

Most of the available information on the levels of use of nitrogen, phosphorus, and plant density refers to a random sample of parcels for the Project area. In general, therefore, the analysis made here refers to the *percentage of parcels* with a certain level of adoption of the recommended practices. If farmers were to use the new technology uniformly on all their parcels, then the percentage of parcels with a given level of adoption should be similar to the percentage of farmers with the same level of adoption. However, in the Project, where the farmers had an average of slightly over three parcels and tended to adopt the new technology initially on only a part of their land, it was expected that percentages calculated in terms of parcels would be lower than percentages calculated in terms of farmers for a given level of adoption. This assumption was substantiated by estimating (from the survey data for 1967 and 1970) the percentages of farmers with a high level of adoption of nitrogen and phosphorus, and comparing them with percentages of parcels with high levels of use of the two practices.

Analysis here is in terms of the average amounts of nitrogen, phosphorus, and plants per hectare and to the percentages of parcels on which these practices were used at high, intermediate, and low levels. The available information with respect to time of applying fertilizers, weed control, and insect control was not sufficient for drawing conclusions about changes in farmer use of these practices.

### All Farmers in the Area

The 1967 survey involved a random sample of all the farmers in the Project area. The 1970 survey, as well as the yield evaluations for the years from 1968 to 1972, involved a sample of all farmers in the area and another sample of farmers on credit lists. (These farmers were organized into groups and were aided by the technical assistance agents in arranging for credit and in using the new technology properly.) The data from the sample of all farmers provide the relevant information on the level of adoption of the recommendations for the Project area and are presented first. The use of the recommendations by the farmers on credit lists is discussed later.

The average rates of nitrogen and phosphorus and average plant densities for maize plantings in the Puebla area for the period 1967-1972 are shown in Table 9.2.

TABLE 9.2. The average amounts of nitrogen and phosphorus in kilograms per hectare and the average number of plants in thousands per hectare used in maize plantings in the Project area from 1967 to 1972.

Practice	1967	1968	1969	1970	1971	1972	% increase*
Nitrogen	34	--	--	53	83	78	129
Phosphorus (P <sub>2</sub> O <sub>5</sub> )	14	--	--	19	30	27	93
Plant density	--	31	31	33	33	34	10

\* The difference between the values in 1972 and the first year with information, expressed as a percentage of the value for the first year.

From 1967 to 1972, the average increases were: nitrogen, 129 percent; phosphorus, 93 percent; and plants/ha, 10 percent. The increase in nitrogen use is remarkable and reflects the farmers' general awareness of the need to apply large amounts of this fertilizer. The slightly smaller change in the average application of phosphorus is due in part to the recommendation that farmers use no phosphorus for maize in Zone V.

The small change in average plant densities is believed to be due to one or more of the following reasons: (a) farmers are often uncertain at planting time whether they will obtain all the fertilizer they need; they use a rate of seeding lower than that recommended with the idea that the maize will produce better at the lower plant density, should they not obtain sufficient fertilizer; (b) farmers are concerned about drought and believe their maize will do better, in case of drought, if the plant density is low; and (c) the farmers' major concern is in increasing their production of large ears, and they feel this can best be achieved with plant densities below the recommended levels. All of these reasons have a certain validity and provide an excellent example of how difficult it is to convince low-income farmers in rainfed areas to radically change their technology, and how difficult it is to develop and deliver recommendations that are adequate for the extremely variable production and economic conditions of the farmers.

The levels of adoption of the recommended rates of nitrogen, phosphorus and plant density can also be examined in terms of changes in the percentages of parcels with high, intermediate, and low levels of use of these practices. Table 9.3 shows the information needed for this analysis for the period 1967-1972. During this time, the percentages of parcels with a high level of adoption of the three practices increased; whereas, the percentages of parcels with a low level of adoption decreased, and the percentages of parcels in the intermediate category remained constant.

In 1972, the percentages of parcels with a high level of adoption of each of the three practices were about equal, varying from 44.8 percent for nitrogen to 39.4 percent for plant density.

From 1967 to 1972, the increase in the percentage of parcels with a high level of adoption of the nitrogen recommendation (37.4 percent) was much greater than the increases for the phosphorus (20.6 percent) and plant density (25.4 percent) recommendations. This finding again suggests that the farmers in the area have accepted the nitrogen recommendation more readily than the phosphorus and plant density recommendations. The 25.4 percent change in the percentage of parcels with a high level of adoption of the plant density recommendation indicates a greater acceptance of this recommendation than was suggested by the increase of only 10 percent in the average plant density for all plantings in the area.

Since there is usually a positive interaction among the production factors in their effects on maize yields, the maximum increase from a package of production practices is obtained when all factors are used at the recommended