

Development of Mobile Traction Aid for Farm Machinery (Mo-Traid)

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Abstract

High moisture content of wetland soil makes wheeled farm vehicles have to struggle with severe loss of their mobility. Farm machinery are prone to being bogged down and traffic-ability of the soil surface layer is very poor, when working on problematic soil or soft soil area with low load-bearing capacity. This is due to hard pan damage or zero hard pan to support the machines, resulting in the machines not having sufficient traction and ability to float. A traction aid fitted to the wheels of a prime mover is needed to improve ground traction and its ability to maneuver on soft soil. Farm vehicles that are operated in these conditions require a traction aid fitted to the wheel or in place of wheel is needed to improve ground traction and its ability to maneuver on soft soil. The main purposes of this study are to examine soil behavior under traction aid device attached on the farm machinery wheel. As per the studies conducted earlier, Mobile Traction Aid for Farm Machinery (Mo-Traid) that have been develop are found to be the most effective device for wet rice fields to support and help the farm machinery when it encounter soft soil area. Mo-Traid made by mild-steel with size 30cm x 10cm x 7cm. This equipment can be adjustable with maximum length is 45cm. The weight of this equipment is 5kg and it practical to be carry to the field. From the research it was revealed that the Mo-Traid exert more pull in comparison with tires in flooded soil conditions.

Keywords: Trafficability, soft soil, mobility, traction, Mo-Traid

Introduction

High moisture content of wetland soil makes the machinery unsuitable for use with pneumatic tyre. Trafficability of the surface soil layer is very poor, being extremely soft with low load-bearing capacity when cone index are generally less than 0.3MPa at depth 30cm [1][2]. Performance of conventional rubber-tyred wheel is not acceptable because of high slippage and adhesion of sticky soil. Farm tractors and other farm vehicles that are operated in these conditions often require special devices used with tires or in place of tires. To increase the grip between machine wheels and the ground surface and to spread load weight, traction aids are needed to fit on farm machinery. The area of the wheel in contact with the ground is called the 'footprint' area [3]. If traction aids have a greater area in contact with the ground than wheels alone the footprint size increases and ground pressure exerted by the machine is reduced. Traction aids can also increase machine stability, improves flotation and protect tyres. Inappropriate selection of traction aids can have a negative impact on soil, water, the standing crop, and on machine and operator ergonomics [4]. Appropriate traction aid selection for use with a machine in a given situation is therefore very important.

Types of Traction Aid

Tyres

Traction is created where a machine makes contact with the ground; therefore the first consideration for increasing machine traction is the tyre specification. Different tread patterns impart different flotation, grip, load distribution and self-cleaning properties to the wheel; changing tyre specification can result in gains in traction. Rice production calendar generally includes the period of soil puddling and transplanting of rice seedling processes in which rice field soils are in flooded or slurry-like condition [5]. At this point of time, the wheeled farm vehicles have to struggle with severe loss of their mobility even in the field with appropriate hardpan.

Mobile Traction Aid for Farm Machinery (Mo-Traid)

Mo-Traid made by mild-steel with size 30cm x 10cm x 7cm. The weight of this equipment is 5kg a robust, easy to transport, quick to fit means of gaining additional traction (Table 1, Figure 1). Correct fit of adjustable strake to tyre is important to obtain maximum benefit and avoid damage to the tyre through slippage. The incorporation of expandable strake fit on the tyre rim provides increased grip although this may cause greater ground disturbance and operator discomfort due to a rougher ride. Mo-

Traid follow a curved profile around the wheel to reduce stress on the machine transmission. Mo-Traid plates wider than the machine wheels have flotation benefits. Anti-skid ‘spikes’ or ‘lugs’ give lateral grip to the track, helping to prevent lateral movement on side slopes. Flotation is increased as the footprint area is greater than that of the wheels. The broader the expandable plates are open, the greater the increase in flotation. Mo-Traid designed with broad plates and the smallest gap possible between plates to maximize the machine’s footprint area.

Table 1: Advantages and disadvantages of traction aids.

Advantages	Disadvantages
Increased ability to work on slopes coupled with increased safety.	Can increase width of the machine and some aggressive characteristics can cause damage to standing trees and root systems.
Increased traction.	On hard surfaces increased vibration may have negative consequences for operator ergonomics.
Prevent tyre wear and damage.	Potential for site disturbance if used inappropriately.
Increased manoeuvrability of the machine due to traction gain.	Poor fit can cause tyre wear and damage to the machine.
Reduced downtime as the machine will become bogged less often.	Additional weight and rolling resistance may lead to higher fuel consumption and reduced manoeuvrability.

Conclusion

Tread patterns may prove incompatible with some traction aids as widely spaced lugs have reduced surface area for track plate grip and support. Mo-Traid provides traction and flotation advantages under a diverse range of operating conditions. It is important to appreciate that gaining the best results in terms of traction and flotation during farm operations is achieved through a combination of appropriate traction aids and operating methods. Inappropriate

use of traction aids can be detrimental to the site. Correctly fitted aids should prolong the useful life of machine tyres with no wear.

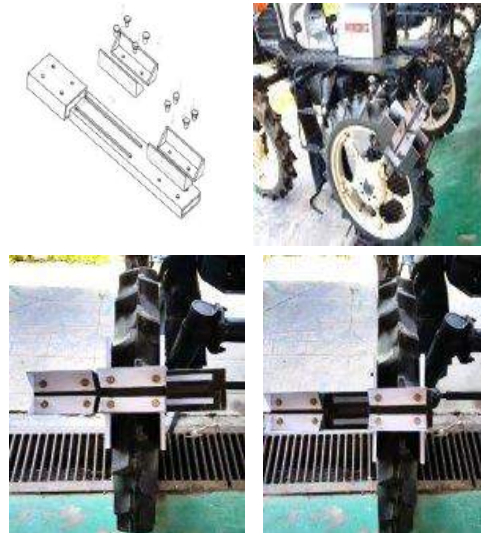


Fig.1. Mobile Traction Aid for Farm Machinery (Mo-Traid) fitted to High Clearance tyre

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