

## Radicle Emergence Test – A Quick Germination Test in Different Field Crops

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Wheat, mustard and pearl-millet are important staple food crops grown in India. Since quality seed plays an important role in production and productivity, seed quality testing is important to know the status of seed lots before use. The standard germination test is universally accepted viability test in seed laboratories which is based on the count of normal seedlings in germination tests [1]. This can take place at various periods, depending on the species and can be as high as 35 days in some species such as *Asparagus aethiopicus*, *Asparagus plumosus*, *Dorotheanthus bellidiformis* and *Freesia refracta* [1]. Germination testing is done to estimate the maximum number of seeds that will produce normal seedlings, while giving repeatable results. These results can be used to compare the quality of different seed lots and also to estimate the field planting value [2]. When field conditions are near optimum, the standard germination test may accurately predict seedling emergence in the field and thereby the expected plant population. A quicker estimation method for normal seedling percentages would be valuable, in that higher normal seedling percentages are likely to emerge in the field and in transplant modules, especially under stressful conditions. The radicle emergence test, is recommended by the ISTA, as a vigor test for maize (*Zea mays* L.), oilseed rape (*Brasica napus* L.) and radish [1], although it has also shown potential for other species [3]. Development of seed vigor and quick germination tests are important for assessing the planting value of seeds as these help farmers in implementation of their production plan. Hence, an accurate and quick method for predicting the field emergence and stand establishment (based on germination and seed vigor of the seed lots) is needed. Late receiving of seed testing reports from the seed testing laboratories is one of the hindrances in timely seed marketing. To overcome this

problem and to compare the radicle emergence with germination test the present study was planned, so that time can be saved in making marketing decisions with a quick seed testing procedure.

The present study was conducted on fresh (harvest of *Rabi* 2019-20 and *Kharif* 2019) and one year old (harvest of *Rabi* 2018-19 and *Kharif* 2018) seed lots of three crops viz., pearl-millet (*Pennisetum glaucum*, var. HHB 67 imp.), mustard (*Brassica juncea*, var. RH 30) and wheat (*Triticum aestivum*, var. WH 1105) in the laboratory of Department of Seed Science & Technology, CCS Haryana Agricultural University, Hisar during 2020. Radicle emergence (%) was calculated according to International Seed Testing Association [1] by using recommended methods *i.e.* top of the paper method (TP) for mustard and pearl-millet, and both between paper (BP) and TP methods for wheat seeds. The experiment was conducted by using four replications of 50 seeds from each lot (fresh and one year old) which were put over sufficient moistened (soaked for half an hour in water) filter papers at 20°C, in case of wheat & Indian mustard and 25°C, in case of pearl-millet, as per ISTA Rules. The observations were made periodically and radicle emergence was recorded as and when maximum number of germinable seeds attained 2mm radicle protrusion. The final counts for germination test were recorded after 7 days in mustard and pearl-millet and after 8 days in wheat. Only normal seedlings were considered for recording the percent of germination [1]. The recorded data were analysed as per statistical methods suggested by [4] and by using OPSTAT software.

The time taken for radicle emergence was determined as the interval at which 2 mm radicle emergence was recorded for maximum number of germinable from the

**Table.** Radicle emergence (%) and germination (%) in different seed lots of pearl-millet, mustard and wheat

Crop/varieties	Seed lots (L)			
	Fresh seed Lot		One year old seed Lot	
	Radicle emergence (%)	Germination (%)	Radicle emergence (%)	Germination (%)
Pearl-millet (HHB-67 imp)	87.00 (68.88)	86.00 (68.08)	67.00 (54.96)	66.00 (54.39)
Mustard (RH-30)	98.25 (82.57)	98.00 (82.18)	90.00 (71.65)	90.50 (72.14)
Wheat (WH 1105) in TP method	51.00 (45.56)	89.05 (71.36)	67.00 (54.93)	88.00 (69.74)
Wheat (WH 1105) in BP method	85.50 (67.62)	86.75 (68.64)	81.00 (64.21)	79.00 (62.72)
CD at 5%	Pearl-millet	Mustard	Wheat (TP)	Wheat (BP)
	L- 5.09	L- 2.29	L- 3.75	L- 2.66
	RG- NS	RG- NS	RG- 3.75	RG- NS
	LxRG- NS	LxRG- NS	LxRG- 5.30	LxRG- NS

\*Figures in parenthesis are transformed values  
L- lots, RG- radicle emergence and Germination

start of the testing. The results revealed that in pearl-millet 2mm radicle emergence was complete after 32 hours at 25°C, in mustard it took after 40 h and in wheat 45 h at 20°C temperature in case of fresh seed lots. The time taken for radicle emergence was significantly longer in case of one year old seed lots in all three species, which was 36 hours in pearl-millet, 45 h in mustard and 48 hrs in wheat at similar temperatures. Although, more time period taken in radicle emergence was recorded in one year old seed lot as compared to fresh lots but difference in radicle emergence and germination percentage was found at par in the lots (fresh as well as one year old). This difference in time period taken in radicle emergence was due to difference in vigour status in fresh and old seed lots which results in slow seedling emergence. The final count for germination test (%) was found at par with radicle emergence (%) in all the three crops. In pearl-millet radicle emergence was recorded 87.00 and 67.00 per cent and germination on 7<sup>th</sup> day was 86.00 and 66.00 per cent in fresh and one year lot respectively while in mustard, the radicle emergence was 98.25 and 90.00 per cent and germination on 7<sup>th</sup> day was 98.00 and 90.50 percent in fresh and one year old seed lots, respectively. In wheat, radicle emergence in TP method was 51.00 and 67.00 per cent and germination was recorded 89.05 and 88.00 per cent in fresh and one year seed lot respectively while in between paper (BP) method radicle emergence was 85.05 and 81.00% and germination was recorded 86.75 and 79.00% in fresh and one year old seed lot, respectively. In wheat crop difference in radicle emergence and germination percentage was observed in TP method but in BP method radicle emergence and germination percentage were

found at par. This may be due to unavailability of sufficient moisture required for normal germination content in TP method. Due to big size of wheat might not get optimum moisture content in top of method resulting in slow germination process. Mavi *et al.* [5] suggest that the radicle emergence test provides small laboratories with the opportunity to gain early information on the eventual count of normal seedlings. Exact predictions of normal germination may not be possible but laboratories may provide a quick guide as to which seed lots may or may not be suitable for sale. Chinnasamy and Sundareswaran [6] concluded that counting 2 mm radicle emergence at 32 h could be used for a quick evaluation to assess the seed vigour in terms of field emergence in cluster bean seed lots. Ozden *et al.* [7] also concluded in their study that radicle emergence test after 104 hrs count can be used to make quick and repeatable predictions of the percentage of normal seedlings in Aubergine seed lots. Radicle emergence and germination percentage was recorded more in fresh seed lots as compared to one year old seed lot. This may be due to the difference in vigour status of seed lots. It is concluded from the study that radicle emergence test can be used as a quick test to predict germination percentages in small seeded crops like pearl-millet and mustard by using top of the paper method whereas in wheat, BP method is more suitable for radicle emergence test. By using radicle emergence test, 5-6 days can be saved in seed testing procedure in these crops. Onwimol *et al.* [8] found that there was no significant difference in the variance of the germination time between radicle emergence and normal seedlings of rice but there was a significant difference for mung bean. There is need to study this test in other crops also

where seed testing period is upto one month, so that time can be saved in those crops.

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