Pak. j. sci. ind. res., vol. 37, nos. 6-7, June-July 1994

ELECTRICAL CONDUCTIVITY AS A MEASURE OF PLANTING SEED QUALITY IN COTTON

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(Received May 2, 1993 ; revised December 29, 1993)

Investigations were conducted to relate seed exudates conductance to standard germination so as to develop a quick and reliable test for measurement of cotton seed quality. Results showed that cotton cultivars differed significantly in germination percentage and electrical conductivity. Cultivars MNH-93 and CIM-109 had higher germination percentage and less exudate conductance compared to other cultivars. Seeds obtained from first pick were of poor quality than those of second pick. The exudate conductance was negatively correlated with germination (r = - 0.88**). The loss of membrane functional integrity seems responsible for lower germination. These data indicate that electrical conductivity test can provide estimates of seed quality.

Key words: Electrical conductivity, Measurement, Cotton seed quality.

Introduction

The desired plant stand is pre-requisite for efficient cotton production. Plant establishment, in return, is a function of a quality of seed that is being sown [1]. The quality of cotton seed is generally determined by various germination and vigour tests conducted in the laboratory prior to planting [2]. One disadvantage with many tests is time, i.e., 7 - 10 days are required to obtain results. However, measurement of the electrical conductance (EC) of seed soak water has been purported to provide quick estimates of seed germination or vigour in 24 hrs or less [3].

The EC test is a measure of cellular integrity. Cell membranes provide for compartmentalization of cellular and organelle constituents in viable seeds. Loss of membrane integrity and subsequent loss of cytoplasmic solutes with electrolytic properties are indicative of rapid seed deterioration. Therefore, the evaluation of seed leachate could be a measure of seed deterioration and hence seed quality for planting purposes [4-5]. Similarly, the relationships between seed exudates and quality has been worked out in several crops such as peas, beans and corn [3, 6-8].

This study was designed to determine the relationship between seed exudates conductance and subsequent germination percentage. The results could lead to a quick and reliable test for measurement of cotton seed quality.

Experimental

Seeds used in these studies were produced in field plots of Cotton Research Institute, Multan. Seed cotton was harvested twice during the production season. The first harvest was collected in the last week of Sept.; the second harvest was collected in the first week of Nov., each year.

Cotton seeds of two picks of six cultivars, *viz;* MNH-93, NIAB-78, CIM-109, CIM-135, S-12 and FH-367 were acid delinted and washed six times in distilled water to remove salts remaining on or in the seed coats as a result of delinting. These pre-washings consisted of stirring seed for 1 min. in three volumes (w/v) of distilled water. Seeds were then air dried at room temperature. Four replications of 50 seeds each of 6 cultivars were soaked in 100 ml distilled water. The conductance of exudates were then recorded after soaking the seeds for 24 hrs at 23° according to Hopper and Hinton [9]. The standard germination for each pick was determined using the methods described by the Association of Official Seed Analysts [10]. To affect germination, seeds were wrapped in 10 x 46 cm strips of moistened Whatman No.3 filter paper and incubated at 30° for four days. Seeds, which failed to produce a radicle 3 mm in lenght, were considered non-germinated.

Results and Discussion

The percent germination and electrical conductivity (EC) values for six cultivars are presented in Table 1. The six cultivars differed significantly in germination percentage and electrical conductivity. High germination percentage was equated with less electrical conductivity. The maximum germination percentage was obtained in cultivars MNH-93 and CIM-109 compared with other cultivars. Similar was the ranking for electrical conductivity. These differences in cultivars performance suggest that improvement in seed quality could be made through breeding efforts. El-Zik and Bird [11] reported that the ability to produce a stand of cotton was quantitatively inherited trait that could be enhanced through breeding.

Seeds from second pick were better than the first pick. This probably occurred because early bolls matured in unfavourable weather conditions. The day and night temperatures were quite high in Jul. and Aug. Seed development was poor of these bolls. Thus temperature stress during boll development period could have led to the seed of poor quality.

Data on leachate conductance and germination across all cultivars were regressed (Fig.1) and it showed that leachate conductance was negatively correlated with germination and could be described by an equation.

$$Y = 0.657 - 0.004\ x \qquad r = 0.88^{**}$$

where Y = Conductance of leachate; x = Percentage germination.

These results support the observations of Presley [12] that cotton seed lots with high conductivity readings exhibited low germination values. Andersen *et al*. [4] and Bondie *et al*. [5] stated that membrane degradation was first step in seed deterioration and this led to release of electrolytes on soaking seed in water. It seems that temperature stress during cotton seed development stimulated loss of membrane functional integrity and this resulted in poor quality.

TABLE 1. GERMINATION PERCENTAGE AND ELECTRICAL CONDUCTIVITY (mS/cm) OF SEEDS OF DIFFERENT COTTON CULTIVARS.

Cultivars	Germination		Electrical conductivity	
	First pick	Second pick	First pick	Second pick
MNH-93	71	91	0.33	0.28
CIM-109	71	87	0.33	0.28
CIM-135	69	84	0.37	0.29
S-12	59	72	0.44	0.36
NIAB-78	51	71	0.45	0.37
FH-367	37	53	0.53	0.46

LSD (P=0.05)

	Germination	Electrical conductivity
Cultivars	5.70	0.02
Picks	2.40	0.02

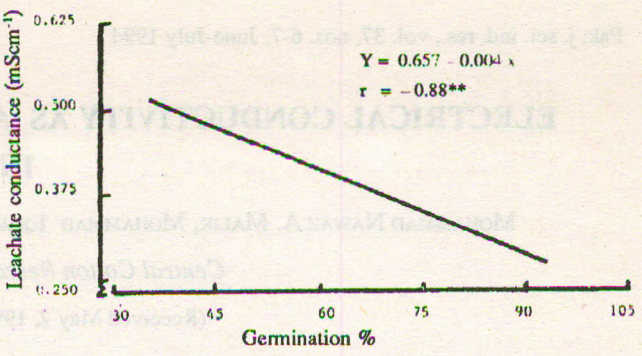

Fig. 1. Relationship between seed germination and electrical conductivity.

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