J. Agric. Sci. Mansoura Univ., 30 (1), 71 - 78, 2005

THE VALUE OF SOME TESTS FOR DETERMINE VIABILITY AND VIGOUR OF SEED RICE LOTS

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ABSTRACT

This investigation was conducted during 2003 season at Seed Technology Unit in Mansoura, Dakahlia Governorate, Egypt. The study aimed to determine the value of some laboratory tests (electrical conductivity, accelerated aging, germination %, speed of germination, germination rate index, plumule and root length (cm), and seedling dry weight(g) to estimate seeds vigor of three varieties of rice (7 lots/ variety). The results declared that electrical conductivity test and germination test gave a similarity results with those obtained by field emergence and showed significant differences between all lots in three rice varieties of Giza 178, Sakha 101 and Sakha 104. On the other hand, accelerated aging, speed germination, germination rate index, plumule and root length and seedling dry weight showed no variation with field emergence and non significant differences between the lots of three rice varieties. So that, this study concluded that application of electrical conductivity test, germination test and field emergence were valuable tests to determine seeds vigour of rice lots.

INTRODUCTION

Vigour testing is an important adjunct to research on seed production, quality and viability is a major components of any assessment of quality and germination test methodology has been refined to high level of reproducibility and reliability. The potential vigour and viability of seed rice lots are an important components of seed quality. Verhey (1960) considered that rate of germination was unreliable as a criterion of seed quality because of difficulties of standardization and reproducibility. Nevertheless, a close examination of the rate of germination and seedling growth under the favourable conditions of the germination test can be used to assess seed vigour. Helmer (1962) suggested that accelerated aging might has an application as a test for predicting seed performance other than storability.

Matthews and Bradnock (1967) showed that when seed lots with acceptable (greater than the 80% minimum) levels of germination were soaked in water, those lots yielding large quantities of electrolytes into the water emerge poorly in the field. Baskin (1970) proposed using the accelerated aging test to predict stand establishment of peanuts (*Arachis hypogaea*).

Accelerated aging as vigor test for soybeans evolved from work in several state and private seed testing laboratories and the Seed Technology Laboratory. Caspar (1974) found that the conductivity test includes the measurement of electrolytes in the leachate after the seeds are soaked in deionized water for a period and at a temperature depending on the species. Yaklich and Kulik, (1979) found that electrical conductivity (EC) test was introduced for measuring viability of many species. Powell *et al.* (1984) found

that measurement of EC value of single seeds in a population using mullet-cell Conductivity meter should disseminate between good and poor quality seeds and the seed which has low-conductivity value is more likely to produce normal seedling. Agrawal (1986) reported that seed lots of apparently equal quality as indicated by germination percentage will produce largely different responses in field emergence. Van Geffen (1986) reported that the germination test is furnish reliable information on the field planting value of seed. The test results can be used to compare the quality of different seed lots and must produce results that are uniform and reproducible within and between seed testing laboratories. Ram and Wiesner (1988) showed that artificial aging increased membrane permeability and enhanced loss of seed electrolytes in water. Elemery and Elrabie (1996) found that substantial differences in conductivity values of seed samples which had similar laboratory germination. The objective of seed testing is to provide the grower with an estimate of the value of seed for planting and to give an impartial guarantee of quality in commercial transactions.

So this study were conducted to determine the value of some laboratory tests to estimate the vigour and viability of rice seed lots.

MATERIALS AND METHODS

This study was carried out during 2003 at the laboratory of Seed Technology Research Unit, Mansoura Dakahlia Governorate, Seed Technology Department. Field Crops Research Institute, Agricultural Research Center, Giza. In this study, three rice varieties were used namely, Giza 178, Sakha 101 and Sakha 104. Seed sample of 7 lots from each variety (the quantity 50 ardab/lot) were obtained from Central Administration for Seed Certification and subjected to the following tests:

1-Field emergence : Field planting was made for all lots in four replicates. Each replicate consisted of four rows, a single row 3m length with 100 seed per row. Data were collected by counting the total number of seedlings emerged in each row after 17 days from planting. The field emergence were calculated according to ISTA Handbook for seedling evaluation (Bekendam and Grob, 1979).

2-Electrical conductivity test : The conductivity test was conducted to evaluate electrolyte leakage from the seeds in each seed lot according to (AOSA, 1983). Four replicates 50 seeds of each lots were weighted to 2 decimal places. The replicates were placed in beakers containing 250 ml of distilled water. The beakers were then placed in the incubator at 30^{o}C for 24 hours. The conductivity of seed steep water was measured immediately after the removal of samples from the incubator, using mullet-cell conductivity meter (CMD 830 WPA) and reported as µ mhos/g dry weight of the seed sample.

3-Accelerated Aging : In this test four replicates, 50 seed of each lot were subjected to a high temperature 41^{o}C and high relative humidity100%RH for 72 h followed by a regular germination test according to (AOSA,1983).

4- Germination test: Four replicates, 50 seed of each lot were sown in sandy soil in plastic box (55 x 12.5 x 6 cm) with 70% holding capacity at 25 ^{o}C in the germinator for 10 days. Counting of normal seedlings was according to ISTA Handbook for seedling Evaluation (Bekendam and Grob, 1979).

5- Germination speed test: Speed germination was computed for each seed lot by dividing the number of normal seedlings removed daily after planting on which they were removed. Thus, quality index of lots were obtained in the following manner:

$$\text{Lot (1)} : \frac{\text{Number of seedling removed daily}}{\text{day after planting}} = \frac{+ + + + + + + +}{1\ 2\ 3\ 4\ 5\ 6\ 7\ 8}$$

= ( )+ ( ) + ( ) + ( ) + ( ) + ( ) + ( ) + ( ) = speed germination lot (1).

6-Germination rate index, calculated according to Bartlette (1937) as:

$$GRI = \frac{a + (a+b) + (a+b+c)}{n\ (a+b+c)}$$

a = Number of seed germination after four days incubation.
b = Normal seedlings to developed into normal mature plants after eight days of incubation.
c = Normal seedlings after 12 days of incubation.
n = Number of counts.

7- Plumule length (cm): This method described in detail here was devised for cereals by Perry (1977). Stiff, water- absorbent paper hand towels, 30x25 cm. A line was drawn at the centre of the long axis of the paper and five parallel lines at 2cm intervals drown to one side of the centre line. The centre line was marked with 25 points at 1 cm intervals to locate seeds. Seeds was orientated with the embryo away from the paper and with the plumule pointing at right angles towards the parallel lines. There 25 seeds per sheet and four replicates of each lot, the paper placed on top and one behind the paper bearing the seeds and all were immersed in water rolls placed in cages or boxes in dark incubator at 25 ^{o}C. The test usually for10 days.

8–Root length (cm): Root length was measured according to the method of Perry (1977) as mentioned for plumule length.

9- Seedling dry weight (g): Seedlings were dried at 110 ^{o}C for17 hrs, and weighed.

All data were subjected to analysis of variance procedures outlined by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Data presented in Table 1 show that determination of vigour seed lots of three rice varieties by application of electrical conductivity test gave the highest value of quality seed were obtained from lots 6 and 7 in Giza 178 and lot 7 in Sakha 101 (0.013) and lots 2 and 7 in Sakha 104 (0.016). The measurements of seed vigour lots were similar with those obtained by field emergence. These results may be due to seed lots with acceptable (greater than 80% minimum) levels of germination are soaked in water, those lots yielding large quantities of electrolytes into the water emerge poorly in the field relationships only include seed lots with greater than 80% laboratory germination (Matthews and Bradnock,1967).

Table (1): Averages of field emergence, electrical conductivity (µM/g seed), accelerated aging and germination tests of different seed lots of the three rice varieties.

Rice varieties	Field emergency	Electrical conductivity test	Accelerated aging test %	germination test %
Giza 178				
Lot 1	81.50	0.014	85.00	92.50
Lot 2	80.50	0.022	74.00	92.00
Lot 3	82.00	0.024	85.50	98.00
Lot 4	82.00	0.019	87.00	94.00
Lot 5	81.50	0.019	88.00	93.00
Lot 6	91.00	0.013	84.00	96.00
Lot 7	95.50	0.013	96.00	98.00
F. test	*	* *	*	*
LSD at 5%	11.26	0.007	11.59	5.32
Sakha 101				
Lot 1	82.50	0.021	67.50	93.50
Lot 2	87.50	0.025	67.00	93.00
Lot 3	79.50	0.028	71.50	91.50
Lot 4	93.50	0.018	74.50	94.50
Lot 5	88.00	0.023	79.50	91.50
Lot 6	91.00	0.015	76.25	89.00
Lot 7	95.00	0.013	79.00	97.00
F. test	*	* *	NS	* *
LSD at 5 %	10.96	0.006	---	4.35
Sakha 104				
Lot 1	88.50	0.030	87.00	95.50
Lot 2	88.50	0.016	96.50	97.00
Lot 3	68.00	0.022	94.50	90.50
Lot 4	80.00	0.019	87.00	91.00
Lot 5	84.50	0.023	96.00	90.50
Lot 6	98.50	0.020	95.50	98.00
Lot 7	99.00	0.016	96.00	98.00
F. test	* *	* *	NS	* *
L SD at 5 %	8.52	0.007	---	5.88

The germination test showed significant differences in percentage of seed vigour lots. The highest values of vigour was obtained from seed lot number 7,7 and 7 (98.00, 97.00 and 98.00 %) in rice varieties of Giza 178, Sakha101 and Sakha 104, respectively. These results are in harmony with those obtained by Van Geffen (1986) who reported that germination test is furnish reliable information on the field planting value of seed.

In addition, accelerated aging test showed that significant differences among lots of Giza 178 but no significant among lots of Sakha 101 and Sakha 104 varieties (Table 1). The highest value of germination after aging (96.00, 79.50 and 96.00 %) were obtained from lots number (7, 5and 7 and7) in rice varieties of Giza 178, Sakha 101 and Sakha 104, respectively. These results related closely to field emergence under adverse conditions Baskin (1970).

Germination speed test showed a significant differences among lots of Giza 178 and Sakha 104 (Table2). The highest value (22.18, 23.00 and 23.94and 23.87) were obtained from lots number (6 and 7), (6) and (6) in rice varieties of Giza 178, Sakha 101 and Sakha 104, respectively. These results was similar with those obtained by field emergence in (Table 1).

Germination rate index% demonstrated significant differences between the rice lots of Sakha 101 and Sakha 104 but it was non significant differences with Giza 178 variety (Table 2). The highest values (64.95, 66.89 and 69.83) were obtained from lots number (7, 6 and 6) with Giza 178, Sakha 101 and Sakha 104, respectively. These results may be due to the test was not related to soil emergence any better than germination because the latter was already highly correlated with emergence (Perry, 1997).

Plumule length (cm) showed that there no significant differences in results with field emergence in Giza 178 and Sakha 104 (Table 2). The highest value of plumule length (Cm) (4.93, 4.68 and 5.55 cm) were obtained from lots number (4, 6 and 3) with rice varieties of Giza 178, Sakha 101 and Sakha 104, respectively.

Root length (Cm). The differences among lots of the three rice varieties insignificant and it was not similar with those obtained by field emergence test (Table 2).

However, seedling dry weight (g) showed that non significant differences among lots of Sakha 101 and 104 whereas the results show that significant differences between seed lots of Giza 178 variety (Table 2). The highest value of seedling dry weight (g) (0.082, 0.0123 and 0.197) were obtained from lots number (1 and 2), (4) and(7) with rice varieties of Giza 178, Sakha 101 and Sakha 104, respectively. These results may be due to the seed lots producing the most growth per normal seedling is considered the best quality (Agrawal,1986).

Table (2): Averages of germination speed test, germination rate index, plumule and root lengths and seedling dry weight of the three rice varieties lots.

Rice varieties	Germination speed test %	Germination rate index %	Plumule length (cm)	Root length (cm)	Seedling dry weight(g)
Giza 178					
Lot 1	19.78	58.00	4.20	6.98	0.082
Lot 2	19.44	57.02	4.68	8.00	0.082
Lot 3	19.43	56.29	4.43	7.38	0.075
Lot 4	19.13	56.25	4.93	7.33	0.072
Lot 5	19.78	57.23	4.83	5.98	0.078
Lot 6	22.18	61.04	4.63	6.73	0.073
Lot 7	22.18	64.96	4.50	5.13	0.074
F. test	*	NS	NS	NS	*
LSD at 5 %	2.68	---	---	---	0.008
Sakha 101					
Lot 1	20.00	57.98	4.58	10.25	0.101
Lot 2	20.68	58.29	3.83	8.40	0.113
Lot 3	19.90	54.35	3.70	9.18	0.110
Lot 4	20.94	57.66	3.58	10.38	0.123
Lot 5	20.45	57.06	3.33	8.25	0.116
Lot 6	23.00	66.89	4.68	10.35	0.115
Lot 7	22.01	63.44	4.33	11.85	0.112
F. test	NS	*	* *	NS	NS
LSD at 5 %	---	8.46	0.66	---	---
Sakha 104					
Lot 1	21.41	62.48	5.28	5.98	0.103
Lot 2	22.02	65.69	4.28	5.68	0.126
Lot 3	16.73	49.39	5.55	5.33	0.103
Lot 4	19.69	55.62	5.28	5.33	0.103
Lot 5	20.94	62.00	4.85	6.08	0.110
Lot 6	23.95	69.83	5.30	8.23	0.107
Lot 7	23.87	68.98	5.10	7.43	0.197
F. test	* *	* *	NS	NS	NS
LSD at 5 %	2.46	8.76	---	---	---

Coefficient of the simple correlation's between rice lot varieties and some laboratory tests i.e. electrical conductivity, accelerated aging, field emergence, germination, germination speed, plumule and root lengths, seedling dry weight and germination rate index are presented in Table (3). The Coefficient of the simple correlation's between rice lot varieties and some laboratory tests were found positively and significantly for accelerated aging, field emergence, germination, and germination rate index but, it was negatively for electrical conductivity root length and seedling dry weight also it was insignificantly for electrical conductivity, germination speed and

plumule length in rice variety of Giza 178. However, the Coefficient of the simple correlation's between rice lot varieties and some laboratory tests were found positively and significantly for accelerated aging, field emergence, germination speed and germination rate index but, it was negatively for electrical conductivity also it was insignificantly for germination, plumule and root lengths and seedling dry weight in rice variety of Sakha 101. In addition, the Coefficient of the simple correlation's between rice lot varieties and some laboratory tests were found positively for, germination speed and root length but it was negatively for plumule and seedling dry weight in rice variety of Sakha 104. From these results we can be concluded that, electrical conductivity test, germination test and field emergence the best tests to determine the vigour of seed rice lots.

Table (3): Simple correlation of rice lot varieties and some studied tests.

Test	Giza 178	Sakha 101	Sakha 104
Field emergence	0.525**	0.435*	0.440*
Electrical conductivity	-0.348^{ns}	-0.590**	-0.435*
Accelerated aging	0.481**	0.383*	0.264^{ns}
Germination	0.416*	0.056^{ns}	0.155^{ns}
Germination speed	0.494^{ns}	0.439*	0.407*
Germination rate index	0.415*	0.422*	0.345^{ns}
Plumule length	0.184^{ns}	0.070^{ns}	-0.108^{ns}
Root length	-0.465**	0.303^{ns}	0.506**
Seedling dry	-0.509**	0.242^{ns}	-0.263^{ns}

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أهمية بعض الاختبارات فى قياس حيوية بذور بعض لوطات تقاوى الارز

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أجريت هذه الدراسة بوحدة بحوث تكنولوجيا البذور بالمنصورة دقهلية خلال موسم ٢٠٠٣ وذلك لدراسة أهمية بعض الاختبارات على تقدير حيوية بذور بعض لوطات تقاوى الارز وكانت أهم النتائج المتحصل عليها مايلى:

وجود تطابق فى نتائج تقدير حيوية بذور لوطات تقاوى أصناف الارز الثلاثة جيزه ١٧٨ وسخا ١٠١وسخا ١٠٤وذلك باستخدام اختبار التوصيل الكهربائى وإختبار الانبات القياسى واختبار الانبثاق فى الحقل. ومن ناحية آخرى كان هناك اختلاف فى نتائج تقدير حيوية بذور لوطات تقاوى الارز بين الأصناف الثلاثه وذلك باستخدام كلا من اختبارات الشيخوخة وسرعة الانبات معدل الانبات القياسى وطول الريشه وطول الجزير والوزن الجاف للبادرات.

يمكن التوصيه باستخدام اختبارات التوصيل الكهربائى واختبار الانبات القياسى واختبار الانبثاق فى الحقل وذلك للحصول على تقدير جيد لحيوية بذور لوطات تقاوى الارز.