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Evaluation of Seed Quality of Chickpea (*Cicer arietinum* L.) Collected from Different Branches

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Abstract

Mature seeds of three chickpea varieties like BARI Chhola-5, 6 and 8 were collected from three different branches like primary, secondary and tertiary, and were evaluated for quality in the Seed Technology Laboratory, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh during August to September of 2004 and 2005. All the seeds were stored in earthen pot for five months before conducting the laboratory study. Significant variation was observed in all three varieties of chickpea for all the parameters studied except seed vigour. The highest moisture percentage (10.17 in 2004 and 10.18 in 2005), dry weight (0.50 g in 2004 and 0.51 g in 2005) and seed vigour (39.7 in 2004 and 41.6 in 2005) was observed in BARI Chhola-8 and the lowest in BARI Chhola-5. Germination percentage was significantly higher in BARI Chhola-5 (87.6 in 2004 and 88.9 in 2005). Seeds of different branches did not vary significantly for most of the parameters. However, seeds of primary or secondary branches had higher moisture and germination percentage, dry weight of seedling and seed vigour. Interaction effects of varieties and seeds of different branch had no definite trend though non-significant effect was observed in most of the parameters.

Keywords: Chickpea, Seed of different branches, Vigour, Moisture, Germination.

Introduction

Seed development is the maximum fresh weight accumulation and seed maturation (Mehta *et al.,* 1993). The seed reaches its maximum dry weight at physiological maturity. Studies on seed development and physiological maturity become important because seeds should be harvested at proper time to ensure their quality in terms of germination potential and vigour. Quality of seeds is deteriorated if they retain on mother plant after physiological maturity.

Storability of seeds is mainly a genetical character which might be influenced by pre-storage condition of seed, seed maturation and environmental factors during pre-and-post harvest stages (Mahesha *et al.,* 2001b). Early harvested seeds will be immature and less developed and as such perform poorly in store compared to seed harvested right at physiological maturity (Singh and Lachanna, 1995; Deshpande *et al.,* 1991).

At physiological maturity seed shall have the maximum viability and vigour. Attainment of physiological maturity is a genotypic character which is influenced by environmental factors (Kole and Gupta, 1982; Mahesha *et al.,* 2001a). As such harvesting of seed crop at optimum stage of seed maturation is essential to obtain better seed quality.

Moisture content of harvested seeds affects quality. Harvesting at high moisture content increases the changes of mycofloral infection on seed while harvesting at low moisture content increases mechanical damage to seed (Yadav *et al.,* 2005).

Seed quality depends on position of seeds in the plant, maturity, seed size, vigour etc. (Khatun *et al.,* 2008). Seed quality is a multiple concept comprising several components which may be divided in four major groups viz. genetic quality, physical quality, physiological quality and pathological quality (Huda, 2001). Farmers store their chickpea seeds in different ways such as i) tin, ii) plastic dram, iii) earthen pot, iv) jute bag with polythene lined, v) polythene bag, vi) bamboo dol, and vii) sac (Khatun, 2007). Harvesting of seed

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from proper site/parts helps to obtain better quality seed. Seeds collected from different site/parts influenced the quality of seed in relation to germination, vigour, viability and also storability. Seed quality in storage is also influenced by the condition, which has not yet been studied for chickpea seed storage. It is necessary to identify right site for harvesting chickpea crops in order to ensure seed quality. Therefore, investigation was carried out to find out the quality of the seeds collected from different parts of chickpea plants.

Materials and Methods

Laboratory experiments were carried out at the Seed Technology Division Laboratory in the Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh during the period from August to September of 2004 and 2005. Seeds of three chickpea varieties viz. BARI Chhola-5, BARI Chhola-6 and BARI Chhola-8 were collected from Pulses Research Centre experimental field of BARI, Gazipur in rabi season of 2003-04 in March considering three different branches i.e. primary, secondary and tertiary branches of chickpea plants. Seeds were collected from the above branches separately and dried, and kept in polyethylene bags for recording data. The collected seeds were preserved in the earthen pot from April 2004 to August 2004 and April 2005 to August 2005. The laboratory experiment was carried out in factorial complete randomized design with the above seeds in order to assess the seed quality in respect of moisture percentage, germination percentage, dry weight of seedlings and seed vigour.

Determination of moisture content

The moisture content of seed samples was determined according to ISTA (1976). Ten g of seeds samples of each branch were grounded and taken into moisture cup and put into a pre-heated oven at temperature of 103 ± 2^{o}C for one hour. Three replicates were taken. After cooling, the weight of the container with its cover and contents were taken. The seed samples were cooled in desiccators and weighed to work out the percent moisture content of the grains. The seed moisture content was determined by dry weight basis and was calculated by the following formula:

Moisture content = $\{(M_2-M_3) / (M_2-M_1)\}$ x 100

Where, M_1 is the weight in grams of the container and its cover,

M_2 is the weight in grams of the container, its cover and its contents before drying, and

M_3 is the weight in grams of the container, its cover and contents after drying.

Determination of germination test

Germination test was carried out according to ISTA (1976). For each treatment, 100 seeds were put into petri dishes. Four replicates were used. The petri dishes were put up on a laboratory table at room temperature (25±2^{o}C). After ten days, normal, abnormal and diseased seeds were counted.

Determination of fresh and dry weight of seedling

After ten days fresh weight of seedlings was recorded. Then the root and shoot were put into paper packet separately, and placed into the preheated oven (70^{o}C) for 48 hours (Morshed *et al.,* 2003; Khatun *et al.,* 2008). After cooling in desiccators, the dry weight was taken.

Determination of seed vigour

Seed vigour was calculated based on the following formulae (Reddy and Khan, 2001):

Vigour index= Percent germination x total dry weight of seedling.

The data for different characters were subjected to statistical analysis following a computer IRRISTAT package programme. The correlation co-efficient were done for different variables wherever needed.

Results and Discussion

Moisture percentage

Varieties differed significantly on moisture percentage (Table I). The highest moisture percentage of 10.17% in 2004 and 10.18% in 2005 was observed in BARI Chhola-8 which was identical to BARI Chhola-6 (9.77%) in 2004 but dissimilar to BARI Chhola-5 (9.59%) and BARI Chhola-6 (9.97%) in 2005. The lowest moisture percentage (8.71% in

2004 and 9.59% in 2005) was observed in BARI Chhola-5. Morshed et al. (2003) reported that chickpea seeds contained 9.28-11.75% moisture content after six months of storing. Shahjahan (2003) observed that chickpea seeds contained 8.74-13.4% moisture content after nine months of storing in six types of containers. Significant response of seed of different branches of chickpea regarding moisture percentage was observed in 2004 (Table II). Seeds of the primary branches showed significantly higher moisture percentage (10.43%) compared to secondary branches in 2004. But in 2005, seeds of primary branches also recorded the highest moisture percent (10.18%), which was not significant to secondary and tertiary branches. Interaction between varieties and seeds of different branches was non-significant for moisture percentage in 2004 but significant in 2005 (Table III). Moisture percentage was the highest (11.00% in 2004 and 10.83% in 2005) by the interaction effect of BARI Chhola-6 and primary branch and the lowest moisture percentage of 7.81% in BARI Chhola-5 and secondary branch in 2004 and of 9.00 in BARI Chhola-5 and primary branch in 2005. The highest moisture percentage recorded by BARI Chhola-8 and primary branch which was identical to a number of combined treatments in 2005.

Germination percentage

There was highly significant response of seed germination percentage for chickpea varieties (Table I). Among three varieties, germination percentage was prominent with BARI Chhola-5, which was significant over BARI Chhola-8, but identical to Chhola-6 in both years. Seeds of the primary branch of chickpea plants showed higher germination percentage (84.1%) in 2004 (Table II). However, the germination percentage of seeds of all branches was statistically identical in 2005, ranging from 84.0-86.1. The interaction effect of variety and seeds of different branches were not significant (Table III) though the highest germination percentage (89.0% in 2004 and 87.9% in 2005) was recorded in seeds of primary branches of BARI Chhola-5 and seeds of tertiary branches of BARI Chhola-5.

Table I: Effects of chickpea varieties on different parameters under laboratory condition

Variety	Moisture (%)		Germination (%)		Dry weight (g plant^{-1})		Seed vigour	
	2004	2005	2004	2005	2004	2005	2004	2005
BARI Chhola-5	8.71b	9.59b	87.6a	88.9a	0.42b	0.41b	36.6	36.8
BARI Chhola-6	9.77ab	9.97b	84.7ab	84.7ab	0.46ab	0.47ab	39.2	40.3
BARI Chhola-8	10.17a	10.18a	78.4b	81.8b	0.50a	0.51a	39.7	41.6
SE (±)	0.276	0.203	1.86	1.07	0.010	0.024	-	-
Level of Sig.	**	*	**	**	**	*	NS	NS

In a column, having common letters are not significantly different by DMRT
*, Significant at 5% level; **, Significant at 1% level; NS, Not significant

Table II: Effects of chickpea seeds collected from different branches on different parameters under laboratory condition

Seeds collected from different branches	Moisture (%)		Germination (%)		Dry weight (g plant^{-1})		Seed vigour	
	2004	2005	2004	2005	2004	2005	2004	2005
Primary branch	10.43a	10.18	84.1	85.4	0.46	0.47	39.1	40.1
Secondary branch	8.79b	9.44	83.4	86.1	0.47	0.47	39.1	39.9
Tertiary branch	9.43ab	10.11	83.1	84.0	0.45	0.46	37.3	38.6
SE (±)	0.276	-	-	-	-	-	-	-
Level of Sig.	**	NS	NS	NS	NS	NS	NS	NS

In a column, having common letters are not significantly different by DMRT
**, Significant at 1% level; NS, Not significant

Table III: Interaction effects of chickpea varieties and seeds collected from different branches on different parameters under laboratory condition

Treatment		Moisture (%)		Germination (%)		Dry weight (g plant^{-1})		Seed vigour	
Variety	Branch	2004	2005	2004	2005	2004	2005	2004	2005
BAR Chhola-5	Primary	9.56	9.00c	88.0	89.1	0.42	0.41	36.7	36.6
	Secondary	7.81	9.33c	89.0	88.2	0.42	0.42	37.6	37.1
	Tertiary	8.77	10.43ab	85.7	89.3	0.41	0.41	35.3	36.7
BARI Chhola-6	Primary	10.74	10.70a	82.0	87.2	0.45	0.47	36.8	41.1
	Secondary	8.76	9.40bc	83.0	84.5	0.48	0.48	39.8	40.7
	Tertiary	9.80	9.80abc	89.0	82.5	0.46	0.47	40.9	38.9
BARI Chhola-8	Primary	11.00	10.83a	82.3	79.8	0.53	0.52	43.6	42.7
	Secondary	9.79	9.60b	78.3	85.6	0.51	0.50	39.9	41.8
	Tertiary	9.72	10.10abc	74.7	80.2	0.48	0.50	35.6	40.2
SE (±)		-	0.057	-	-	-	-	-	-
Level of Sig.		NS	**	NS	NS	NS	NS	NS	NS
CV (%)		8.7	6.1	6.7	4.4	6.6	15.2	11.6	18.8

In a column, having common letters are not significantly different by DMRT
**, Significant at 1% level; NS, Not significant

Dry weight

Seedling dry weight of BARI Chhola varieties was significant (Table I). BARI Chhola-8 recorded the highest seedling dry weight (0.50 g in 2004 and 0.51 g in 2005), which was significantly higher over BARI Chhola-5 (0.42 g in 2004 and 0.41 g in 2005) but identical to BARI Chhola-6 (0.46 g in 2004 and 0.47 g in 2005). Mahesha *et al*. (2001b) reported that sunflower varieties differed significantly on dry weight. The lowest dry weight was observed in BARI Chhola-5. Seed of different branches did not markedly increase the dry weight (Table II). The interaction effect of variety and seed of different branches was non-significant (Table III). It indicated that all the three varieties gave similar response to seeds of different branches. The maximum seedling dry weight (0.53 g in 2004 and 0.50 g in 2005) was recorded in seeds of primary branch of BARI Chhola-8. The minimum seedling dry weight (0.41 g) was observed in seeds of tertiary branch of BARI Chhola5 in 2004, and primary and tertiary branch of BARI Chhola-5 in 2005.

Seed vigour

Seed vigour of three chickpea varieties was non-significant (Table I). The maximum seed vigour of 39.7 in 2004 and 41.6 in 2005 was produced by BARI Chhola-8. The lowest seed vigour was noted in BARI Chhola-5. Seeds of different branches did not increase significantly the vigour (Table II) though the maximum seed vigour (39.1 in 2004 and 40.1 in 2005) was recorded in the seeds of primary branches. Seeds of tertiary branch showed lower seed vigour. The interaction effect of variety x seeds of different branches for seed vigour

Table IV: Correlation matrix among different parameters of chickpea

Characters	Correlation coefficient (r value)					
	Germination		Dry weight		Vigour	
	2004	2005	2004	2005	2004	2005
Moisture	-0.289	0.052	0.210	0.590**	-0.015	0.608**
Germination	-	-	-0.266	-0.043	0.431*	0.259
Dry weight	-	-	-	-	0.754**	0.944**

**, Significant at 1% level; *, Significant at 5% level

was non-significant (Table III). This might be due to similar response of three varieties to seed collection. The maximum seed vigour (43.6 in 2004 and 42.7 in 2005) was observed in seed of primary branch of BARI Chhola-8 and the minimum also in primary branch of BARI Chhola-5.

Correlation

Correlation matrix among the plant characters of chickpea has been shown in Table IV. A positive and significant correlation was observed between moisture percentage and dry weight (2005) and vigour (2005), germination percentage and vigour (2004), dry weight and vigour (2004 and 2005). Moisture percentage had no correlation with germination percentage. A positive correlation (r=0.596) between germination and dry matter was shown (Mehta *et al*., 1993). Reddy and Khan (2001) found a positive and significant correlation between germination and seedling dry weight (0.68**) and vigour index (0.91**). Similar results were reported by Baburatan *et al.* (1993) and Ponnuswamy *et al.* (1991).

Conclusion

The findings indicated that the highest moisture percentage, dry weight and vigour were observed in BARI Chhola-8 and the lowest in BARI Chhola-5 while germination percentage was higher in BARI Chhola-8. Seeds of different branches had significant effect on moisture percentage only in 2004. Collection of pods from primary branches of chickpea plants recorded the highest moisture percentage and secondary branches gave the lowest moisture percentage. Seeds of primary or secondary branches recorded higher germination percentage, dry weight and seed vigour.

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