The sugar beet (Beta vulgaris) is grown for the sucrose which accumulates in its fleshy axis during vegetative growth. The plant is adapted to a wide range of soil and climatic conditions and can be grown with a variety of cultural systems. It is grown widely on irrigated lands in semiarid and arid regions because of its high tolerance to saline conditions and its great productiveness in the long growing seasons common to such regions. Commercial irrigation practices for sugar beets are relatively simple and well developed. Our attention will be given here principally to some of the ecological aspects underlying these irrigation practices. Literature relating to the water and salt relations of the sugar beet under dryland conditions or with only occasional or marginal supplemental irrigation has been ignored in this review. There has been active research on these problems in several areas, particularly the USSR and Israel.

I. CROP DEVELOPMENT

Before examining the water relations of the sugar beet, it will be useful to consider briefly certain aspects of its development as a crop which influence its response to variations in water supply. During its first season of growth, an unvernalized sugar beet plant maintains an indeterminate pattern of vegetative growth. New leaves appear at regular intervals and photosynthates not utilized for growth of leaves and fibrous roots, or in basal metabolism, are available for storage root growth. This pattern dictates a simple set of management principles: Maximum yields will be obtained by maximizing the product of net photosynthesis \( \times \) the proportion of photosynthate which accumulates in the root as sucrose \( \times \) time.

The slowness with which young sugar beet seedlings become established limits effective utilization of the growing season and hence yields. Full cover is achieved slowly because of the small size of juvenile leaves and because only three to four new leaves are initiated each week (Loomis and Nevins, 1963; Morton and Watson, 1948). The commercial plant populations which give optimum yields (20,000 to 50,000 plants/acre in 20- to 30-inch rows) also minimize the time required to achieve a full foliage canopy while permitting the necessary tillage.