Abscisic Acid in Immature Apical Tissue of Sugar Cane and in Leaves of Plants Subjected to Drought

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Summary. Abscisic acid was extracted from immature leaf and stem tissue of sugar cane. Mature leaves of well watered plants contained trace quantities of this hormone but plants subjected to drought accumulated relatively large amounts in their mature leaves. Extracts from wilting leaves contained a substance similar to or identical with (+)-phaseic acid.

Introduction

Sugar cane accumulates sucrose throughout the major part of its life cycle. However, ripening is enhanced during periods of cool or dry weather which tend to slow down vegetative growth and which may promote the storage of sucrose. The role of plant hormones, and specifically that of inhibitors in the ripening process, is not known. Thus, the main objective of this study was to follow changes in the growth inhibitor content of plants subjected to drought.

Materials and Methods

Growth Conditions

Sugar cane plants, Saccharum spp., varieties B 41227 and B 50112 were grown at 28°C/22°C (day/night) under a 13 hour photoperiod (approximately 70000 lux natural light plus 4000 lux artificial light supplied by fluorescent tubes and tungsten lamps). The plants were normally watered three times daily. For the drought stress experiment on variety B 50112, watering was withheld for one, two or three days. The control plants meanwhile were adequately watered.

Extraction Procedure (B 41227)

Immature leaf and stem tissue (1220 g) harvested from 5 month old plants were macerated in ethanol and extracted for 48 hours at 3°C in darkness. Following filtration and evaporation of the filtrate under reduced pressure to a residual aqueous phase, the growth inhibitory fractions were obtained by a modification of the method described by Kohler and Lang (1963) (Fig. 1).
Tissue (1220 g)
  | Macerate in ethanol
  | Filter
  | Re-extract
  | Filter
  | Evaporate to aqueous phase
  | Adjust pH to 4.0
  | Partition against hexane (6 times)

Hexane fraction (F-1)  Aqueous phase (pH 4.0)
  | Partition against chloroform (6 times)
  | Chloroform fraction (F-2)  Aqueous phase
  | Adjust pH to 7.0
  | Partition against chloroform (6 times)

Aqueous phase  Chloroform fraction (F-3)
  | Stir into charcoal/celite
  | Filter

Elute charcoal/celite  Residual aqueous phase (F-5)
  | with acetone (F-4)

Fig. 1. Flow diagram showing the procedure for extraction and separation of growth inhibitors from sugar cane

Drought Stress Experiment (B 50112)

Twelve 5 month old plants were selected for uniformity and 2 plants were used for each treatment. Each day 7 fully expanded leaves (top visible dewlap leaf downwards; Kuipjer, 1915) were severed at the ligule from each of 2 drought stressed and 2 control plants. The leaves were immediately shredded in 96% ethanol and stored in darkness at 3°C for 48 hours.