EFFECT OF INITIAL MOISTURE CONTENT AND DIFFERENT STORAGE CONTAINER ON THE QUALITY OF GRASS PEA (*Lathyrus sativa*) SEED

M.H.A.AMIN[1], M.S. RAHAMAN[2] AND M.O.K. AZAD[3]

[1]MS student, Department of Agroforestry, [2] Lecturer, Department of Agricultural Extension, [3]Graduate Student, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh

Accepted for publication: March 24, 2008

ABSTRACT

Amin M.H.A., Rahaman M.S., and Azad M.O.K. 2008. *Effect of Initial Moisture Content and Different Storage Container on the Quality of Grass Pea (Lathyrus sativa) Seed.* **Int. J. Sustain. Crop Prod. 3(3): 18-24**

An experiment was conducted in front of training room at the academic building of Hajee Mohammad Danesh Science and Technology University, Dinajpur during the period from December, 2006 to March, 2007 to evaluate the effect of initial moisture content and different storage container on the quality of grass pea seed. Three types of containers viz., sealed container (C_1), polythene bag (C_2) and gunny bag (C_3) were used as experimental treatment. Among the three containers, initial moisture content of grass pea seeds were 10.3% (M_1), 9.3% (M_2) and 8.2% (M_3) in ambient condition for three months of storage. The experiment was laid out in the Completely Randomized Design (CRD) with three replications. The parameters studied were percent moisture content and percent germination with an interval of 15 days. The results of the experiment clearly revealed that germination percentage of grass pea seeds decreased with the increased in initial moisture content of seed. In safe moisture 8.2% (M_3) showed highest germination percentage (81.33%) at 15th day stored. Initial moisture 10.3% (M_1) gave lowest germination percentage (74.34%) at 60th day and 9.3% (M_2) was in intermediate. The seal container (C_1) performed highest germination percentage 81.67, 80.00, 80.00, 78.67 at 15, 30, 45 & 60th day respectively. The lowest germination percentage (74.00) was observed in gunny bag (C_3) at 60th day. The highest interaction effect of moisture and storage container was M_1C_3 at 15th day. This study opined that initial moisture and storage container effect on the quality of grass pea seeds as air tight sealed container (C_1) is the best one.

Keywords: Storage container, safe moisture, germination, grass pea seed

INTRODUCTION

Lathyrus sativus, is a legume (family Fabaceae) commonly grown for human consumption and livestock feed in Asia and East Africa. It is a particularly important crop in areas that are prone to drought and famine, and is thought of as an 'insurance crop as it produces reliable yields when all other crops fail. It is also known as grass pea, blue sweet pea, chickling vetch, Indian pea, Indian vetch, white vetch, almorta or alverjon (Spain), cicerchia (Italy), guaya (Ethiopia), and khesari (Bangladesh & India) Cruis, 2006. Germination of grass pea seeds enhances content of vitamins, especially folic acid, biotin and pyridoxine. Normal vitamins are carotene, thiamine, riboflavin, nicotinic acid, biotin, pantothenic acid, folic acid, pyridoxine, inositol, ascorbic acid, and dehydroascorbic acid. Seeds contain 18.2-34.6% protein, 0.6% fat, 58.2% carbohydrate (about 35% starch)" (Duke, 1981). The seeds also contain 1.5% sucrose, 6.8% pentosans, 3.6% phytin, 1.5% lignin, 6.69% albumin, 1.5% prolamine, 13.3% globulin, and 3.8% glutelin. The essential amino acids are (in grams per 16 grams of nitrogen): arginine 7.85, histidine 2.51, leucine 6.57, isoleucine 6.59, lysine 6.94, methionine 0.38, phenylalanine 4.14, threonine 2.34, tryptophane 0.40, and valine 4.68 (Like other cool season food legumes, grass pea is deficient in methionine and tryptophane) (Duke, 1981). "Leaf analysis gave the following values: moisture 84.2%; crude protein 6.1%; fat (ether extraction) 1.0%; carbohydrates 7.6%; ash 1.1%; Ca 0.16% and P, 0.1%; Fe 7.3 mg; and carotene (as vitamin A), 6,000 IU/100 g. Green plant analysis of grass pea, cut at the flowering stage was reported to provide on a dry weight basis: protein 17.3%; fiber 36.6%; fat 4.47%; ash; 6.0%; P_2O_S 0.51%; and CaO, 1.08%" (Duke, 1981). Seeds of grass pea ripen in 4-6 months and are harvested as soon as the leaves begin to turn yellow and when pods are not fully ripe as fully ripe pods dehisce and scatter the seeds (Kay, 1979). It is harvested with sickle or uprooted, left to dry for a few days in heaps and then threshed and winnowed. "The crop can be cut and fed green, or the standing crop may be pastured; it is not fit for silage but can be cured into hay under mild climatic conditions. When fed alone, fresh young plants are reported to be harmful to horses; however, cattle, rabbits, and sheep can consume large amounts without ill effects" (Duke, 1981). Grass pea is grown the Rabi season (October to March) and seeds from harvested crops are stored for at least 8-9 months before sowing in the next season. During this period, seeds tend to lose their viability due to the effect of biotic and abiotic factors viz. pathogens, high and low temperature and moisture etc. The deterioration of stored seed becomes faster if the seeds are not properly dried and the atmosphere is not controlled. Many factors determine the longevity of seeds during storage. These include seed moisture content, temperature, relative humidity, initial viability, stage of maturity at harvest, storage gas and the initial moisture content of seed entering into the storage (Harrington, 1972). One of the most important factors in seed storage is the quality of seed when it enters storage and particularly the initial moisture content of seed (Brett. 1952). For

the maintenance of seed viability, an average level of relative humidity in the storage not higher than the equilibrium with the desired safe seed moisture contents required. This condition can be achieved by storing the seeds in a climatic region where relative humidity to a favorable level by conditioning of the storage environment or by storing seed in moisture proof containers (Delouche *et al.,* 1973).

Moisture is one the major factors contributing to the deterioration during storage of durable agricultural products in the tropics and sub-tropics. All crops contain moisture at harvest. The amount of moisture they contain is of little consequence if the crop is to be consumed immediately after harvest, but if the crop is to be stored for any length of time from one or two days upwards, it is essential that its moisture level be reduced so that it dose not exceed certain well defined limits. The crop, whether it be cereal, oilseed or legume, is a viable organism and as such, it continually respires producing heat and moisture, which, if present excessive amount, produce conditions suitable for the growth of other injurious organisms. These, in turn, will cause a loss in both quantity and quality of the crop while in storage. The conditions may also encourage the germination of the stored seed which may lead to its complete economic loss to the farmer. Relative humidity (RH) influences the moisture content of seed if it is not stored in moisture proof containers. For example, at 15 percent RH, seed will dry down to 6 percent moisture and can be stored safely in this condition for several years. However, at 90 percent RH, seed will dry down to only 19 percent moisture and germination will be poor after one year. Drying, the process of reducing moisture content of agricultural product is of great importance in this regard. Drying is practiced to maintain the quality of grains during storage to prevent the growth of pathogens, and the development of insects and mites injuries to the grains. The use of sun rays is the most widespread methods of drying crops in the tropics. But the system has some limiting factors which make it unsuitable for large scale drying, except in few parts of the world. Seed is stored for a number of season and over various lengths of time. The most common reason is that seed has to be kept in some place between harvest and sowing of the succeeding crop. During the period of storage, the viability and vigor of seed has often to be maintained under a wide range of environmental circumstances. The proper storage of seed is a very important factor for the better production of crop. Maintenance of high seed germination and vigor of seed from harvesting to sowing is the purpose of good storage of seed for sowing. Adequate provisions and facilities for storage are, therefore, important components of seed production program in all climatic regions. Considering the above facts, the present research work was undertaken to identify & determine the best container for storage period and to find out the interaction effect of moisture percentage and storage container on germination of grass pea seed

MATERIAL AND METHODS

Location

The experiment was carried out in front of training room at the academic building of Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, during 24th December 2006 to 19th February 2007.

Seed supply

Grass pea seeds used in this experiment were supplied by the Agronomy Department of Hajee Mohammad Danesh Science and Technology University, Dinajpur. Seeds were kept in following three containers, viz;

Experimental Treatment

A. Storage container:
   i) Sealed container (C_1)
   ii) Polythene bag (C_2)
   iii) Gunny bag (C_3)

B. Storage period:
   i) 15 days,
   ii) 30 days,
   iii) 45 days
   iv) 60 days.

Experimental Design

The experiment was laid out in Completely Randomized Design (CRD).

Storage Condition

Seeds were stored at room temperature and relative humidity (RH) for 2 months. The Sealed container was covered tightly and the Polythene bag and Gunny bag were tight with rope. The prevailing meteorological information during the study regarding temperature and relative humidity has been presented in the Figure 4.

Among the three containers, initial moisture content of grass pea seeds were-

1. 10.30% (M_1),
2. 9.30% (M_2) and
3. 8.20% (M_3)

Regular testing of seed kept in 3 containers

During the storage period, seeds samples were taken every 15 days from the containers for determination of germination percentage.

Moisture test

Moisture content was determined by using high constant temperature oven method following International Rules for Seed Testing in the Agronomy laboratory of HSTU. 5g of seeds from each 3 containers were taken. After grinding the seeds in grinding mill the weighed ground materials were poured in a small container with cover and kept in an oven maintained at a temperature of 125-130^{o}C for a period of 2 hours. The moisture content of seeds (wet basis) was determined by the following formula.

$$\% MC = \frac{(X_2 - X_3)}{(X_2 - X_1)} X\ 100$$

Where

X_1 = Wt. of container

X_2 = Wt. of container + ground materials before drying

X_3 = Wt. of container + ground materials after drying

Germination test

Germination test was done in plastic tray in room no. 219 Shahid Ziaur Rahman hall, of Hajee Mohammad Danesh Science and Technology University, Dinajpur. Germination test was conducted using sand as substratum. The sand was sieved to discard particles bigger than 0.8 mm and smaller than 0.05 mm in diameter. Rectangular plastic boxes were used to put the sand. For every test new sand was used.

Seed was placed on a uniform layer of moist sand and then covered to a depth of 10 mm with sand, which was left loose. 100 seeds were planted in each plastic tray and replicated three times. The plastic trays with seed were incubated at room temperature and irrigated at every odd day. After 5days and 10 days, germination percentage was recorded. The normal seedlings and abnormal seedlings and ungerminated seed were classified according to the prescribed rules given by ISTA.

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds tested}} \text{ x } 100$$

Seeds were stored at ambient condition in different containers and germination test was performed every 15 days.

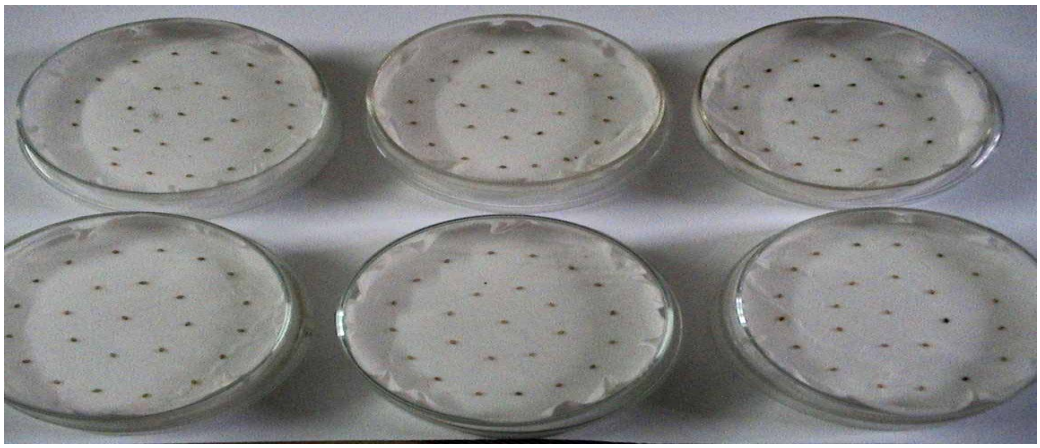

Figure 1. Experiment set to determine the effect of different storage container on germination of grass pea seed

Record keeping of dry bulb and weight bulb temperature and relative humidity

Reading of dry bulb and weight bulb temperature and relative humidity of inside the room and out side the room were recorded in 7.45 am, 3.00 pm, and 10.45 pm every day. Amount of rainfall and maximum and minimum temperature were collected from Research laboratory of HSTU. Air temperature and relative humidity (RH %) data of seed store house were collected by dry bulb and wet bulb methods with the help of Psychometric chart.

Statistical analysis

The recorded and calculated data were statistically analyzed using a MSTAT-C Statistical Computer Package Programme in accordance with the principles of Completely Randomized Design (Gomez and Gomez, 1984.), Duncun's Multiple Range test (DMRT) was performed to compare variations among treatments.

RESULTS AND DISCUSSION

Effects of storage container on germination of grass pea seed

From first observation (after 15 days of storage) it was observed, among the three containers, average germination of the seeds of sealed container was the highest (81.67%) and is significantly vary from polythene bag and gunny bag. Average germination percentage of the seeds of the gunny bag was the lowest (74.00%) at 60 days after storage (Table 1). Such result is in agreement with the findings of (Harrington, 1963).

Table 1: Effects of containers (sealed, polythene bag, gunny bag) on germination of grass pea seed

Containers	Germination %			
	15^{th} day	30^{th} day	45^{th} day	60^{th} day
Sealed container (C_1)	81.67 a	80.00 a	80.00 a	78.67 a
Polythene bag (C_2)	79.22 b	78.22 b	77.89 b	76.34 b
Gunny bag (C_3)	77.67 b	76.56 c	75.78 c	74.00 c
LSD	1.651	1.583	1.77	1.715
CV %	1.21	1.18	1.33	1.31

In a column, figures having similar letter(s) do not differ significantly where as figure s bearing dissimilar letter(s) differ significantly(as per DMRT).

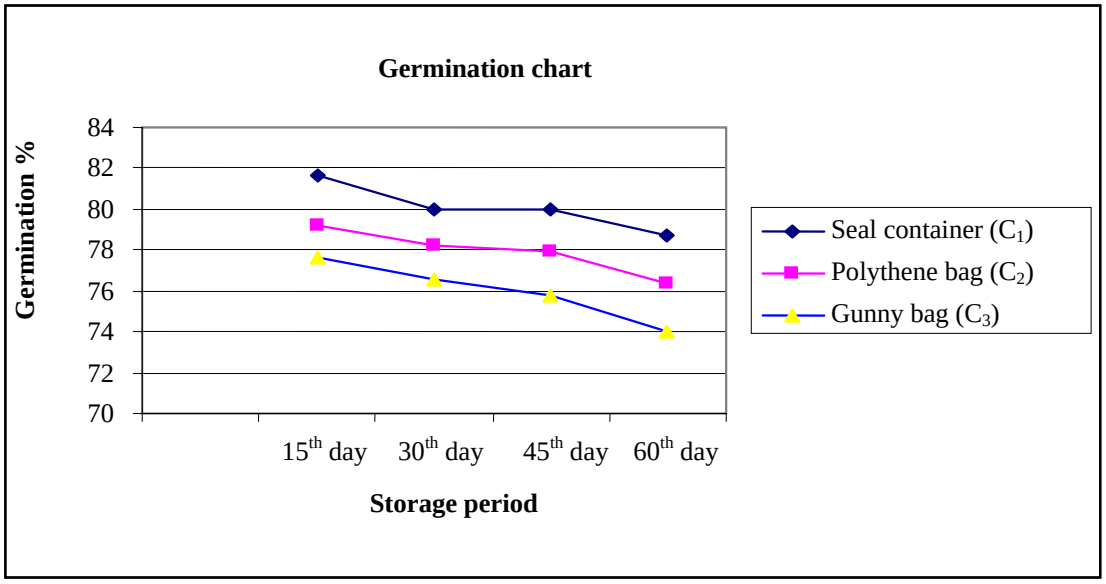

Figure 2. Effects of storage period on germination of grass pea seed

But increasing with storage period germination percentage was decreased. At 60^{th} days, germination percentage observed in sealed container, polythene bag and gunny bag were 78.67%, 76.34% and 74.00% respectively and have significant variation between them.

Effects of initial moisture content on germination of grass pea seed

Among the three different initial moisture contents, average germination of the seeds of M_1 was the lowest (77.33%) and significantly varies from M_2 and M_3, 79.89% and 81.33% respectively at 15 days after storage

with significant variation. (Table 2). This same significant observation was found in 30, 45 and 60 days after storage.

Table 2: Effects of initial moisture content on germination of grass pea seed

Initial moisture%	Germination%			
	15th day	30th day	45th day	60th day
M_1	77.33 b	75.34 b	75.33 b	74.34 b
M_2	79.89 a	79.11 a	78.33 a	76.67 a
M_3	81.33 a	80.34 a	80.00 a	78.00 a
LSD	1.651	1.583	1.77	1.715
CV%	1.21	1.18	1.33	1.31

In a column, figures having similar letter(s) do not differ significantly where as figures bearing dissimilar letter(s) differ significantly (as per DMRT).

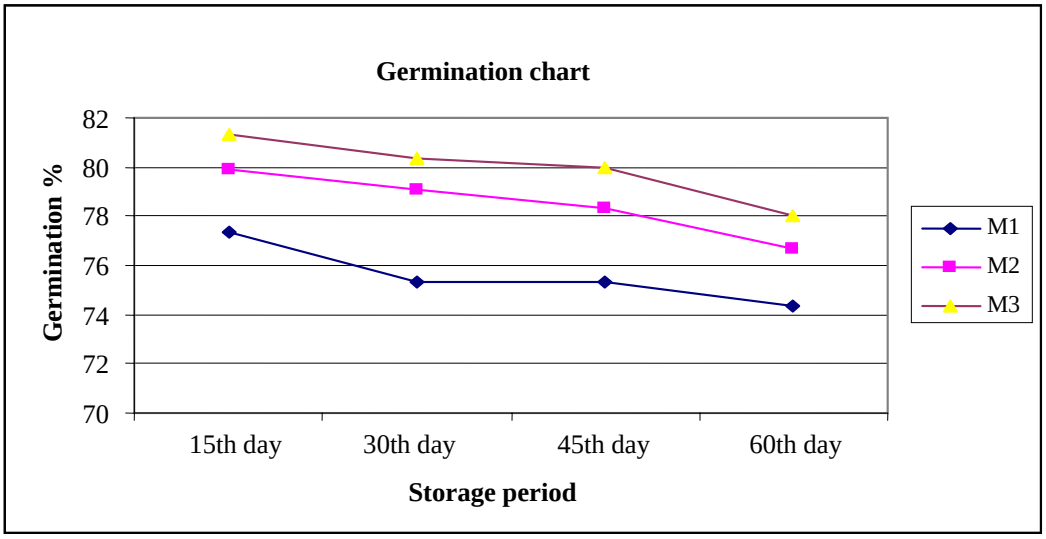

Figure 3. Effects of moisture percentage and storage period on germination of grass pea seed

Interaction effects of storage container and moisture percentage on germination of grass pea seed

The highest germination percentage (84.00%) was found in sealed container x third initial moisture (C_1M_3) at 15 days which was statistically significant. Minimum germination percentage (73.00 %) was found in gunny bag at first initial moisture level (C_3M_1) at 60 days which was statistically different to C_3M_1 at 15 days.

Table 3: Interaction effects of moisture levels and containers on germination of grass pea seed

Storage container x Moisture Level	Germination			
	15th days	30th days	45th days	60th days
M_1C_1	78.00 d	76.00 de	77.00 c	76.00 d e
M_1C_2	77.00 e f	75.00 e	77.67 d	74.00 f g
M_1C_3	76.00 f	75.00 e	74.33 d	73.00 g
M_2C_1	82.00 b	81.00 b	80.00 b	79.00 b
M_2C_2	79.67 c d	79.67 b	79.00 b	77.00 c d
M_2C3	78.00 d	76.67 c d	76.00 c d	74.00 f g
M_3C_1	84.00 a	83.00 a	83.00 a	81.00 a
M_3C_2	81.00 b c	80.00 b	80.00 b	78.00 b c
M_3C_3	79.00 d	78.00 c	77.00 c	75.00 e f
LSD	1.651	1.583	1.77	1.715
CV%	1.21	1.18	1.33	1.31

Abnormal Seedling

The initial abnormal seedling of seeds in sealed container, polythene bag and gunny bag were 5.6 percent, but it was increased with increasing storage time. At the end of 2 months the abnormal seedling of grass pea seed were increased to 8.7, 11.25 and 12.60 percent. The increasing rate was higher in seeds of gunny bag, because it was due to high moisture and fungal activities (Ansari *et al*., 1996).

Dead Seed

The amount of dead of seed in polythene bag and gunny bag were 6.50 percent, but it was increased with increasing storage time. At the end of 2 months the amount of deed seed were increased to 8.64, 9.7 and 11.51 percent. The increasing rate was higher in seeds of gunny bag, because it was due to high moisture and fungal activities (Ansari *et al*., 1996).

Biotic Factors

Biotic factors like pulse beetle insects were observed during the storage period in gunny bag, but during investigation like germination analysis, several fungi was observed such as *Alternaria, Aspergillus, Fusarium, Penicilium* and *Rhizopus*. No insect was found to any storage container. Higher number of fungus was observed in seeds of gunny bag than polythene bag. Because as is highly hygroscopic living materials and it absorbs moisture from the surrounding atmosphere, this higher moisture in the seed may be the main reason for growing of fungus in the seeds of gunny bag (Ansari *et al.*, 1996).

Meteorological Information

The meteorological information in terms of average air temperature (^{O}C) and relative humidity is given to the Figure 4.

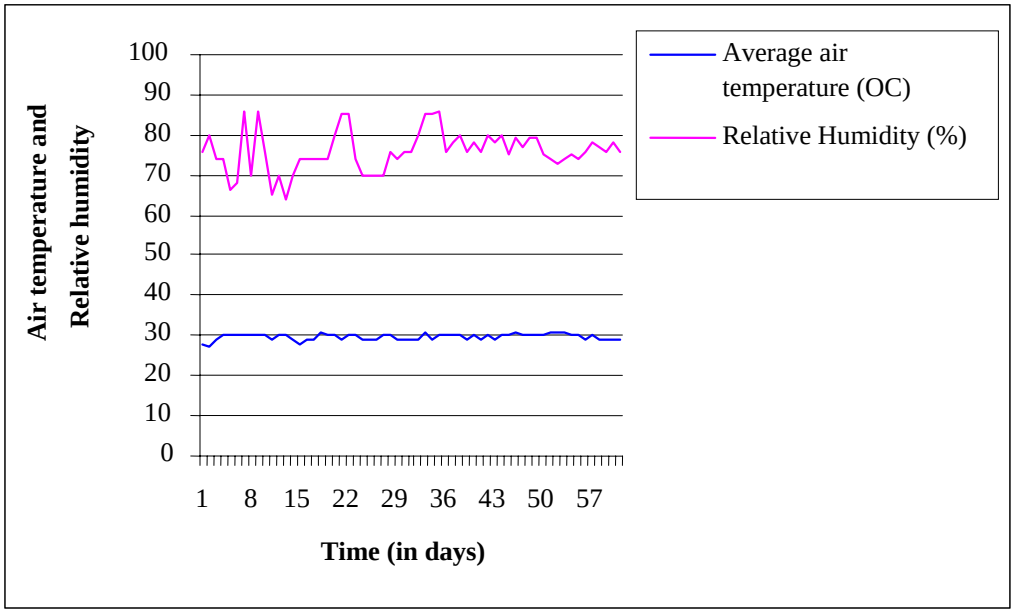

Figure 4. Trend of average air temperature and relative humidity

CONCLUSION

The initial germination percentage of different containers, seeds was around (81%) but after storage it was declined. The decline rate is higher in seeds of gunny bag. Seed deterioration is natural phenomena and life span of seeds decrease with the passing of time and increasing abnormal seedling and dead seeds, the increasing rate is higher in seeds of gunny bag compare to seeds of other containers. In case of storage period, there was significant variation between 15th, 30th, 45th and 60th days on germination percentage of the storage seed. The present result revealed that seed storage in sealed container with lower initial moisture (8.2 %) and short storage period is better than gunny bag and polythene bag with higher moisture content of grass pea seed.

REFERENCES

Ansari, T.H., Suratuzzaman, M. and Islam, M.S. 1996. Status of health and germination of seed stored in different containers at farmers' level in Mymensingh. Progress Agric. 7(2): 109-111

Brett, C.C. 1952. The influence of storage conditions upon the longevity of seeds, with special reference to those of root and vegetable crops. Rept. 13th Int. Hort. Cong. 2:1019-1032

Cruis W. 2006. The Botanical Magazine, Vol. 4. Project Gutenberg Literary Archive Foundation.

Delouche, J.C., Matthes, R.K., Dougherty, G.M. and Bass, A.H. 1973. Storage of seed in sub-tropical and tropical regions. Seed Sci. Tech. 1: 671-700

Duke, J.A. 1981. The quest for tolerant germplasm. p. 1–61. In: ASA Special Symposium 32, Crop tolerance to suboptimal land conditions. Am. Soc. Agron. Madison, WI

Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for Agricultural Res. 2nd edn. John Wiley and Sons, New York. p. 680

Harrington, J.F. 1972. Seed storage and longevity. In Kozlowski, T.T. Seed Biology, Vol. 3, Academic Press, New York and London. pp. 155-214

Harrington, J.F.1963. Practical instructions and advice on seed storage. Proc. Int. Seed test Assoc. 28: 989-993

Kay, J. 1979. General considerations concerning the harvesting and storage of grass pea seeds. Proc. Int. Seed test. Assoc. 28: 827-835