

# 3 AGRONOMIC RESEARCH

## INTRODUCTION

Crop production on a given area depends on several factors, including soil and climatic conditions, plant variety, and production practices. The physical environment cannot be changed readily and thus determines the yield potential of a region. Varietal characteristics and management practices, however, are more easily manipulated, and improvement of these factors can provide higher yields and net income. Thus, agronomic research in the Puebla Project was designed to provide information on soil management practices and varieties that would produce higher returns for the farmers' production investments.

## GENERAL STRATEGY

Production practices that can greatly influence crop yields in rainfed areas include: land preparation; planting date; seeding rate; amount and kind of fertilizers applied; time and method of applying the fertilizers; control measures for weeds, insects, rodents, and diseases; and depth of plowing. As a first step in developing better information on these agronomic practices, the Project sought to gather as much information as possible on farmers' production practices, soil and climatic characteristics, and the experiences of other researchers in the area. This information was gained by interviewing farmers and agronomists residing in the area, by reviewing the research findings of the National Agricultural Research Institute, by analyzing the available climatic data, and by studying the properties of the soils in the area. Through this process an understanding was obtained of the physical environment and the traditional technology of the farmers, as presented in Chapter 1.

A list of technological questions to be investigated was prepared and arranged in order of priority by taking the information available at the beginning of a given cropping season and estimating: (a) probable deficiencies in existing technology, (b) probable improvements that could be made economically, (c) which improvements would most likely provide the largest increases in yield and net income, and (d) which of these aspects of the technology should be investigated in the Puebla area.

Next, field experiments were carried out to answer questions of highest priority. The ecological diversity of the area was taken into account in planning the research and in locating the field trials. In 1967 and 1968, information on

the physical environment was limited, and field experiments were distributed fairly evenly over the area. In 1969 and afterward, two or more producing systems were recognized in the area, and the experiments were located to sample these systems. (Note that a producing system is defined as a part of a production universe in which the uncontrollable production factors for a crop are reasonably constant. These factors include: soil morphology, geomorphology, climate, previous crop, and at times, planting date.)

During the growing season, observations were made periodically on the factors influencing production at each experimental site. The trials were harvested, data analyzed, and results expressed as treatment means or production functions. Data on crop response to rates of fertilization and plant density were expressed both as mathematical functions and as two-dimensional graphs, for greater certainty and ease of interpretation.

In 1967, the information available from the National Agricultural Research Institute was taken as a first approximation to the recommendations on crop production practices for the Puebla area. (The recommendation for rainfed maize in Puebla was: fertilize with 80 kg N and 40 kg  $P_2O_5$ /ha, use the hybrid H-28 with 40,000 plants/ha, and plant at the beginning of the rainy season.) Data collected in 1967 were used to revise the existing recommendations on maize production and to calculate a second approximation to the recommended practices. The data collected in subsequent years were used to generate third, fourth, fifth, etc., approximations.

Beginning in 1969, maize recommendations were formulated for distinct producing systems. All available information on climatic variability and prices for maize and inputs was taken into account in estimating the optimal levels of practices. Recommendations were made after carefully weighing: (a) the precision of the available information on the relationship between yield and the production factors, (b) the marginal productivity of the factors in question, and (c) the risk involved in making recommendations that might not be appropriate for the farmer.

The remainder of this chapter describes the agronomic research in the Puebla area in each year, 1967-1973. A final section seeks to evaluate the adequacy of the maize technology and to estimate the potential benefits of the improved technology, as compared with technology existing in 1967. Appendix A provides a benefit: cost analysis of the agronomic research program in the Project.