Alternative 4, which is introduced essentially to obtain the extreme lowest value of the benefit-cost ratio, consists of imputing all 12.1 additional man-days of labor requirements to the associated costs, at the full opportunity cost of hired labor. (By using 12.1 days per hectare as the additional labor requirement of farmers employing the recommended technology, the true increases in labor costs have probably been overestimated. Many farmers on credit lists did not use project recommendations fully and obtained increases in yield less than those used in making the calculations in Table 10.3. Consequently, their additional labor requirements were less than 12.1 days per hectare.)

Other inputs (insecticides, herbicides, improved seeds, etc.) are seldom used; thus, failure to include them in the estimation of associated costs should not affect the global value significantly.

The calculation of the costs associated with the direct benefits varied somewhat over the 1968-1973 period. The fertilizer costs per hectare, using the Project recommendations, were as follows for the years 1968-1973:

Year	Fertilizer Costs ($/ha)
1968	62.88
1969	57.92
1970	45.41
1971	40.42
1972	40.87
1973	41.38

These fertilizer costs include charges for transportation and interest. The value for 1968 is an average cost of fertilizer for the high-yield plots conducted that year.[3] The 1969 figure was calculated from data obtained from the fertilizer distributor, Agrónomos Unidos, which distributed fertilizer for 2,719 ha of high-yield plantings.[4] The values for 1970-1973 were calculated from data provided by the fertilizer distributor, Impulsora de Puebla, on its fertilizer sales to farmers on credit lists.

There was no expenditure for crop insurance in 1968. For 1969-1973, the calculation of the cost of crop insurance was based on the average premium of $6.57/ha paid by farmers in the five Project zones. It was assumed that the area covered by crop insurance corresponding to farmers on the credit lists represented 50 percent of the total holdings receiving credit from the official banks. For these farmers on the credit lists, the estimated number of insured hectares was: 1,560; 3,969; 5,528; 8,009; and 8,186 ha in 1969, 1970, 1971, 1972, and 1973, respectively.[5]

3. Jairo Cano and Delbert T. Myren, "Benefit-Cost Analysis of the Puebla Project," *Strategies for Increasing Agricultural Production on Small Holdings*, CIMMYT, México, D.F..

4. *Ibid.*

5. According to the data in Table 7.2, the total received by farmers in the Puebla area as indemnization in 1969-1971 exceeded total premiums paid to the insurance agency. This suggests that perhaps no charge should have been made for crop insurance.

It was estimated that the cost of fertilizer would have been $23.10/ha if applied according to traditional practices. This estimate included a $20.88 fertilizer cost (320 kg/ha of 10-8-4 at $65.28/ton, including transportation) plus $2.22 in interest. The associated costs used in the calculation of the direct net benefits in Table 11.1 were obtained by subtracting the estimated fertilizer cost using the traditional practices from the fertilizer cost using the Project recommendations.

The average fertilizer costs (including interest) for all farmers in the area and for farmers on credit lists were estimated from data collected in surveys at harvest time in 1971-1972. Estimates of the average fertilizer cost for those farmers not on credit lists were made using the following relationship:

Average fertilizer cost of all farmers =

$$\left(\text{Average fertilizer cost of farmers on credit lists}\right)\left(\frac{\text{Hectares of farmers on credit lists}}{80{,}000}\right) + \left(\text{Average fertilizer cost of farmers not on credit lists}\right)\left(\frac{80{,}000 - \text{hectares of farmers on credit lists}}{80{,}000}\right)$$

These average per hectare fertilizer costs (including a 6.21-percent transportation charge) for farmers not on credit lists were $28.01 in 1971, $31.47 in 1972, and $24.69 in 1973. These average costs, less the $23.10 fertilizer cost using traditional practices, gave the associated costs used in calculating the derived net benefits in Table 11.2.

Project Costs

Calculations of the annual costs of the Project took into consideration: (a) the costs of vehicles, equipment, and other durable items, were charged to the year in which they were purchased, even though they continued to be used for several years, even beyond 1973; (b) an estimation of charges for the rental of offices and work areas, which were made available at no cost; (c) an estimation of charges for services and materials provided by the Graduate College at Chapingo at no cost; and (d) an estimation of the cost of consulting services to the Puebla Project team from specialists in CIMMYT, the Graduate College at Chapingo, and USAID.

Table 11.3 shows the annual costs of operating the Puebla Project, listed by program. Information on individual program costs provides an indication of the relative emphasis placed on the several components of the Project. Program expenses included: costs of salaries, perquisites, travel expenses, equipment, materials, operation and maintenance of vehicles, and miscellaneous materials and services.

An estimation of the costs of the consulting services provided for the five programs is shown in Table 11.4. The total cost used in the calculation of the benefit-cost ratio was the sum of the operating expenses in Table 11.3 and the consulting services in Table 11.4. In addition, the total