Editorial

Electrical conductivity tests in maize seeds

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In the world seed industry, cold test has widely been used to determine vigour of maize seeds. Recently, ISTA has validated radicle emergence test for maize seeds as a vigour test. On the other hand, in terms of labour and time, a cost-effective and quick vigour test needs to be revealed. From this perspective, the electrical conductivity (EC) test provides a measurement of electrolyte leakage from plant tissues and has been well developed as a routine seed vigour test to predict field emergence of garden peas. Nevertheless, it has also been shown to apply a wide range of grain legumes (e.g., soybean, French bean and mung bean) as well as some other species.[1,2]

It should be noted that there are several factors that influence the EC test results such as differences in the amount of electrolyte leakage in different species. In this context, several studies have been reported related to those factors which affect the test results such as test period,[3] temperature[4] seed moisture content,[5] seed size,[6] seed amounts per sample and rinsing requirements.[7] Therefore, the aim of this study was to develop an EC test protocol to determine vigour of maize seeds.

Seeds of maize 'cv. Shemal' (obtained from May Agro Seed Corporation in Bursa, Turkey) were used in this research. Maize seeds were stored in hermetically closed glass jars in a fridge at 3±1°C until they were required for the experiments. The seeds had an initial moisture content of 13.3% and 93.5% normal germination rate. Determination of initial seed moisture content and the germination test were conducted according to the ISTA Rules.[2]

The EC tests were conducted with the four 50-seed replicates which were weighed and placed in 500mL glass jars. Then, 250mL distilled water (EC<5µScm^{-1}) were added in each jar and the lids were tightly closed. Following this, the jars were placed in an incubator running at different temperatures (20, 25 and 30°C) for different periods (6,12,18,24,36 and 48hours). At the end of the EC tests, electrical conductivity (µS cm^{-1} g^{-1}) of the substances leaking from the seeds was determined. Besides, the change in weight following EC treatments was determined and the final seed moisture content of each group was estimated according to Sivritepe.[8] The experiments were set up using a two-factor factorial design. Statistical analysis of variance and LSD tests were conducted at 0.05 confidence level in a JMP 7.0 computer programme.

Table 1 shows the changes occurred in seed moisture content and EC due to different temperatures and periods. As the results of the analyses of variance, statistically significant differences ($p \leq 0.05$) were found in the amount of seed leachates occurred due to different temperatures and periods. The results suggested that radicle protrusion was occurred above 35% seed moisture content in all the treatment groups.

When the subsequent seed moisture contents (i.e., a good indicator to determine the threshold for radicle protrusion) and EC values were evaluated together, it was determined that the optimum period and temperature for the EC test protocol of maize seeds 'cv. Shemal' were 24hours and 25°C, respectively.

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Table 1 The changes occurred in seed moisture content and EC due to different temperatures and periods in seeds of maize 'cv. Shemal'

Temperature (°C)	Period (hours)	Seed moisture content (%)	EC (µS cm^{-1} g^{-1})
20	6	25.5 k*	1.7 l
	12	29.8 h	2.2 k
	18	31.7 g	2.8 ij
	24	33.5 e	3.3 h
	36	35.8 c	4.4 f
	48	37.2 b	5.0 d
25	6	27.2 j	2.1 k
	12	32.1 fg	2.6 j
	18	33.2 e	3.2 h
	24	**34.9 d**	**4.3 f**
	36	36.3 c	4.8 e
	48	37.5 b	6.0 b
30	6	28.5 i	2.2 k
	12	32.5 f	2.9 i
	18	34.5 d	3.9 g
	24	35.9 c	4.8 e
	36	37.0 b	5.6 c
	48	38.6 a	7.3 a
Temperature (A)		**	**
Period (B)		**	**
A x B		**	**

*Values not associated with the same letter are significantly different (P≤0.05).
** Significant at 0.05 level.

Therefore, it was concluded that the results of the EC tests were obtained in a relatively short period compared to the cold test and radicle emergence test. The seed vigour of maize seeds is determined by cold test within 14days.[1] This period is either 144hours at 13°C or 66hours at 20°C by radicle emergence test.[2] Nevertheless, the period was reduced to 24hours by the use of the EC test. Moreover, reliability of this protocol should be tested in seeds of different maize cultivars, lots and in different laboratories.

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Conflict of interest

The author declares no conflict of interest.

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