EFFECT OF VARIATIONS IN SALINITY AND ALKALINITY OF APPLIED IRRIGATION WATERS ON THE AMINO ACID MAKE-UP OF PHASEOLUS AUREUS

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SUMMARY

A marked decrease in the content of various amino acids was observed when the boron concentration was increased from 0.5 to 2.0 ppm particularly at low value of SAR and low level of conductivity. At medium level of conductivity along with low level of boron increase in value of SAR definitely suppressed the content of lysine, arginine plus histidine, aspartic acid plus glutamine, threonine plus alanine, proline and cystine in plants. Increase in levels of conductivity specially at low value of SAR and low level of boron substantially affected the content of lysine, arginine plus histidine, aspartic acid plus glutamine, threonine plus alanine, proline and cystine.

INTRODUCTION

The effect of salinity and alkalinity on composition of plants has attracted some attention. It is by now known that the salinity affects the mineral make-up in a definite manner and a review of literature appears elsewhere. Practically very little work is done on changes in the organic make-up of plants caused as a result of variations in sodium adsorption ratio (SAR) conductivity and boron levels in the growing medium. Changes in composition of organic components of crop plants grown on saline and alkali situations along with boron toxicity has not been properly understood. In the present investigation effect of variations in SAR, conductivity and boron levels of the applied irrigation water have been evaluated from the point of view of amino acid make-up of the plants.
MATERIALS AND METHODS

A greenhouse study was conducted to assess the effect of quality of applied irrigation water on the amino acid composition of Phaseolus aureus. Plants were grown in 6-kg capacity pots in sandy clay loam (clay 26.5%; silt 25.7%; sand 47.8%) soil of Udaipur of pH 8.0 and electrical conductivity 2.9 mmmhos/cm in July, 1968 by putting in 7 seeds which were later thinned to 5. The synthetic irrigation waters (12 in all) were made up of all possible combinations of three levels of conductivity (1.5, 3.0 and 4.5 mmmhos/cm at 25°C), two values of SAR (15 and 30) and two levels of boron (0.5 and 2.0 ppm). SAR values and conductivity levels were adjusted using sodium chloride, calcium chloride and magnesium chloride (Ca:Mg, 1:1). Irrigations were given at appropriate time to maintain moisture at 50% of the field capacity. The above ground parts of the plants were harvested after eight weeks of sowing. Amino acid composition was assayed using paper chromatography technique, the details of which are given below:

A half gram of oven-dry plant material was hydrolysed for 36 hours over water bath using reflux condensor in 10 ml of 6 N hydrochloric acid. It was then filtered and evaporated to dryness over water bath. One ml of distilled water was then added and stirred. Amino acids were extracted from the hydrolysates using n-butanol saturated with 1 N hydrochloric acid.

One tenth ml of the amino acid extracts were spotted on Whatman No. 40 filter paper and the chromatograms were run using solvent, n-butanol : acetic acid : water (25:6:25 v/v) for 16 hours and employing one-dimensional descending chromatography. The spots were developed by spraying 0.2% ninhydrin in 95% ethanol. The paper was then incubated at 55° to 60°C for two hours so as to develop maximum intensity of colour. The spots so developed were identified by comparing Rf values with those of standards run simultaneously. Quantitative estimation was done by dissolving the spots of individual amino acids in 50% ethanol and comparing the intensity of the colour with those of the standards.

RESULTS

The results of the variation in amino acid are presented in Table I. It is apparent from the data that waters with low (1.5 mmmhos/cm) and medium (3.0 mmmhos/cm) levels of conductivity along-with low value of SAR (15) caused a marked decrease in the amino acid content when boron concentration was changed from 0.5 to 2.0 ppm. This is true for lysine, arginine plus histidine, threonine plus alanine, aspartic acid plus glutamine, proline and cystine. For the amino acids, tyrosine, tryptophane, valine, methionine, phenyl-alanine, and leucine content of plants water with low value of SAR (15) and low level of conductivity (1.5 mmmhos/cm) caused similar decreases.