An improved method of seed germination testing in *Kabuli* chickpea

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ABSTRACT

An experiment was conducted during 2014-2015 to standardize the seed testing method in *Kabuli* chickpea MNK-1 by number of seeds and number of germination papers. Among the different testing methods 25 seeds per replication recorded highest seed germination percentage (91.58%), less number of fresh un-germinated seeds (1.91%), abnormal seedlings (4.00%), diseased seeds (2.33%) and significantly higher seedling vigour index-I and II (2844 and 7792), among the number of germination papers used 2+1 as in between paper method (Bottom 2 and one paper above) recorded significantly higher germination percentage (92.12%), less number of fresh un-germinated seeds (1.41%), abnormal seedlings (3.66%), diseased seeds (2.33%) and significantly higher seedling vigour index-I and II (2463 and 6900), when compared to other. Irrespective of number of germination paper and seeds used however, interaction of 25 seeds per replication and 2+1 between paper method of seed germination testing showed significantly germination percentage (96.50%), less number of fresh un-germinated seeds (0.00%), abnormal seedlings (1.00%), diseased seeds (1.00%) and significantly higher seedling vigour index-I and II (2215 and 6863) followed by 50 seeds per replications.

Key words: *Kabuli* Chickpea, Seed testing methods, Seed quality and Seed germination.

INTRODUCTION

Chickpea (*Cicer arietinum* L.), also called garbanzo bean or Bengal gram is an Old World pulse and one of the seven Neolithic founder crops in the Fertile Crescent of the Near East (Lev-Yadun et al., 2000). Chickpea is the third most important pulse crop in production, next to dry beans and field pea (FAO 2011). Chickpea is a good source of carbohydrates and protein, together constituting about 80 per cent of the total dry seed mass (Chibbar et al 2010) in comparison to other pulses. Chickpea is cholesterol free and is a good source of dietary fiber, vitamins and minerals (Anonymous 2006, Wood and Grusak, 2007). India is the major producing country for chickpea, contributing for over 75 per cent of total seed production in the world. There are two types of chickpeas viz., desi and *Kabuli* grown in the world. Out of two types of cultivars grown in India, *Kabuli* type occupies nearly 15 per cent and desi type occupies about 85 per cent of the area. But the instability the crop yield and low yield level are the major constraints in production.

Germination test has been accepted as an index of seed quality, in spite of facing some serious problems of standardizing in some crops and varying results in the classification of normal and abnormal seedlings. ISTA has recommended a constant temperature of 20°C and 90 % relative humidity and germination testing methods for chickpea. Standard germination test in *Kabuli* chickpea is affected due to presence of thin seed coat and bold seediness, hence it requires more moisture for germination. The relevant study was undertaken to identify the accurate method of seed germination testing for *Kabuli* chickpea which is having 100 seed weight more than 45gms as compared to less than 28gms in desi chickpea.

MATERIALS AND METHODS

Experiments were conducted to standardize the seed germination testing procedure for chickpea variety MNK-1. For the standardization of seed germination testing procedures, the treatment combinations were used as follows number of seeds per replication N1, 25 seeds, N2, 50 seeds and N3, 100 seeds, between germination paper methods (Between paper method) T1, - 2+1, T2, - 3+1, T3, - 2+2 and T4, - 3+2 and treatment combinations used were (N1T1, N2T1, N3T1, N1T2, N2T2, N3T2, N1T3, N2T3, N3T3, and N1T4, N2T4, N3T4). Standard germination test was conducted by maintaining required temperature and relative humidity throughout the test period by following ISTA procedure (Anonymous., 2010). The different number of seeds viz., 25 number of seeds, 50 number of seeds, 100 number of seeds were placed on different methods of two moist germination Papers (viz., 2+1 between paper method, 3+1 between paper method, 2+2 between paper method, 3+2 between paper method) and they were rolled. The rolled towels were placed in the germinator in slant position at the required temperature and relative humidity according to the treatment. Total 400 seeds were tested for each treatment. The experiment laid out in two Factorial Completely Randomized Design. seeds were sown between paper and kept under the test conditions of 25°C ±1°C.

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and 95° ± 3 per cent relative humidity maintained in a walk in germination room. After the test period of fourteen days the normal seedlings, abnormal seedlings, dead seeds and fresh ungerminated seeds were counted and the mean values expressed as the percentage (ISTA, 1999) to the total number of seeds placed for germination.

Seedling vigour index values were computed, adopting the procedure of Abdul Baski and Anderson (1973) as given below and expressed as the whole number.

Seedling Vigour index I = Germination (%) x Total seedling length (cm).

Seedling Vigour index II = Germination (%) x Seedling dry matter (g)

RESULTS AND DISCUSSION

The data with respect to germination percentage is influenced by number of seeds and number of germination paper are presented in Table 1. Among the number of seeds N1- 25 seeds per replication has recorded significantly higher germination percentage (91.58%), less number of fresh un-germinated seeds (1.91%), abnormal seedlings (4.00%), diseased seeds (2.33%) and significantly higher seedling vigour index-I and II (2215 and 6863), followed by N2- 50 seeds (88.16), fresh un-germinated seeds (1.91%), abnormal seedlings (7.00%), diseased seeds (3.16%) and significantly higher seedling vigour index-I and II (2070 and 6508). Whereas lower germination percentage (86.25%) higher fresh un-germinated seeds (2.16%), abnormal seedlings (8.30%), diseased seeds (3.50%) and significantly lower seedling vigour index-I and II (2042 and 6334) was recorded with N3- 100 seeds. In Festuca arundinacea seeds between paper method recorded highest germination percentage (Rujan et al., 2012).

The increase in seed quality parameters was noticed in 25 seeds followed by 50 seeds which might be due to more availability of space and moisture for better germination and growth of seedlings and increase in number of seeds to 100 seeds recorded more fresh un germinated seeds and abnormal seedlings which may be due to less availability of moisture and space, as the seeds are bold and require more moisture for germination. In the case of 25 seeds and 50 seeds higher seedling vigour index obtained which may be due to better utilization of space and moisture for better growth of seedlings correspondingly leading to more increase in seedling vigour index. These results are argued with Krishna et al (2014).

Among the number of germination papers used (2+1) recorded significantly higher germination percentage (92.12%), less number of fresh un-germinated seeds (1.41%), abnormal seedlings (3.66%), diseased seeds (2.57%) and significantly higher seedling vigour index-I and II (2463 and 6900), where as lowest was recorded in case of (3+2) lower germination percentage (984.75%), higher

| Treatments | Normal seedlings (%) | Fresh un germinated seeds (%) | Abnormal seedlings (%) | Diseased seeds (%) | Seedling vigour index-I | Seedling vigour index-II |
|------------|----------------------|-------------------------------|-----------------------|-------------------|------------------------|------------------------|
| N1 - 25 seeds | 90.75 | 92.12 | 91.58 | 1.87 | 1.91 | 1.91 | 1.75 | 2.33 | 2215 | 2508 |
| N2 - 50 seeds | 88.62 | 89.25 | 88.16 | 1.75 | 1.75 | 1.75 | 3.00 | 3.50 | 3.16 | 2137 | 2380 |
| N3 - 100 seeds | 83.25 | 84.25 | 84.62 | 2.21 | 2.62 | 2.57 | 8.75 | 8.75 | 8.75 | 1664 | 1880 |

S.E.m ± 0.29 0.30 0.29 NS NS NS NS NS NS NS

CD (0.01) 0.85 0.86 0.88 NS NS NS NS NS NS NS

Table 1: Effect of number of seeds/replication on seed quality of Kabuli chickpea (Cv. MNK-I).
Table 2: Effect of no of germination paper on seed quality of Kabuli chickpea (Cv. MNK-1 (Between paper method).  

| Treatments | Normal seedlings (%) | Fresh un germinated seeds (%) | Abnormal seedlings (%) | Dead seeds (%) | Seedling vigour index-I | Seedling vigour index-II |
|------------|----------------------|-------------------------------|-----------------------|----------------|------------------------|------------------------|
| Number of seeds (S) | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled |
| T1 (3+1)   | 91.58 | 89.66 | 89.75 | 1.91 | 1.91 | 1.91 | 7.0 | 6.00 | 6.00 | 3.16 | 3.66 | 3.66 | 2070 | 2356 | 2340 | 6508 | 6590 | 6547 |
| T1 (3+2)   | 86.25 | 86.83 | 86.54 | 2.16 | 2.16 | 2.16 | 8.3 | 7.33 | 7.33 | 3.50 | 3.16 | 3.16 | 2042 | 2223 | 2216 | 6334 | 6432 | 6411 |
| T1 (2+2)   | 84.16 | 85.33 | 84.75 | 2.5 | 2.16 | 2.16 | 9.0 | 8.33 | 8.33 | 2.83 | 2.83 | 2.83 | 1952 | 2152 | 2137 | 6068 | 6152 | 6109 |
| S.Em±      | 0.29 | 0.30 | 0.19 | 0.49 | 0.50 | 0.40 | 0.30 | 0.28 | 0.06 | 0.22 | 0.20 | 0.06 | 10.04 | 13.23 | 7.26 | 27.56 | 23.42 | 16.90 |
| CD (0.01)  | 0.85 | 0.86 | 0.55 | NS | 1.45 | 1.15 | 0.87 | 0.82 | 0.19 | 0.64 | 0.60 | 0.19 | 28.80 | 37.95 | 20.84 | 79.03 | 67.20 | 48.48 |

Table 3: Interaction effect of Number of seeds x testing methods.  

| Treatments | Normal seedlings (%) | Fresh un germinated seeds (%) | Abnormal seedlings (%) | Dead seeds (%) | Seedling vigour index-I | Seedling vigour index-II |
|------------|----------------------|-------------------------------|-----------------------|----------------|------------------------|------------------------|
| Number of seeds x testing methods | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled | 2014 | 2015 | Pooled |
| N1T1       | 96.00 | 97.00 | 96.50 | 0.00 | 0.00 | 0.00 | 2.00 | 1.00 | 1.00 | 2.00 | 1.00 | 1.00 | 2412 | 2859 | 2844 | 7768 | 7832 | 7792 |
| N1T2       | 92.00 | 93.50 | 92.75 | 0.00 | 0.00 | 0.00 | 6.00 | 4.00 | 4.00 | 2.00 | 3.50 | 3.50 | 2196. | 2494 | 2474 | 7146 | 7089 | 7032 |
| N1T3       | 89.50 | 90.00 | 89.75 | 0.00 | 2.00 | 2.00 | 8.00 | 6.00 | 6.00 | 2.50 | 2.00 | 2.00 | 2189 | 2375 | 2369 | 6849 | 6887 | 6868 |
| N1T4       | 85.50 | 88.00 | 86.75 | 5.00 | 3.00 | 3.00 | 9.00 | 8.00 | 8.00 | 2.00 | 1.00 | 1.00 | 2037 | 2305 | 2272 | 6382 | 6568 | 6475 |
| N2T1       | 93.25 | 94.00 | 93.63 | 1.00 | 0.00 | 0.00 | 2.00 | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 2296 | 2451 | 2441 | 7446 | 7515 | 7485 |
| N2T2       | 88.50 | 89.50 | 89.00 | 2.00 | 2.00 | 2.00 | 6.00 | 5.00 | 5.00 | 3.50 | 3.50 | 3.50 | 2169 | 2517 | 2503 | 6793 | 7030 | 6990 |
| N2T3       | 86.75 | 87.50 | 87.13 | 2.00 | 2.00 | 2.00 | 8.00 | 7.00 | 7.00 | 3.50 | 3.50 | 3.50 | 2057. | 2303 | 2293 | 6640 | 6862 | 6832 |
| N2T4       | 86.00 | 86.00 | 86.00 | 2.00 | 3.00 | 3.00 | 9.00 | 7.00 | 7.00 | 3.00 | 4.00 | 4.00 | 2025 | 2251 | 2251 | 6513 | 6513 | 6513 |
| N3T1       | 85.50 | 87.00 | 86.25 | 3.50 | 3.00 | 3.00 | 8.00 | 7.00 | 7.00 | 3.00 | 3.00 | 3.00 | 1936 | 2123 | 2104 | 5376 | 5470 | 5423 |
| N3T2       | 84.00 | 85.50 | 84.50 | 3.00 | 3.00 | 3.00 | 9.00 | 9.00 | 9.00 | 4.00 | 4.00 | 4.00 | 1845 | 2057 | 2044 | 5586 | 5652 | 5619 |
| N3T3       | 82.50 | 83.00 | 82.75 | 4.00 | 4.00 | 4.00 | 9.00 | 9.00 | 9.00 | 4.50 | 4.00 | 4.00 | 1881 | 1992 | 1985 | 5515 | 5548 | 5531 |
| N3T4       | 81.00 | 82.00 | 81.50 | 5.00 | 4.00 | 4.00 | 9.00 | 10.00 | 10.00 | 5.00 | 4.00 | 4.00 | 1794 | 1900 | 1888 | 5309 | 5375 | 5338 |
| S.Em±      | 0.59 | 0.60 | 0.38 | 0.98 | 1.01 | 0.80 | 0.60 | 0.57 | 0.13 | 0.45 | 0.41 | 0.13 | 20.08 | 26.46 | 14.53 | 55.12 | 46.85 | 33.80 |
| CD (0.01)  | 1.71 | 1.72 | 1.11 | 2.82 | 2.91 | 2.30 | 1.74 | 1.65 | 0.39 | 1.29 | 1.20 | 0.39 | 57.67 | 75.90 | 41.68 | 158.07 | 134.40 | 96.97 |
number of fresh un-germinated seeds (2.16%), abnormal seedlings (8.33%), diseased seeds (2.83%) and significantly higher seedling vigour index index-I and II (2137 and 6109), whereas lower seed quality parameters were recorded in N1T4, lower seed germination percentage (81.50%), higher number of fresh un-germinated seeds (4.00%), abnormal seedlings (10.00%), diseased seeds (4.00%) and significantly lower seedling vigour index index-I and II (1888 and 5338). Tulasi recorded highest germination percentage and seedling vigour index in between paper and soil method compared to the top paper method and sand method (Jyothi et al., 2014). In Bael seeds, sand (83%) and between paper (78%) method recorded highest germination percentage and seedling vigour index, hence these two methods were recommended for seed testing (Venudevan et al. 2013). Ashwagandha seeds recorded highest germination percentage in between the paper method than top of the paper method at 20°C (Suryavanshi et al., 2001).

CONCLUSION

From the present study, it can be concluded as 25 seeds followed by 50 seeds per replication are used for germination testing found an accurate method of seed germination (%) and all other seed quality parameters of Kabuli chickpea/MNK-1. Hence it is advised to adopt this improved method for testing seed germination in Kabuli chickpea.

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