

ABSTRACT

Leaf Demography, Bud Germination, Establishment and Root Growth of Sugarcane.

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This study investigates various aspects of the growth of sugarcane (*Saccharum officinarum* L.). Its major objective was to compare the use of traditional methods of growth analysis with the more recent demographic approaches. Through this comparison, the efficacy of demography as a more effective tool for the assessment of growth in clonal systems such as sugarcane would be determined. Both approaches were used to compare growth responses to varying levels of fertiliser, two herbicide treatments and the application of compost in three separate agronomic experiments.

The classical and demographic approaches to plant growth analysis were found not to be comparable as techniques for measuring the responses of plants to their environment. Leaf demography indicated physiological attributes of the crop in relation to survival, that could not have been revealed by the traditional approach. As a result, it was concluded that the two approaches were complementary.

It is generally believed that the younger buds, from the top of sugarcane stems, germinate faster than older buds. This was tested by an in depth study of germination and establishment, in relation to bud position along the length of a stem, using a diversity of clones. Bud age/germination time relationships were more prevalent in clones of *S. officinarum* and it appears

that this trait may be characteristic of, and inherited from, this species. Since bud age did not have an effect on germination time in all the cultivars examined, it is concluded that the belief, based on Clements' (1940) experiments with a single clone is not applicable to the whole range of *Saccharum* material available today.

It was also discovered that sugarcane plants of the same clone, which germinate late, had the ability to catch up in growth at least in terms of leaf production, with those which germinated earlier. The physiological status of the canes and their effect on bud germination and environmental influences on the genetic expression of germination characteristics are also examined and discussed.

Shoot and root growth are analysed, and their relationships determined, for three cultivars of sugarcane and *Erianthus arundinaceus*, a species that has been crossed with sugarcane and shows potential for inclusion in sugarcane breeding programmes. The root system of *E. arundinaceus* was shown to be far more extensive and vigorous than those of the sugarcane cultivars. A full description of the growth characteristics of both roots and shoots is provided for the four cultivars studied.

The inherent constraints on experimentation due to the nature of sugarcane are discussed in the context of the current study.