Introduction

Increases in land and labor productivity are essential for farmers in Mexico who are facing increased competition from world markets. Conservation tillage (CT) has been promoted as a productively enhancing and resource conserving technology that benefits grain farmers, but despite its advantages has not been widely adopted. Some information exists on CT adoption rates but the information is incomplete and divergent.

This study examines CT adoption among farmers in Guanajuato, Mexico. A diagnostic survey was designed to procure baseline information for a participatory research development program to develop sustainable farming practices based on CT principles.

Materials and methods

The study was conducted in the state of Guanajuato in central Mexico. Guanajuato features a range of agro-ecological environments. The southern part of the state, known as “Bajío”, is a large plateau (3800 masl) with favorable rainfall conditions (600-800 mm). Most farmers have access to irrigation either from the irrigation district or from individually owned tube-wells. The northern part of the state is more elevated (1900-2000 masl), and features semi-arid conditions (400-600 mm).

Five agro-eco-ecological zones were identified, clustering agro-ecological areas on the basis of distances computed from the quantitative correspondence analyses were then used as inputs for a disjoint cluster procedure, SAS Institute, 1990). The outputs of the multiple correspondence analyses were then used as inputs for a disjoint cluster analysis on the basis of distances computed from the quantitative variables (FORTHCOMING).

Within each zone, seven communities were sampled and within each community, five agricultural households were sampled, bringing a total of 175 households that were surveyed. Out of 175 questionnaires completed, 162 were retained as valid.

Production and cropping systems typologies were established by using multivariate statistical analysis. The raw data from questionnaires were first analyzed using multiple correspondence analysis (CA), R (Tholen et al. Forthcoming).

Types of production systems

Small farms without access to irrigation (2 groups)

These farmers are "typical subsistence farmers". Their strategy has been one of intensification of the production system. They have large landholdings and one or several tube-wells. They do not produce horticultural crops and agricultural activities are concentrated on grain production (maize and sorghum). All the grain produced is consumed by the animals.

Small and medium-size production systems with partial access to irrigation (2 groups)

These farmers also have large landholdings and two cycles a year. They have capital and concentrate their activities on high-value horticultural crops. The farmer then incorporates the residues into the soil using animal-driven plow, or using tractor and disc plow.

Specializing in industrial production of animal products (meat or milk)

These farmers have small landholdings with intensive livestock activity such as pork, eggs and milk. They do not produce horticultural crops and agricultural activities are concentrated on grain production (maize and sorghum). All the grain produced is consumed by the animals.

Adoption of conservation tillage practices

Techniques classification

Conservation tillage is a generic term that means different things in Mexico. To go beyond a general analysis of adoption of conservation tillage, we decided to classify CT according to two criteria - residue management and soil preparation:

Residue management, when residues of the previous crop were:
- completely exported, or burned (SR)
- were not or only partially removed (CR)

Soil preparation using:
- a deep plow + superficial plows (discs): TT
- only superficial plows (discs): RT
- no soil preparation: NT

Discussion on adoption figures:
Adoption partial in many aspects:
- Only on irrigated plots
- Only during the summer cycle

Table 1: Adoption of conservation tillage when two grain cycles per year Guanajuato, Mexico, 2001

<table>
<thead>
<tr>
<th>% plots</th>
<th>Winter cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TT</td>
</tr>
<tr>
<td>Summer cycle TT</td>
<td>6.9</td>
</tr>
<tr>
<td>TT</td>
<td>12.1</td>
</tr>
<tr>
<td>NT</td>
<td>19.7</td>
</tr>
<tr>
<td>Total winter</td>
<td>58.6</td>
</tr>
</tbody>
</table>

Figure 1: The five agro-ecological zones were determined using GIS based information.
**Farmers’ experiences of conservation tillage**

Unsustainable adoption of conservation tillage

Many farmers alternate soil preparation with two different objectives:

- Traditional till with incorporation of residues → To reduce soil compaction and improve soil quality (organic matter)
- No till without residues → For cost and labour savings

Most farmers still find these two objectives incompatible. In general farmers encountered difficulties planting with the large quantities of residues, and preferred to remove or burn them. This progressively compacts the soil and after several cycles farmers have to invert the soil to be able to plant.

Adoption: A solitary crusade!

Technical training was provided for some farmers (field day or more formal course), but no technical assistance was provided during the initial trials. Farmers are therefore encountering serious problems in using equipments such as drill calibration.

Subsidies on no-till drills: The hardware without software

The Mexican government subsidized the purchase of no-till drills. However, there needs to be more emphasis on farmers’ training as this is still lacking. Because of this lack of training, farmers sometimes use their no-till drill as conventional ones.

**Conservation tillage: Farmers’ perceptions**

What is clear!

There is a general consensus among farmers about the advantages of CT:

- Cost saving
- Labor saving

Mentioned with less frequency, but always in the same vein

- Yield increase

Points of divergence

While other important points were mentioned by farmers about CT, there was no consensus among farmers on:

- Water saving
- Difficulties when managing residues under an irrigated system

**Bibliography**
