the intention of getting a reliable transporter for peat area.

### TRIANGULAR TRACK SYSTEM.

The standard articulated tractor (*Figure 2*) comes with four standard tyres. The specifications of the tractor are shown below:

Table 1: Specification of the articulated tractor

Dimension (mm)	4540 (L) x 2200 (W) x 1915 (H)
Engine	JD diesel, 24.5 HP, 2-Cylinder, Water Cooled
Gross Weight	850 kg
Transmission	5 speeds, 4 forward and 1 reverse
Fuel Tank Capacity	15 Litre
Max. Carrying Load	500 kg
Tyre Size	7.5 x 16
Maximum Speed	18 km/hr.



Figure 2 : The Hunan 124Y articulated tractor

**Advantages:**

- Improved tractive performance compared with wheeled tractor.
- Lower ground pressure than with wheeled tractor.
- Lower weight than conventional crawler.
- Can be retrofitted to conventional 2 WD or 4 WD tractors.
- Can be attached to other implements such as pesticide spraying, fertilizer application etc.

To further utilize this interchangeable 4WD system, a larger size of front wheels (12.4 x 16) were fitted on and triangular tracks system (Figure 3) were installed at the rear axles. The rubber tracks were mounted to rear axle hub and anti-torque bar were installed to secure the track to the axle. The track is allowed to rotate 15 degree with respect to the chassis to ensure the machine can travel smoothly on uneven ground.



Figure 3 : Triangular track system

**DESCRIPTION OF INVENTION**

The present invention relates to an application – This invention relates to a method of collecting bunches in area where wheel type transporter having difficulty to traverse on this area. The vehicle which has been developed can be run with standard four wheels or a combination wheels mounted on front axle while rear axle fitted with triangular track (in placed of conventional wheels) enabling the vehicle to encounter less problematic whenever it traverse onto soft structured soil or peat.

For full track transporters/machines, since 1980 many fabricators/importers have tested/evaluated their units and among comments that are gathered from this exercise was the maintenance cost particularly on the track and transmission system were high. With that in mind, MPOB has developed new wheel/track transporter where compactness of the transporter design and material selection has been emphasized during fabrication with the intention of getting a reliable transporter for peat area and soft textured soil. This invention relates to a machine with a single chassis, powered by a 38hp water cooled diesel engine, coupled to a gear shift type transmission gearbox. The front bay of the chassis house the engine and transmission gearbox while the rear chassis carry a bin with a full capacity of 750 kg. The front axle is hinged to chassis and is able to swing 15 degrees, providing excellent ground contact when traveling over rough terrain. The additional mechanism that has been improved in this new innovation is the inclusion of dual mode gearbox which is placed between front and rear axle. The input shaft from gearbox will be connected to front axle while the output shaft from the gearbox will be connected to the rear axle. Both of these connections are done through propeller shaft. The selection to run with all wheels or a combination tyre and track can be executed by positioning the control lever to the designated point. The machine can be run either with all four (4) wheels or a combination of front axle with conventional tyre while rear axle mounted with track. With this innovation the durability of track can be extended as it only be fitted to the machine when the ground condition is demanding it.

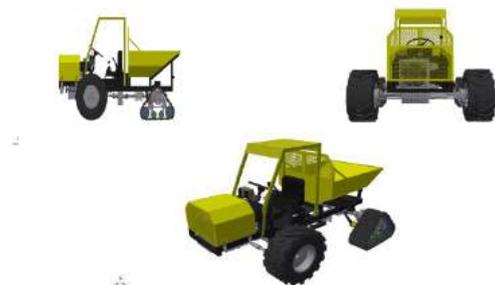


Figure 4 : The schematic drawing of the complete assemble prototype

## FIELD TRIAL

A function test was conducted once the track has been installed to the machine (*Figure 4*). It was found that after installing the track, the ratio movement between front wheel and rear track is not synchronized causing the track to slip out of the sprocket. To solve this problem a new gearbox has been constructed in order to get the suitable ratio. A gearbox provides speed and torque conversion from a rotating power source using different gear ratio. The final drive of gear ratio will allow the rear axle with sprocket to rotate 2.47 faster than front axle which is installed with tyre to have the same travelling speed.

The prototype later on was tested at the matured peat area at Penor, Pahang (*Figure 5*). From the observation, it was found that this transporter is able to function effectively in this area. However it was noticed that, the articulated tractor need to be fully engaged with the 4WD system especially for infield operation or otherwise it will tend to bog down. This prototype should have no problem to travel under 2WD mode on the main road.



*Figure 5: Field test conducted at peat area with load*

## CONCLUSION

In general, the triangular track system fitted standard 4 x 4 transporter works well in areas that inaccessible to the conventional wheel type transporter and reduces the problem of uncollected bunches. With this machine it is envisaged that the recovery of fresh fruit bunches will be greatly improved. The triangular track transporter has the advantages of better traveling speed compared to full track transporter. Besides for infield transportation of FFB, the transporter can also be used for other field activities such as fertilizer application, weed control, maintenance etc. The machine is able to reduce manual requirement as well as improve the productivity and income of the worker.

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