Population Density of Unirrigated Maize and its Influence Upon Fertilizer Efficiency in Central Mexico

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It has been shown that nitrogen and phosphorus are deficient in many soils of Central Mexico, and that present low yields can be greatly increased by the use of these two fertilizer elements (2)3. However, high prices have restricted their general use for corn.

This investigation explores methods of increasing fertilizer efficiency through use of light, economical dosages and through the combination of higher population densities with relatively heavier fertilizer dosages.

Little has been published regarding the exact population densities which occur in Mexican farmers' fields. The corn varieties are extremely diverse as to type, size of plant, and size of ear (1). Climatic diversity is also great due to variations in altitude and rainfall. Such different conditions may be expected to require different rates of stand.

The literature on effects of stand density upon yields of corn has been reviewed by Stringfield and coworkers (6). Results are cited showing optimum acre populations of 14,250 in Jamaica, 16,518 in Russia, 10,680 in Kentucky, and between 8,900 and 10,680 in Eastern Nebraska. Their experiments in Ohio demonstrated the direct relation of optimum population with expected yield. In experiments on soil with a productive capacity of 80 or 90 bushels, the optimum yields for three common hybrids occurred at about 16,000 plants per acre. Hybrids producing larger plants require 20% less population.

Experiments in Tennessee reported in 1920 (3) showed that optimum populations for many varieties vary from about 10,000 per acre on good bottomland to about 5,000 on uplands. Small, short-season varieties required thicker stands. For a given variety of open pollinated corn, the weight of grain per plant at the optimum population is practically constant on lands of widely different levels of fertility. Averaging 17 varieties, the yield per plant at optimum stand was over 1/2 pound.

EXPERIMENTS IN FARMERS' FIELDS

Corn production occurs throughout Central Mexico up to 9,000 or 10,000 feet above sea level. The planting season extends from March to July in different areas. Since the objective was to sample the typical soils of each region as completely as possible, it was necessary for the field party to be on the roads on those strategic days when farmers with oxen and plows appeared in the fields.

Fertilizer experiments and counts of final stand were made in 106 farmers' fields, of which 76 were harvested.

EXPERIMENTAL PROCEDURE

Each experiment required 16 furrows of about 160 feet in length. The average width between furrows varied from 27 inches in the State of Oaxaca to about 40 inches in parts of the State of Michoacán. Plot length was determined by the width of the rows in the field to produce an area of 374 square inches in the State of Oaxaca to about 40 inches in parts of the State of Michoacán. Plots were randomized within the blocks. Replication was used to two blocks at each field. Further replication was through more sites in each valley. Rates of application were 17.8 pounds per acre and 35.6 pounds of P₂O₅ 35.6 pounds per acre; of potash 35.6 pounds. Nitrogen was supplied from ammonium sulfate from 20% superphosphate, and potash from potassium chloride.

Planting in Mexico follows closely behind the plow. In some cases, it was desirable to apply the fertilizer on land already planted. Elsewhere, to plant beans or horsebeans (Vicia faba), it was necessary to wait while 16 rows were furrowed out. In some areas the fertilized furrow was left open, whereas in Western Mexico customary to plow the furrow shut as soon as it was open in order to conserve moisture. The fertilizers were spread uniformly along the furrow.

Local planting systems follow a well established ritual and it did not appear that the farmer modified his practice in the experimental areas.

Each site was revisited once during the growing season to count populations and make measurements of plant diameters. Only individual plants were counted, not tassels.

Yields of ear corn from the two center rows were weighed in the field by a spring milk scale on a tripod. Shelling samples of 4 to 8 typical ears were taken for drying from the treatments 0-0-0, 40-0-0, and 40-40-0, showing percentage and moisture factors for unsampled were chosen or calculated by comparison of these and the treatments sampled. Yields are reported in bushels of shelled corn containing 15.5% moisture.

FERTILIZER RESPONSE AND RAINFALL

Although 1948 was considered to be a very good season generally, from the standpoint of rainfall, areas of drought were encountered. Some experiments were lost because of drought in the states of Jalisco, Guanajuato, Querétaro, and Hidalgo. Other experiments were totally lost because of drought in Ciudad Guzmán, Puebla, Veracruz, Tlaxcala, or Michoacán.

The average yields of shelled corn and population density of experiments conducted in farmers' fields during the 1948 season are presented in Table 1. Averaging the results of all 76 experiments harvested during the 1948 season is presented in Table 1. Averaging the results of all 76 experiments harvested during the 1948 season is presented in Table 1. Averaging the results of all 76 experiments harvested during the 1948 season is presented in Table 1. Averaging the results of all 76 experiments harvested during the 1948 season is presented in Table 1. Averaging the results of all 76 experiments harvested during the 1948 season is presented in Table 1.