

Tillage Rating of Soil

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Abstract Tillage is an important soil management practice for crop production. Evaluation of tillage requirement for diversified soil conditions and to specify the soil requirement for various tillage treatments is essential for economic level of crop production (Das, 1997). A tillage rating system has been proposed for assessing the applicability of tillage and no tillage practices for different soils in the tropics (Lal, 1985). Soil and climatic properties considered in developing the rating system include erosivity, erodibility, soil loss tolerance, compaction, soil temperature regime, available water holding capacity, cation exchange capacity and organic matter. Also included is the quantity of crop residue on the soil surface at seeding. No till is applicable for soils with cumulative rating of less than 30 and conventional tillage system of ploughing and harrowing for soils whose cumulative rating values exceed 45. For soils with intermediate rating some form of minimum or reduced tillage is suggested.

In alluvial soils of Delhi, Punjab and Haryana States having low organic matter and restricted (compact) subsurface layer and surface crusting, the soil management practices should include ploughing once in 2-3 years, contour, ridge and furrow bed planting (Aggarwal *et al.*, 1997; Gajri *et al.*, 1997). Soane and Pidgeon (1975) related tillage requirement to soil physical properties such as soil strength, aeration, soil water status, soil temperature and field situations. Triplett *et al.* (1973) developed a guide to assess application of no tillage on the basis of surface texture and internal drainage. Pidgeon and Ragg (1979) related tillage needs of soil to the ability of soil to resist or recover from compaction.

The major physical constraints in red sandy loam soils (Alfisol) of Tamil Nadu and Andhra Pradesh States include formation of hard large clods after cultivation following rice crop, low organic matter content, development of sub soil hard pans and low available soil water content. To alleviate such constraints chiseling to break the hard pans and addition of organic matter to improve structural conditions have been suggested (Natesan *et al.*, 1991; Uma Devi *et al.* 1991). For Vertisol of Madhya Pradesh having low infiltration rates and poor drainage, recommended practices included construction of graded bunds, contour ditches, raised bed and sunken beds, minimum tillage and mulching (Tomar *et al.*, 1996).

The development of an expert system called TESTOP that eventually would help farmers in deciding which tillage method would be most appropriate for a given farming system was reported by Mannering *et al.* (1988). Allmaras and Dowdy (1985) outlined tillage requirement of soils in US on the basis of climate and cropping systems.

The accumulated tillage rating index (ATRI) estimated from Lal's Model (1985) varied from 37-41 for lateritic sandy loam soil under both rice-wheat and rice-mustard cropping system (Anon., 1996a). The estimated ATRI indicates that compaction or minimum tillage meets the optimum tillage requirement of coarse laterite soil for raised upland rice-irrigated wheat cropping system. An improved performance of wheat crop can be attained by the application of both primary and secondary tillage. In Punjab, the tillage rating was estimated for maize and paddy by the use of 8 soil properties only, with the result the summation was relatively low (Anon., 1996b). The tillage rating indices (TRI) for different soil and climatic parameters were obtained from the values as reported by Lal (1985) and its modified form. Accumulative tillage rating index was obtained by numerical addition of tillage rating values of all 14 soil and climatic parameters. Finally, the ATRI and the corresponding appropriate tillage system were obtained from the classification described by Lal (1985) and its modified form.

Bases on soil physical constraints studied and the tillage rating indices obtained according to Lal's model and its modified form, the tillage recommendation for cultivation of *kharij* and *rabi* crops to enhance crop productivity are depicted. Wide variability exists in tillage rating indices not only among major soil groups but within different soil series of a specific soil group because of variation in physical and chemical characteristics, crops, climatic conditions and management.