

(with margins of error believed to be in the neighborhood of 10 percent) and the ratio of the yield of each crop to "normal" yield (with errors appraised often at 30 percent).

The data on water supply, from both rainfall and canal irrigation, are believed to be of higher quality except for two problems. One is the effect of transit losses that intervene between canal diversion and the application of water to crops. In the absence of specific information, canal by canal, we have taken these losses to be uniformly 30 percent of diversions.⁽²⁾ Second is the problem that the water supply data do not contain information on the division of the total water supply among crops. Much of our work, as will be seen below, was devoted to overcoming this deficiency. We had no information about the contribution of Persian Wheels and other non-governmental sources of irrigation water. Therefore our estimates are of most significance in those areas where the unrecorded sources of water supply are relatively unimportant.

Our estimating method is based on the relationship between soil moisture content and crop yields. Those considerations imply that if sufficient water is applied to keep the moisture tension low throughout the growing season, water availability will not limit crop growth or yield. Additional water supplied above the amount required to keep the moisture tension low will not increase yield and, after a point, is likely to be deleterious. Thus there is a level of water supply at which yield reaches the maximum attainable in the light of all the other circumstances of the agricultural regime. We call this quantity of water the saturation amount, denoted by S_i (i for crop i).

The saturation amount depends principally on the amount of water that the plants and the surrounding soil can evaporate during the period of plant growth. It appears that this quantity is not very different for different plants but depends mainly on humidity, wind, amount of sunlight and other meteorological conditions, and, of course, on the dates of seeding and harvest. Estimates of potential evapotranspiration by month for a number of points in the Punjab were provided by the U.S. Weather Bureau⁽³⁾ and dates of seeding and harvest were taken from Crops, Vegetables, and Fruits in Pakistan. Potential evapotranspiration cumulated over the growing seasons provided estimates of the saturation quantities of water for each of the crops and canals analyzed.

(2) This percentage is lower than the 46 percent of losses from canal diversions computed in Chapter 7, but the latter estimate was made at the river barrages and moreover it allows for an increase in seepage and non-beneficial evapotranspiration from new link canals, and for increased seepage caused by lowering of the water table.

(3) See Appendix A.1.