IMPROVED TILLAGE SYSTEM AND USE OF LASER-GUIDED TECHNOLOGY FOR RICE PRODUCTION

Background

In developing countries like the Philippines, common four-wheel farm tractor operation is as follows: primary tillage is done dry/moist at 20 cm initial tillage depth, while secondary tillage is done under flooded conditions. Wet and soft soil condition combined with the equipment's heavy weight and traction result in deep (>20 cm) wheel penetration and tillage depth. Continuous operation under these conditions leads to poor field trafficability and drainage, and waterlogged areas due to tire ruts and uneven soil surface. These cause equipment mobility problems (Fig. 1), non-uniform emergence and crop growth, and eventually low productivity. Improving the tillage system is needed to mitigate if not eradicate these problems.

Figure 1. Deep tillage causing bog down of equipment, a common sight in lowland areas.

The "Improved Tillage" System for Rice Production

A method of cultivating rice field similar to the common practice where primary tillage using moldboard, disc plow or rotovator is done dry/moist, while secondary tillage using harrow or rotovator is done under wet conditions (Fig. 2). The difference is that the initial tillage depth during primary tillage is at maximum of 10 cm only. This is to obtain a uniform and shallow tillage depth and a leveled soil surface using four-wheel tractor. Under wet condition, maximum of two tractor passes in the field is observed to maintain shallow tillage depth of up to 20 cm.

Benefits

- Enhance mechanization due to better trafficability
- Reduce power requirements
- Reduce water requirements
- Uniform distribution of water
- Uniform germination and crop growth
- Improve weed and snail control
- Reduce costs of operation

Limitations

- Need skilled operator
- Require well-drained fields

Figure 2. Shallow (a) dry and (b) wet tillage reduces power requirement and improves trafficability.

Laser-Guided Precision Leveling in Improved Tillage System

Laser guidance system (Fig. 3) application is commonly known and used in civil works and is widely used in the agriculture of developed countries like Australia, Japan and America. Farm operations at IRRI, particularly in leveling, is now making use of the laser technology. The use of laser in improved tillage system results in more uniform tillage depth, especially on fields that are not properly leveled.

Benefits

- Level and smooth soil surface
- Reduction in time and water required to irrigate the field
- More uniform distribution of water in the field
- More uniform moisture environment for crops
- More uniform germination and growth of crops
- Reduction in seeds, fertilizer, chemicals and fuel used in cultural operation
- Improved field trafficability (for subsequent operations)

Limitations

- High cost of the equipment/laser instrument
- Need for skilled operator to set/adjust laser setting and operate the tractor
- More efficient for regularly sized and shaped field

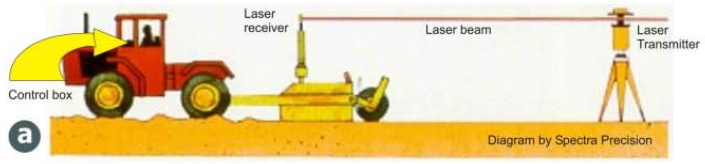

Figure 3. (a) Schematic diagram of laser operation. The control box activates the tractor hydraulic system to raise, lower or maintain the height of the tillage implement base on the horizontal laser beam. (b) Actual laser field operation. The precision (laser) leveling system for puddled soil was developed by Spectra Precision and IRRI.

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