SECTION 5

Conclusions and Implications

5.1. The Scope of this Study

This study relates to the dry tropical regions of India. These regions, which are composed of 151 arid and semi-arid tropical districts with limited possibility of irrigation, constitute 53% of India's total geographical area. Around 30% of India's rural population live in these areas, which have over 55% of the cropped area and 74% of the area of coarse grains in India. The bulk of the nationally (as distinct from regionally) important crops, such as pulses, oilseeds, and fiber (e.g., cotton) crops, are produced here.

The major problem of the seasonally dry tropical regions is interyear and intrayear variability of rainfall. Farmers have adapted to this by building diversity and flexibility into their farming systems. Policy makers and planners have also attempted to reduce the instability of dryland agriculture and its impact on the rest of the economy. However, the measures adopted by them have often in the past been designed to protect against drought rather than to respond to both negative (drought) and positive (high rainfall) aspects of rainfall variability.

Both farm-level adjustments and public interventions have imparted some degree of stability to dryland agriculture. However, they have both evolved through a process of trial and error, and without much input from modern science and technology, and have thus not fully exploited the potential within the agricultural environment for stability and growth in dryland agriculture. More recently, advances in science and technology have provided new methods and data enabling improved understanding of the agroclimatic, agrobiological and other environmental variables affecting agriculture, and these have demonstrated the extent to which it is possible to obtain higher and more stable crop production.

The opportunity offered by combining traditional and conventional approaches has been enhanced by recent changes in the perspectives of public intervention measures. Public measures for combating droughts have placed greater emphasis on the incorporation of productive components in relief measures. In area-based development strategies for dryland agriculture, complementary use of institutional, infrastructural and technological components is also increasingly emphasized. The present study demonstrated some approaches to

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help the new public policies and programs for dryland agriculture that reflect these changes in emphasis.

In the determination of what would be included in this case study, the availability of relevant material was a prime consideration. Hence, the experimental results presented in different sections of the study do not all relate to the same locations and periods. However, the locations are in the same broad agroclimatic zones and are closely related.

In Section 1 we concluded that the drought relief interventions, which originally were mainly short-term and purely welfare-oriented *ad hoc* activities, have recently acquired productivity orientation and long-term focus. Some form of integrated development strategy for drought-prone areas is taking shape, combining technological, institutional and infrastructural components. We also identified specific components that could be enhanced by the inclusion of scientific approaches and information discussed elsewhere in the case study. One of these approaches is a method of identifying agroclimatically homogeneous tracts to facilitate area-specific intervention measures and assessing the effects of rainfall variability on crop yields in these areas (*see* Section 2). In Section 3, we considered methods for assessing the dependability of rainfall for quantifying the interacting effects of the different variables that influence crop performance in various soil moisture situations. Section 4 evaluated conventional long-term and short-term adjustment strategies in coping with different levels of rainfall variability, and considered the opportunities by combining them with new agroclimatic knowledge and techniques, and with modern public intervention measures.

5.2. Summary of Results

The variability of agricultural production in India is directly related to the interannual variability of rainfall received in different parts of the country. A method of assessing the impact of rainfall variability on crop yields was demonstrated with respect to sorghum in a semi-arid tropical subregion in Karnataka State in South India (Section 2). The mean annual rainfall of the area is 710 mm and the standard deviation is 180 mm. Rainfall variability for two data periods, 1918–1941 and 1941–1970, showed that the frequency of droughts was greater in the earlier than in the later period. In the years 1941–1980, only two consecutive drought years (1971 and 1972) were identified. Homogeneous climatic clusters or cropping zones were identified, and the possibility of predicting crop performance in advance on the basis of the location and intensity of the inter-tropical convergence zone (ITCZ) was also considered. The rather large variation in the distribution of the seasonal rainfall seems to have led the farmers to devote a huge proportion of their annual crop production to post-rainy season cropping when the crops are raised on residual moisture. This practice, however, has led to increased soil erosion as bare lands are exposed during the rainy season.

Section 3 considered the variations in crop yield (sorghum) that occurred under various climatic scenarios. In areas where the annual rainfall exceeds 750 mm and the available moisture storage capacity of soils exceeded 150 mm,