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**Development of a Computer Based Decision Support System for
Introducing No-Till Technology**

***A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENT
FOR THE DEGREE***

OF

***DOCTOR OF PHILOSOPHY IN
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My life has been so blessed with many wonderful friends. I have a special love for those who continued to ask me about my work. Without your interest and encouragement, it might have been very difficult. A dedication to me and my other brothers and sister of a book by my elder brother proved that he had faith in me. I thank each of you.

Abstract

No-Till cropping systems have evolved rapidly since the early 1960s and have attracted attention world-wide. The difficulty of transferring new technologies is also well established. The selection of a tillage system is a difficult management decision with long term implications. Specific constraints impede its implementation. No-Till has the potential to conserve soil and energy as well as to sustain the agricultural ecosystem, yet some soil types have high cultivation requirements to maintain optimum soil structure. Climatic factors, such as level of precipitation, can influence both plant response to soil compaction and the timing of crop establishment. Furthermore, biological constraints such as plant diseases or specific weed species can become controlling factors governing the successful adoption of No-Till. The use of an expert system is considered the best way to derive the researchers' knowledge and aid the process of choosing an appropriate tillage technique.

The No-Till Expert (NOTE) System is designed to aid farmers and extension workers in their decision-making process for promoting No-Till. A prototype expert system has been developed and initially run in Pakistan under the rice-wheat and cotton-wheat rotation. A model for popularizing No-Till technology is also proposed. Over-drilling pasture, and crop establishment data from New Zealand conditions has been incorporated for possible use of this expert system in developed agriculture.

The following technical, social, and economic input parameters have been incorporated in the NOTE. Users are required to input information concerning each parameters (guidance in selecting values is provided).

Technical: Soil texture, soil slope, crop rotation, weed and pest management, straw residue management, seeding technology, and soil moisture condition around seed micro-environment at the time of planting.

Social: The ability to carry out a particular operation correctly determines the farmer's ability to manage No-Till successfully. Therefore, the literacy level, use of knowledge for correct and timely operations is also considered under the social aspects in this study.

Economic: If the cost of productions, and productivity is not likely to vary positively with the change in tillage technique, it would be difficult for extension workers to convince farmers to change their existing practices. Thus, the economic aspects of No-Till were also considered.

Environmental, local legislation, residue handling, use of chemicals, and its impact on ground water contamination were the other key factors that were considered while designing NOTE. However, these were not incorporated in the final design of NOTE because of lack of the available quantitative data.

NOTE interactively considers the above parameters and makes appropriate recommendations as to the acceptance/rejection of No-Till. Based on the wide range of studies on above subjects, NOTE out-richtly rejects No-Till under the following conditions:

1. If the area is affected by rice stem borer, and the requisite pesticides are not available under Pakistani condition.
2. If the soil texture is heavy and not well drained.
3. If the requisite weed control chemicals are not available.
4. For growing cereal after pasture, as sowing of an intermediate crop is recommended under New Zealand situation because of likely transfer of Argentine

stem weevil. However, if farmer could afford to apply some appropriate pesticides, No-Till could be considered.

5. If farmer does not have access to a No-Till drill.

NOTE, however, has in-built facilities for future upgrading. Such upgrading would be required to account for more specific climatic conditions, locations, and crops.

A User's Guide has also been developed to assist end-users to use this decision support package.

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