RESEARCH ARTICLE **(Open Access)**

Seed viability testing of Common bean (*Phaseolus vulgaris* L.) landraces stored in long-term storage conditions

AVNI BEHLULI[1*], SHUKRI FETAHU[2], SALI ALIU[1] AND AGIM CANKO[2]

[1]University of Prishtina, Faculty of Agriculture and Veterinary, Department of Plant Production, Prishtina, Kosovo

[2]Department of Plant Sciences and Technologies, Faculty of Agriculture and Environment, Agricultural University of Tirana

*Corresponding author E-mail: avni.behluli@uni-pr.edu

Abstract

Loss of viability and seeds vigour influences the nutritional characteristics and reduce their agricultural use. The aim of this research was the testing of seed viability, vigour and germination ability respectively, in the seeds of common bean landraces stored in Gene Bank of Kosovo for Plant Resources, stored in long-term storage conditions (-18 to -25°C). The experiment was conducted in the laboratory. For this purpose were used seeds of 10 accessions. The experimental design was random complete block with three replications: 10 landraces x 3 replications x 2 parameters = 60 measurements. For each accession, 45 seeds (15 seeds per replication) were tested. Seed viability test was carried out according to ISTA (2003) rules. Seeds vigour was estimated after 4 days, while germination ability was evaluated 8 days after testing. Data was subjected to Analysis of Variance (ANOVA) and means separated by Least Significant Difference (LSD) at P <0.05, P <0.01. The research results show significant differences among common bean landraces for seed vigour and germination ability on the level P0.01 and P0.05.

Key words: Common bean, germination, viability, landrace, storage

1. Introduction

The common bean is cultivated in all regions of Kosovo, on an average area 7.505 ha and annual consumption about 11.53 kg capita-1. The great value for human nutrition, compared to other vegetables, ranks the common bean in the first place (Fetahu et al., 2012).

Adequate seed storage is a significant agricultural problem because of the need to maintain seed viability and vigor (Zhang et al., 1995), particularly in tropical regions with a high humidity. In general, seeds can be classified as recalcitrant (lose their viability within a few days) or orthodox (remain viable for a long time). As an example, the storage of maize seeds (considered to be orthodox seeds) at a temperature and relative humidity higher than 25°C and 65-80% respectively, for more than 4 months, may be harmful (Abba and Lovato, 1999).

Seed quality is a multiple concept and thereby affected by multiple factors in production level, harvesting, processing and storage condition (Huda, 2001). Seeds have to be stored for a certain period for production of crop in the following season. Environmental condition is also one of the most important factors for quality control both in production and storage level. Among the environmental factors the relative humidity and temperature are most important for storing seed (Huda, 2001). According to Justice and Bass (1978) when in storage condition the moisture content of seed goes above 8-9% then the risk of insect, fungal and bacterial attack increases. It was found that for decrease of 1% relative humidity and decrease of each 5°C temperature the longetivity of seed increases a twice (Agrawal, 2004). Therefore the aim of this research was to evaluate the seed viability, vigour and germination ability respectively, in the seeds of common bean landraces stored in long-term storage conditions, in Gene Bank of Kosovo for Plant Resources.

2. Material and Methods

2.1 *Plant material*

As research material were use the seeds of 10 local common bean landraces, collected in different regions of the Kosovo's territory (Table 1) and stored in Gene Bank of Kosovo for plant resources. Seeds

*Corresponding author: Avni Behluli; E-mail: avni.behluli@uni-pr.edu
(Accepted for publication)
***ISSN**: 2218-2020, © Agricultural University of Tirana*

before enter in storage are cleaned separately and dried to optimum moisture values for storage, then they are sealed in aluminum bags and placed in the deep frost refrigerators (-18 to -25 ° C), where they are stored for a 5-year period in long-term storage conditions.

Table 1. Data of common bean accessions (landraces) used in the research.

Accession Code	Genus	Species	Latitude	Longitude	Altitude	Collecting place	Colectin site
FAGB129	Phaseolus	vulgaris	42^0 49'4.00"	20^{0}56'00"	544	Dalak	Vushtrri
FAGB130	Phaseolus	vulgaris	42^0 21'22.28"	20^{0}47'50.77"	365	Reshtan	Suharekë
FAGB134	Phaseolus	vulgaris	43^0 02' 49.00"	21^{0}07'20.00"	744	Pollatë	Podujevë
FAGB135	Phaseolus	vulgaris	43^0 02' 55.00"	21^{0}03'14.00"	1009	Zhiti	Podujevë
FAGB138	Phaseolus	vulgaris	42^0 34' 29.00"	20^{0}54'38.00"	603	Komoran	Komoran
FAGB139	Phaseolus	vulgaris	42^0 38' 18.00"	21^{0}18'37.00"	815	Mramor-Busi	Prishtinë
FAGB152	Phaseolus	vulgaris	42^0 28' 41.00"	20^{0}44'40.00"	525	Malishevë	Malishevë
FAGB170	Phaseolus	vulgaris	42^0 39' 52.12"	21^{0}24'29.36"	957	Marec - Bullaj	Prishtinë
FAGB187	Phaseolus	vulgaris	42^{0}32'07.00"	20^{0}16'47.00"	665	Deçan	Pejë
FAGB189	Phaseolus	vulgaris	42^{0}54'32.18"	20^{0}59'48.69"	1019	Gumnishtë	Mitrovicë

2.2 Germination test

Seed germination testing was conducted in Petri dishes. In each box were set 15 seeds, lined with paper towels and soaked in tape water and then placed for germination at room temperature 18-23 ° C for 10 days. Experimental scheme was randomized complete block with three replication: RCB = 10 accessions x 2 parameters x 3 replications = 90 results or measurements.

For the experiment were used 45 seeds from each accession, i.e. 15 seeds for replication. Researched parameters were: seed germination vigour (SGV), seed germination ability (SGA), which both of them represents the seed viability.

Seed germination vigour (SGV) is calculated based on the germination percentage on the 4th day of testing, according to the formula:

$$G\% = \frac{NSG}{NST} \times 100$$

, where NSG – number of seeds germinated and NST – number of seeds tested, (ISTA, 2003).

Radicle emergence was considered indicative of germination.

While, seed germination ability was calculated also based on the percentage of seed germination and viability on 8th day of testing. Viable seeds were considered those in which was found emergence and the normal development of embryonic stem and root.

2.*3 Statistical* a*nalysis*

Statistical analysis was performed using one-way ANOVA and Microsoft Excel.

3. Results and Discussion

The research results related to seed germination vigour (SGV) and the seed germination ability of common bean accession (landraces), collected in different regions of Kosovo and stored in Gene Bank of Kosovo for Plant Resources, in long-term storage conditions, are presented in Table 2 and Figure 1.

The table shows that the highest values of SGV had accession FAGB138 = 88.89%, while the lower accession FAGB189 = 7.78%. This variability was highly significant on level LSD 0.05 and 0.01. The research results related SGA indicate also significant values (p = 0.05 and 0.01), for accessions FAGB129 = 87.34 and FAGB189 = 21.33.

Research results showed also high significant differences among accessions, in terms of seed weight. The table shows that the highest seed weight has accession FAG139 = 119 g/100 seeds, and lower one had accession FAG130 = 39.44 g/100 seeds.

While the relation between SGV and SGA is shown in figure 1. The graph shows that the seeds with higher SGV also show a higher SGA, with some exceptions (FAG138).

Table 2. Mean values for seed weight (SW), seed germ. vigour (SGV) and seed germ. ability (SGA).

Landraces	SW (g/100 seeds)	SGV (%)	SGA (%)
FAGB129	50.67	76.67	87.34
FAGB130	39.44	74.44	85.33
FAGB134	59.89	66.67	84.67
FAGB135	51.56	63.33	83.67
FAGB138	47.33	88.89	79.00
FAGB139	112.78	32.22	72.67
FAGB152	45.00	78.89	86.00
FAGB170	44.00	54.44	87.33
FAGB187	48.33	83.33	87.33
FAGB189	55.33	7.78	21.33
LSD p=0.05	***6.365***	***17.957***	***3.908***
LSD p=0.01	***8.681***	***24.402***	***5.330***

Germination differences were also observed by other authors in different crop cultivars. This variability of cultivars for germinations and other growth traits could be due to heterogeneity in their genetic makeup (Asfaw, 2011).

Seed viability maintaining depends also on the type of storing containers (Khalequzzaman KM et al, 2012). Mali et al. (1983) reported that increasing rate of abnormal seedling was higher in seeds of gunny bag, because it was due to high moisture and fungal activities.

Although at lower level, the research results clearly show a decrease of viability, SGV and SGA respectively of common bean seeds after 5-year storage in long-term conditions. According to some authors this slow rate of reduction in germination and vigour in cold storage condition is due reduced rate of respiration and metabolic changes occurring in seeds (Das et al., 1998).

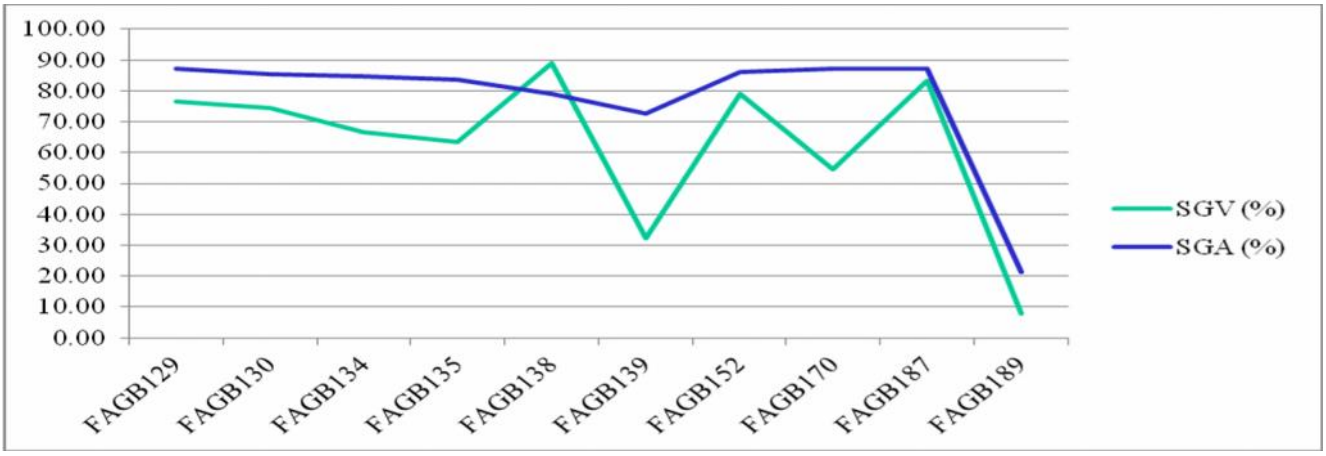

Figure 1. Graph of relation between SGV and SGA

According to Basavegowda et al. (2013) with passing of storage period vigour seeds decline due to catabolic activity going on seed and thus seed though viable reduction in length of shoot and root observed.

4. Conclusions

Based on the research results could be concluded that the long-term storage conditions, respectively in the temperature -18°C to -25°C have a low negative effect in seed germination vigour and seed viability. These findings leads to another conclusion that seed storage at low temperatures may be used successfully in the safe storage of germplasm in long-term.

5. Acknowledgements

This research was conducted at the Faculty of Agriculture, University of Prishtina, respectively in the laboratory of Gene Bank of Kosovo for Plant Resources. Therefore, I'm grateful to Prof. Dr. Shukri Fetahu as leader of this institution, as well as my PhD mentor Prof. Dr. Agim Canko for the ideas and suggestions regarding this research.

6. References

1. Abba EJ & Lovato A: **Effect on seed storage temperature and relative humidity on maize (Zea mays L.) seed viability and vigor.** Seed Sci. Technol. 1999, 27, 101-114.

2. Agrawal, R.L: **Seed Technology.** 2Edn. Oxford and IBH Publishing Co. Pvt. Ltd. 2004 pp: 229-422.

3. Asfaw KG: **Effects of salinity on seedling biomass production and relative water content of twenty sorghum (Sorghum**

biolor L. Moench) accessions. Asian J. Agric. Sci. 2011, 3 (3): 242-249.

4. Basavegowda, Gururaj Sunkad & Arunkumar Hosamani: **Effect of commercial cold storage conditions and packaging materials on seed quality of chickpea (*Cicer arietinum* L.)**. Global Journal of Science Frontier Research Agriculture and Veterinary Sciences Volume 13 Issue 2 Version 1.0 *In review*.

5. Das, B. K., Barua, I. C. and Dey, S. C: **Effect of packing material, storage condition and duration of storage on seed viability, vigour and seedling survivability in Rajmah (*Phaseolus vulgaris* L.)**. Legume Res., 1998, 21(2): 91-95.

6. Fetahu, Sh., Aliu S., Rusinovci I., Kelmendi B., Caka H., Maliqi N: **Diversity of seeds size and weight of common beans landraces (*Phaseolus vulgaris* L.) in Kosovo**. Proceedings. 47th Croatian and 7th International Symposium on Agriculture. Opatija. Croatia, 2012, 270–274.

7. Huda, M.N: **Why Quality Seed?** Reality & Packaging, Dhaka-1000. 2001: 9-156.

8. ISTA: **Handbook of vigour methods**. The International seed Testing Association, Zurich. 2003: 28-37.

9. Justice, O.L. and L.N. Bass: **Principle & Practices of Seed Storage**. Agricultural Handbook No. 506, Washington, D.C, 1978.

10. K. M. Khalequzzaman , M. M. Rashid, M. A. Hasan, And M. M. A. Reza: **Effect of storage containers and storage periods on the seed quality of French bean (*Phaseolus vulgaris*).** Bangladesh J. Agril. Res. 37(2): 195-205, June 2012. ISSN 0258-7122.

11. Mali, J. B., M. B. Joi and P. A. Shindh: **Fungi associated with chilli seeds**. J. Mah. Agril. Univ. 1983, 8: 69-71.

12. Zhang M, Yoshiyama M, Nagashima T, Nakagawa Y, Yoshioka T, Esashi T: **Aging of soybean seeds in relation to metabolism at different relative humidities.** Plant Cell Physiol. 1995, 36, 1189-1195.