

TABLE 9.10. An estimation of the increase in average maize yields in the Puebla area due to the use of the recommended production practices, in which the effect of climate is calculated from the maize yields of farmers on credit lists.

Year	(a) Average yield of the upper 1/3 of farmers on credit lists kg/ha	(b) Estimation of the effect of climate (%change compared to 1968)	(c) Estimation of the effect of climate plus technology (%change compared to 1968)*	(d) Estimation of the effect of technology (c-b) (%change compared to 1968)	(e) Average yields for area kg/ha	(f) Estimated increase in yield due to technology** kg/ha	(g) Estimated average yield without the technology (e-f) kg/ha	(h) %increase in average yields attributable to technology ($\frac{f}{g} \times 100$)
1968	4965	base	base	-	2140	-	2140	
1969	4090	-17.6	-14.4	+ 3.2	1832	68	1764	3.9
1970	4085	-17.7	- 8.3	+ 9.4	1962	201	1761	11.4
1971	4043	-18.6	- 9.9	+ 8.7	1927	186	1741	10.7
1972	4087	-17.7	+ 16.8	+ 34.5	2499	738	1761	41.9

* From Table 9.8

** Percentage in Column (d) multiplied by the average yield in 1968.

age yields of all farmers in the area varied from 3.9 percent in 1969 to 41.9 percent in 1972. This method also has obvious limitations. The average use of the new technology by the upper third of farmers on credit lists may have been higher in 1968, than in other years. Or, stated more generally, there is no empirical basis for assuming that the use of technology by the upper third of farmers on credit lists was reasonably constant. It is also possible that the upper third of farmers on credit lists does not provide a representative sample of the producing conditions in the Puebla area.

The two methods for estimating the increases in maize yields attributable to the use of the new technology give similar percentages for 1969, 1970, and 1971, but differ markedly for 1972. It is probably reasonable to assume that the true percentage increase in average yields due to the new technology is somewhere near the average of the values obtained with the two methods. This calculation would suggest that average maize yields in the Puebla area probably increased through the use of improved technology by about 30 percent from 1967 to 1972.

The above efforts to adjust average maize yields for the effect of climate indicate the need for a project to develop plans from the outset for collecting the data required for such an adjustment. Experience in the Puebla Project suggests that the necessary data can be generated by making simple plantings, consisting of three plots managed at low, medium, and high production levels, at sites distributed throughout the Project area. The number of sites required would be determined as a function of the variability among sites, and these would be located adequately to sample the different producing systems in the Project area. The same general sites (but not the exact site) and plot treatments would be used each year. If sufficient information were not available the first year to accurately establish the limits of the several producing systems, the number of sites should be increased initially by perhaps 100 percent to assure that

each system was adequately sampled. It should be possible at a later date (once the limits of the producing systems were defined) to reduce the number of sites to those necessary, based on the variability among sites and the level of precision desired. Annual differences in the average yields for each of the treatments should provide a reliable estimate of the effects of climate.

FACTORS INFLUENCING THE ADOPTION OF THE MAIZE RECOMMENDATIONS

Some information on the adoption of the maize recommendations, such as the number of farmers on credit lists (Table 9.6), suggests a rapid rate during 1969 and 1970 and a somewhat slower rate for the next 3 years. The information on the increases in average yields attributable to the new maize technology (Tables 9.9 and 9.10), on the other hand, indicates an accelerated rate of adoption in 1972. Based on the available information, it seems reasonable to conclude that there has been a fairly continual rate of increase in the use of the Project recommendations since 1969.

This increase in the use of the new maize technology has produced an increase in average maize yields that has been estimated to be around 30 percent over the 4-year period 1969-1972, or about 7.5 percent per year. There seem to be no valid yardsticks for judging whether this is a reasonable rate of progress for a rainfed area with a moderate level of agronomic risk. It is evident, however, that many farmers at the end of 1972 were not using the recommendations (41 percent of parcels with a low level of adoption of the nitrogen recommendation, Table 9.3), and others were only using them partially (75 percent of parcels with a low level of adoption of one or more of the three main practices, Table 9.5). Thus, it seems appropriate to ask why the rate of adoption has not been faster and to examine some of the reasons farmers have continued to use their traditional practices.