

Study of usefulness of rotary tiller in agricultural practice

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Abstract

The purpose for this paper is to know the uses of physical rotary implement and the procedure on how to handle it about engage and disengage with 3-point hitch of tractor. Estimation on basic calculation of diesel fuel consumption by the tractor is calculated and found that with depth of tilling on 1cm and rpm of 1700, 48 seconds is needed to complete the tilling of the given length. From the data, the number of piston revolution and fuel consumption for 48 seconds is 1359.84 revolution and 0.0024 litres. Thus, the amount of fuel consumed is 1.765×10^{-6} litres per revolution. This paper showed the hand on knowledge and information about the method for handling the tractor and the rotary implement while the basic knowledge the uses of the rotary implement in agriculture is briefly discussed.

Keywords : Farm mechanization, Tractor and Rotary Implements, Agriculture Science, Crop and Soil Science

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The Rotary Tiller is after harvesting of every crop, the land has to be sowed for the next crop to be planted. For this, Rotary Tiller is a must to every farmer in order to save fuel cost, time and energy. It is the tillage operations employing rotary action to cut, break and mix the soil. It can be used in wet and dry land [1,2].

Rotary Tiller, globally known as a rotavator, is a cultivator that works on the soil by means of rotating blades. It is a tractor-operated implement attached to a three point linkage of the tractor and are driven by a power take off shaft. Unlike tractor drawn implements, the power is directly transmitted from engine, so it pulverizes the soil with minimum draft. Generally it is considered as a secondary tillage implements and also it is commonly used for primary tillage. It consists of gearbox, rotary tynes, P.T.O. shaft with shear bolt for overload protection, option of side chain drive or side gear drive, adjustable trailing board, sealed bearing, adjustable depth control skid and many more [3-5].

The Rotary Tiller is a 3 in 1 implement used to for the purpose of land preparation in the agriculture fields. It ploughs, pulverizes and levels the soil in one operation there by preparing the seed bed in one shot. Rotary Tiller is better than conventional tillage equipment because it saves time, fuel, soil compaction & wear and tear of the tractor as it accomplishes better pulverization in shortest time. It leaves the worked soil perfectly levelled. Stubbles & residues of previous crop are chopped into pieces and thoroughly mixed in soil to form organic manure. No need for multiple operations of cultivator, disc harrow and plank. Paddling in wet fields is done smoothly and quickly. Small tilling equipment, used in small gardens such as household gardens and small commercial gardens, can provide both primary and secondary tillage. For example, a rotary tiller does both the "plowing" and the "harrowing", preparing a smooth, loose

seedbed. It does not provide the row-wise weed control that cultivator teeth would. For that task, there are single-person-push able toothed cultivators. A small rotary hoe for domestic gardens was known by the trademark Rototiller and another, made by the Howard Group, who produced a range of rotary tillers, was known as the Rotavator. Field cultivators are used to complete tillage operations in many types of arable crop fields [6,7]. The main function of the field cultivator is to prepare a proper seedbed for the crop to be planted into, to bury crop residue in the soil (helping to warm the soil before planting), to control weeds, and to mix and incorporate the soil to ensure the growing crop has enough water and nutrients to grow well during the growing season. The implement has many shanks mounted on the underside of a metal frame, and small narrow rods at the rear of the machine that smooth out the soil surface for easier travel later when planting [8,9]. In most field cultivators, one-to-many hydraulic cylinders raise and lower the implement and control its depth.

Based on the experiment that had been done at the field, we can discuss here the tractor used the rotary implement to plough or tillage the soil. Rotary implement globally known as a rotavator, is a cultivator that works on the soil by means of rotating blades. It is a tractor-operated implement attached to a three point linkage of the tractor and are driven by a power take off shaft. Unlike tractor drawn implements, the power is directly transmitted from engine, so it pulverizes the soil with minimum draft. Generally it is considered as a secondary tillage implements and also it is commonly used for primary tillage [10,11]. It consists of gearbox, rotary tynes (wear resistant blades), P.T.O. (as in figure 1 - 3) shaft with shear bolt for overload protection, option of side chain drive or side gear drive, adjustable trailing board, sealed bearing,

adjustable depth control skid and many more (as in figure 4-5).

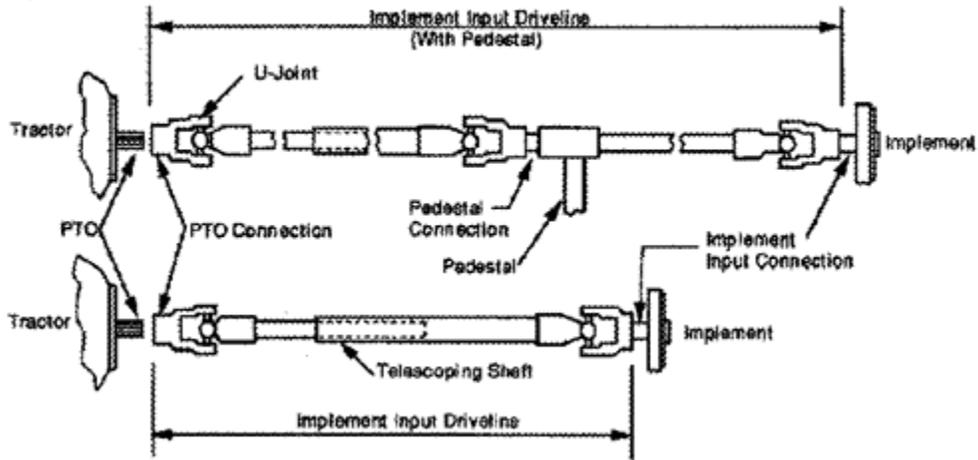


Figure-1: Major parts of PTO instrument

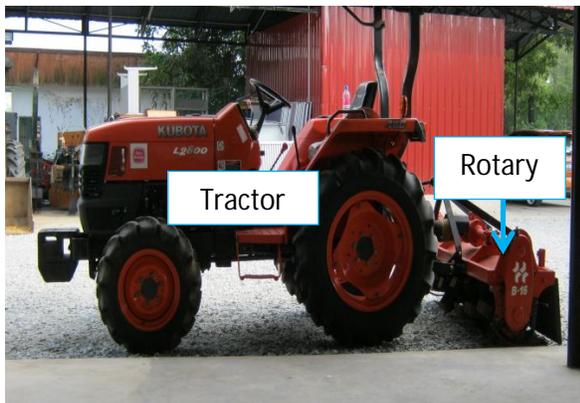


Figure-2: Rotary implement attached to tractor.

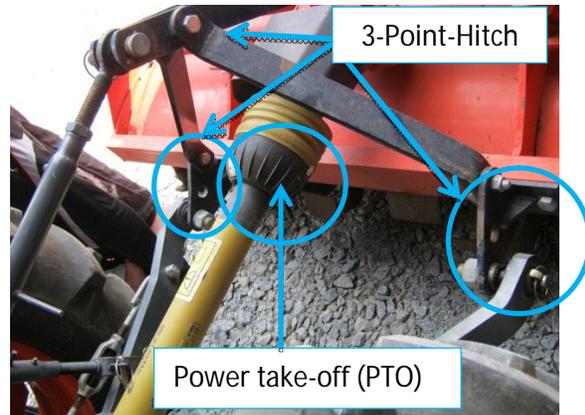


Figure: 3-Point Hitch and PTO attachment between the rotary



Figure-4: Field condition after application of rotary.



Figure-5: Rotary tractor working on field.

Rotary tillers are used for sugarcane stubble removal, eradication of rhizomes such as couch grass and broken fern and many more application. Rotary tiller is ideally smooth for seed bed preparation for root crops, fodder crops orchards & cash crops. Unlike traditional implements can produce a seed bed with one or two passes [9]. As in figure 6 since it requires no traction, the tractor and rotary tiller combination can commence cultivation much sooner after rain than traditional drawn implements. Rotary tiller can be used for puddling operation along with mulching in wet lands such as in paddy field for seed bed preparation and thus can be applied to the field of where it is needs. Rotary Tiller is used to remove sugarcane stubbles, tapioca, cotton, banana plant and mixing them back into the soil to help them with humus content and can be operated in wet and dry land conditions Rotary Tiller is used to prepare seed beds with 1 or 2 passes and incorporating other residuals in the soil while it used in eradication of weeds in orchard and coconut farming and also it can be used for puddling operation along with mulching in wet lands.

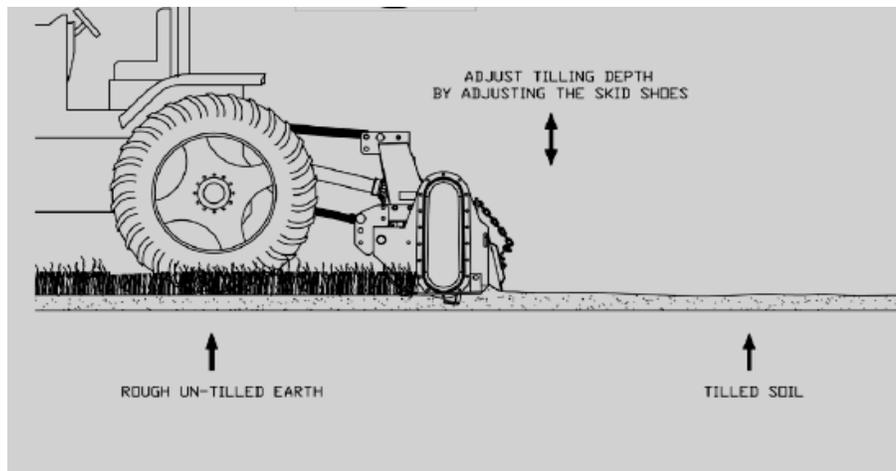


Figure-6: Theory of rotary tiller operation and application

Calculation for determination of fuel consumption on field work

The data collection during filed work is shown in table-1. So to calculate the fuel consumption of tractor with rotary implement on such type of soil are;

Table-1: Data collection from file work

Time taken	48 seconds
Depth used	1inch
RPM	1700

$$\text{RPM} = 1700 / 60 \text{ seconds}$$

$$= 28.33 / \text{seconds}$$

$$28.33 \times 48 \text{ seconds} = 1359.84 \text{ revolution}$$

Table-2: Average fuel consumption on different types of engine [5].

Engine fuel type	Average fuel consumption per rated PTO-hp
Diesel fuel	0.048 gal/hr
Gasoline	0.068 gal/hr
LP gas	0.080 gal/hr

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