

## Seed Germination and Vigour Index as Influenced by Method of 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. 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 index-I and II (2215 and 6863), 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 index-I and II (2463 and 6900), when compared to other. Irrespective of number of germination paper and number of seeds used in each replication 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 index-I and II (2844 and 7792) followed by 50 seeds per replication.

**Keywords:** Kabuli Chickpea, Seed testing methods, Seed quality, Seed germination, Seed vigour

### 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<sup>8</sup>. Chickpea is the third most important pulse crop in production, next to dry beans and field pea (F.A.O.S.T.A.T., 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, & Grusak, 2007). India is the major producing country for chickpea, contributing for over 75 per cent of total production in the world. There are two types of chickpeas viz., desi and *Kabuli* grown in the world.

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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 for germination testing of 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 28 gms 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 N<sub>1</sub> =25 seeds, N<sub>2</sub> =50 seeds and N<sub>3</sub>=100 seeds, between germination paper methods (Between paper method) T<sub>1</sub> - 2+1, T<sub>2</sub> - 3+1, T<sub>3</sub> - 2+2 and T<sub>4</sub> - 3+2 and treatment combinations used. 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° ±1°C and 95° ± 3 per cent relative humidity maintained in walk in germination room. After the test period of eight days the normal seedlings, abnormal seedlings, dead seeds and fresh ungerminated seeds were counted and the mean values expressed as the percentage to the total number of seeds placed for germination.

Seedling vigour indices 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 as influenced by number of seeds and number of germination paper are presented in Table1 and Plate1. Among the number of seeds N<sub>1</sub>- 25 seeds per replication has recorded significantly higher germination percentage (91.58%), less number of fresh ungerminated 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 N<sub>2</sub>- 50 seeds (88.16), fresh ungerminated seeds (1.91%), abnormal seedlings (7.00%), diseased seeds (3.16%) and significantly higher seedling vigour index index-I and II (2070 and 6508). Whereas lower germination percentage (86.25%) higher fresh ungerminated seeds (2.16%), abnormal seedlings (8.30%), diseased seeds (3.50%) and significantly lower seedling vigour index index-I and II (2042 and 6334) was recorded with N<sub>3</sub>- 100 of 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 ungerminated 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 (2.33%) and significantly higher seedling vigour index index-I and II (2463 and 6900), where as lowest was recorded in case of (3+2) lower germination percentage (94.75%), higher 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), The data are presented in Table 2 and Plate 2. Medicinal plants like Podaptri and Dulagundi recorded highest germination percentage in between germination paper than the top of the germination paper results were observed by Jyothi et al. (2014).

Highest seed quality parameters were noticed in use of 2+1 and 3+1 methods compared to other methods which may be due to more availability of moisture by additional

germination paper. Among these testing methods, 2+1 method was found to be good because of uniform supply of moisture from upper and lower layers of germination papers, further increase of germination paper layers to (3+2) between paper method showed less seed quality parameters which may be due to problem of aeration for respiration of seedlings as well as more moisture availability leading to suffocation for growth of seedlings. These are live findings of with Krishna et al. (2012).

Irrespective of number of germination paper and seeds used, interaction of N<sub>1</sub>T<sub>2</sub> showed significantly higher germination percentage (96.50 %), less number of fresh ungerminated seeds (0.00 %), abnormal seedlings (1.00 %), diseased seeds (1.00 %) and significantly higher seedling vigour index index-I and II (2844 and 7792), whereas lower seed quality parameters were recorded in N<sub>3</sub>T<sub>4</sub>, viz., 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). In Tulasi, highest germination percentage and seedling vigour index were noticed in between paper and soil method compared to the top paper method and sand method<sup>6</sup>. 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 paper method than top of the paper method at 20°C (Suryavanshi et al., 2001).

**Table 1: Effect of number of seeds/ replication on seed quality of *Kabuli* chickpea (Cv. MNK-1)**

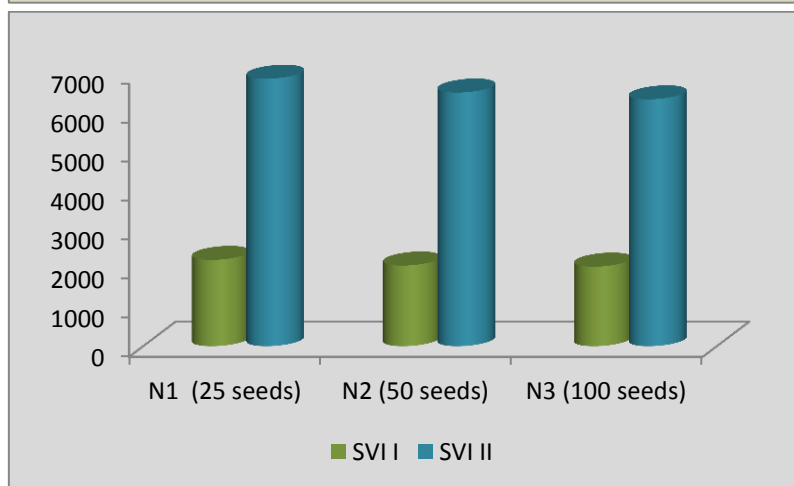
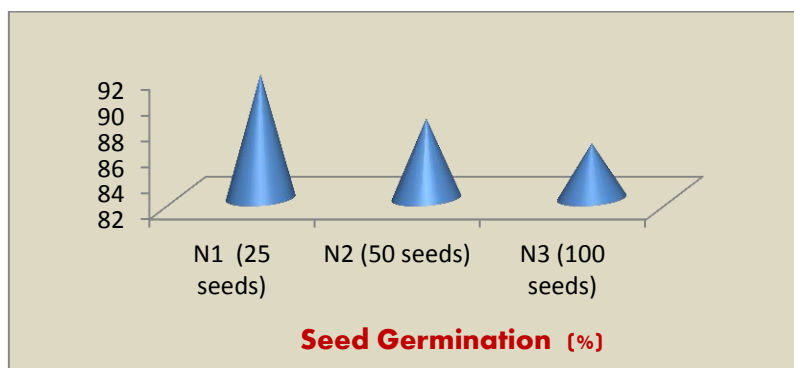
Treatments	Normal seedlings (%)			Fresh un germinated seeds (%)			Abnormal seedlings (%)			Dead seeds (%)			Seedling vigour index-I			Seedling vigour index-II		
	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled
N <sub>1</sub> 25 seeds	90.75	92.12	91.58	1.87	1.37	1.91	6.25	4.75	4.0	1.75	1.75	2.33	2208	2508	2215	7036	7094	6863
N <sub>2</sub> 50 seeds	88.62	89.25	88.16	1.75	1.75	1.91	6.25	5.5	7.0	3.0	3.50	3.16	2137	2380	2070	6848	6980	6508
N <sub>3</sub> 100 seeds	83.25	84.25	86.25	2.75	2.62	2.16	8.75	8.75	8.3	4.12	3.75	3.50	1864	2018	2042	5446	5511	6334
<b>S.Em±</b>	0.29	0.30	0.29	0.49	0.50	0.49	0.30	0.28	0.30	0.22	0.20	0.22	10.04	13.23	10.04	27.55	23.42	27.55
<b>CD (0.01)</b>	0.85	0.86	0.85	NS	NS	NS	0.87	0.82	0.87	0.64	0.60	0.64	28.80	37.95	28.80	79.35	67.20	79.03

**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		
	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled
Number of seeds (S)	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled
T <sub>1</sub> (2+1)	91.58	92.66	92.12	1.91	1.41	1.41	4.0	3.66	3.66	2.33	2.33	2.33	2215	2477	2463	6863	6939	6900
T <sub>2</sub> (3+1)	88.16	89.33	88.75	1.91	1.91	1.91	7.0	6.00	6.00	3.16	3.66	3.66	2070	2356	2340	6508	6590	6547
T <sub>3</sub> (2+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
T <sub>4</sub> (3+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 × testing methods**

Treatments	Normal seedlings (%)			Fresh un germinated seeds (%)			Abnormal seedlings (%)			Dead seeds (%)			Seedling vigour index-I			Seedling vigour index-II		
	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled
Number of seeds × 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	85.00	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

**Plate 1: Effect of number of seeds/ replication on seed quality of *Kabuli* chickpea (Cv. MNK-1)**

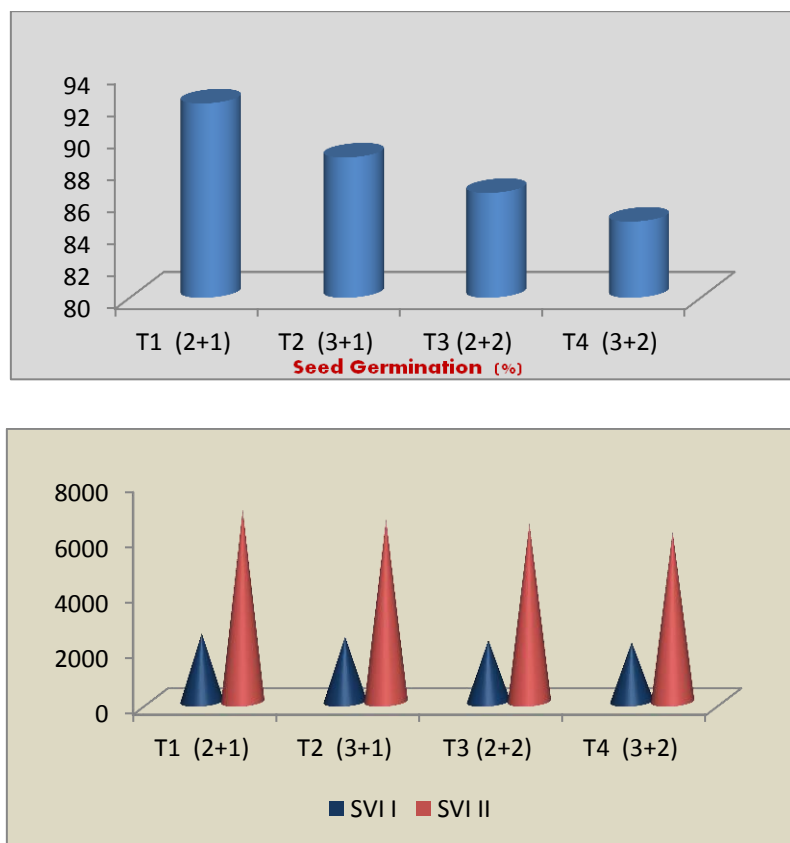


Plate 2: Effect of no of germination paper on seed quality of *Kabuli* chickpea (Cv. MNK-1) (Between paper method)

### CONCLUSION

From the present study, it can be concluded that 25 seeds followed by 50 seeds per replication could be 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* chick pea.

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