Mesfin Tafesse Goshu 2007: The Optimum Design Parameters for a Rotary Blade Power Tiller Under Unsaturated Sandy Clay Loam Condition. Doctor of Philosophy (Tropical Agriculture), Major Field: Tropical Agriculture, Interdisciplinary Graduate Program. Thesis Advisor: Associate Professor Sakda Intaravichai, Ph.D. 124 pages.

One of the major concerns of agricultural machinery engineers is to develop high performance tillage equipment with low energy requirements for desired soil manipulation capability. Optimization theory has been applied widely in agricultural, mechanical, electrical and civil engineering fields, Particularly, it is used in engineering science for the development of new electronics machines, computers, and robots to reduce labour power. Moreover, it has been also applied for the development of agricultural machinery.

The study focused on optimizing design parameters in terms of total specific energy requirements of various rotary blades of a power tiller, namely, a "Pick", a "C", an "I" an "L" and a "J"- shaped rotary blade under unsaturated sandy clay loam condition. Using an optimization solver, optimum design parameters of the rotary blades have been obtained that have influenced the total specific energy requirement model. The simulated total specific energy requirement (E_{TSP}) was predicted to be 231.61, 160.72, 196.87, 168.56 and 167.56 kJ/m^3 for the "Pick", the "C", the "I", the "L" and the "J"- shaped rotary blade, respectively. The highest specific energy requirement was exhibited by the "Pick"- shaped and lowest by the "C"- shaped. Optimum design parameters of the" Pick"- shaped, namely, rotational velocity, rotor radius, depth of tillage and cutting width of 150 rpm, 170, 100 and 10 mm were obtained, respectively. The "Pick"- shaped blade was predicted to be optimum in the preset study. Accordingly, the higher specific energy requirement the lower volume of soil tilled and the most effective and optimum soil tillage operational cost were determined. Compared to another study in the same soil condition the specific energy requirement per volume of soil tilled by the "Pick"- shaped was exhibited 1900 kJ/m^3 which was higher by 87.81 % than the "Pick"- shaped blade of the study. Consequently, the specific fuel consumption requirement was predicted to be 1800 kJ/L.

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