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# Effect of Storage Condition and Duration on Seed Germination of *Pongamia pinnata* L.Pierre

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## Abstract

*A study was carried out at the College of Forestry, OUAT, Bhubaneswar,India to evaluate the effect of different storage condition (i.e. Closed light, open light, closed dark, open dark) and different storage duration (0,30, 60, 90, 120 days) respectively on seed germination of Pongamia pinnata. Seeds in different storage condition and duration for 30 days stored in closed polythene bag in dark gives maximum germination (61.11%), mean daily germination (1.52), peak value (2.06) and germination value (8.14). In addition seed germination was maximum (45.55%) even after 120 days of storage in closed dark condition is the most appropriate storage condition for long term storage of seeds of Pongamia pinnata.*

**Keywords**: Germination, condition, duration, peak value.

## Introduction

India ranks sixth in terms of energy demand. Its economics is projected to grow at 8-9% over next two decades and its energy demand is accepted to grow at an annual rate of 4-8% over the next couple of decade's. So "Energy independence" will be one of the vital areas to make India a developed nation. Among the bioenergy, plants role is considered very promising because of its renewable nature and sustained production with low cost maintenance. Biodiesel produced from trees yielding oil is fast emerging as a viable alternative to petro diesel, particularly in the fall of its diminishing supply and resulting steep increase in price because of heavy requirement of edible oil, non edible oil yielding plants and trees are considered ideal for Indian condition for the production of biodiesel. India has many non-edible tree borne oil seed among which *Pongamia pinnata* has a lot of potential. *Pongamia pinnata* locally known as Karanja is an indigenous tree to India. It is a medium sized evergreen or briefly deciduous glabrous tree,15-25m high, with straight or crooked trunk 50 -80 cm or more diameter and broad crown of spreading or drooping branches. The bark is grayish green or brown, smooth or covered with tubercles, leaves compound, imparipinnate, leaflets opposite, 5-9 in number ovate or elliptic. Flowers white tinged with pink or violet, fragrant, in axillary racemes pods are compressed woody, elliptic to obliquely oblong pointed at both ends, Indehiscent, yellowish gray when ripe, varying in size and shape, 4.0-7.5 cm long and 1.7-3.2 cm broad, seeds usually one, rarely two, elliptical or reniform, 1.7-2.0 cm long and 1.2-1.8 cm broad, wrinkled with reddish brown leathery testa. It is found almost throughout India up to an altitude of 1200m[1]. It is chiefly found along the bank of stream and river or near sea coast, beach and tidal forest[2]. It is widely grown from tropical dry to subtropical dry forest. It is shade bearer and is considered to be good tree for planting in pastures, as grasses grow well in its shade. The tree is suitable for afforestation especially in watershed areas and drier parts of country. Andra Pradesh, Harayana, Karnataka, Madhya Pradesh, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh are the potential states in the country. Large numbers of Karanja trees have also been planted in roadside both in highways and also in urban area during last two decades. The yield of fruits varies from 9 to 90 kg per tree for different age trees[3]. The oil yield was reported about 32 % [4]. Besides its use for production of bio-diesel the oil is also used for tanning leather, soap, as illuminating oil and for lubrication. The oil cake is used as pollutary feed[5]. The oil is also used for curing rheumatism; powdered seed is used as febrifuge, tonic and for curing bronchitis and whooping cough. Flowers are used for diabetics and bark for internal bleeding piles, diarrhea and curing beriberi[6,7]. Keeping in view of the importance of the crop and its propagation by seeds, the present experiment was designed with the objective to identify proper storage condition and duration for seeds of *Pongamia pinnata.*

## Materials and Methods

The investigation was carried out at College of Forestry, Orissa University of Agriculture and Technology (OUAT), Bhubaneswar. Seeds were collected from candidate plus trees identified in Bhubaneswar, India during the month of February 2012. The dried seeds of 100 g were then stored in polythene bags under different storage condition (i.e. Closed light, Open light, Closed dark, Open dark) for 0, 30, 60, 90, 120 days respectively. Seed then were sown in nursery bed prepared with soil, sand and FYM planting mixture of ratio 2:1:1 in interval of 0, 30, 60, 90,120 days respectively for each storage condition. Observations basing on the number of seeds germinated, the different parameters have been shown here following under mentioned methodology.

**Germination percentage:** Germination percentages were calculated as number of seed sown and number of seeds germinated express in percentage.

$$\text{Germination \%} = \frac{\text{No. of seeds germinated}}{\text{No. of seeds sown}} \text{ X } 100$$

**Mean daily germination (MDG):** Mean daily germination was calculated as the average daily germination (ADG) or per day germination and was calculated[8].

$$\text{MDG} = \frac{X}{N}$$

X=Final germination percentage, N=Number of days in the standard germination test.

**Peak value:** Peak value was calculated as the maximum MDG reached at any time during the period of the test[8].

$$\text{PV} = \frac{\text{Final germination percentage}}{\text{No. of days required to reach the peak value of germination}}$$

**Germination Value:** Germination value is an index combining speed and completeness of seed germination. Daily germination counts were recorded and G V was calculated[8].
Where: GV= PV×MDG,

PV=Peak value of germination. MDG= Mean daily germination. GV= Germination value.

The experiment was designed in completely randomized design (CRD) and replicated thrice. The data observed were subjected to statistical analysis[9]. The data were transferred from where ever required before suitability of ANOVA analyzed in statistical package SAS version 7.0.

## Results and Discussion

The result obtained during the present course of investigation was carried out to visualize a significant influence of different storage condition and duration on seed germination of *Pongamia pinnata* seeds. Mean value of germination percentage (averaged over storage period for 120 days for each storage condition) showed maximum (57.55%) in seed stored in closed polythene bag where as lowest germination percentage (47.28%) recorded in seeds stored in open polythene bag kept in light, in case of seeds stored in open polythene bags kept in light shows low germination which may be due to deterioration of the seeds because of physiochemical changes and fungal decay caused by high temperature and humidity of air (table-1). The mean germination percentage (averaged over four storage condition) decreases with increased in storage period from 73.33% (figure - 1) at the time of storage to minimum (39.71%) after 120 days which may be due to more exposure of seed to the atmospheric high temperature and humidity causing biochemical changes and fungal attack there by deteriorating the seeds germinating quality. In case of seeds kept in closed polythene bag kept in dark condition the reduction in germination percentage from 73.33% to 45.55% may be because of rise in room temperature. Seeds stored in closed polythene bags gives maximum germination percentage 61.11% after 30 days in comparison to other storage condition which may be due to less deterioration of the seeds as the seeds affected by low temperature. The seed stored in open polythene bag in light for 120 days gives minimum germination (29.99%) because of the more deterioration of seeds due to physio-biochemical changes within the seeds and fungal infestation as it comes in contact with maximum atmospheric temperature and humidity. These finding corresponds to these reported elsewhere that unfavourable storage conditions (higher air temperature and high humidity of air) accelerate seed deterioration, causing seed quality losses and there in lowering germinability percentage of stored seed[10,11]. The longevity of stored seeds of any crops considerably depends on the storage condition, primarily in term of air temperature and relative humidity in storage[12]. Higher seed quality losses were reported in oil seeds crops of Soya bean, Sunflower and Mize at $25^0$C (air temperature) and relative humidity 75% than $12^0$C(air temperature and 60% relative humidity.In case of Jatropha the germinability decreases with increase in age of seeds[13]. The storage duration combined with temperature had a storage effect on germination of the Jatropha seeds as the seeds stored at $25^0$C showed more asynchronous germination than seed stored at $4^0$C. The mean value of mean daily germination of seeds (averaged over 120 days) was maximum in seeds stored in closed polythene bag in dark (1.43) and minimum (1.17) in seeds stored in open polythene bags in light. The mean value of mean daily germination (averaged for four storage conditions) as maximum at the time of storage (1.83) and minimum (0.99) at 120 days. Mean daily germination recorded at the time of packing of seeds (1.83) was maximum after 30 days (1.52) in closed polythene bag kept in dark and minimum (0.74) in open polythene bag kept in light after 120 days (table-2). The mean daily germination follows the same trend of result as germination percentage. Value of mean daily germination depends on final germination percentage and number of days in the standard germination test (which is constant for each treatment i.e. 40 days) (figure- 2). The peak value of germination follows the similar trend of mean daily germination. Peak value recorded at the time of packing of seeds under different storage condition and duration decreased for each storage condition with increase in storage period (table-3). Peak value was found maximum in closed polythene bag kept in dark after 30 days of storage (2.06) (figure- 3) because of high ratio of final germination percentage and number of days required to reach the peak value this may be due to maximum germination percentage and less number of days required to reach the peak value. Peak value was found minimum (0.94) in seeds stored in open polythene bag kept in dark which may be due to more number of days required to

reach the peak value. The mean germination value of seeds (averaged over 120 days) was maximum in seeds stored in closed polythene bag in dark (2.72) and minimum (2.23) in seeds stored in polythene bags in light. The mean value of germination value (averaged for four storage conditions) as maximum at the time of storage (4.46) and minimum (1.13) at 120 days. Germination value recorded at the time of packing seeds (4.46) was maximum after 30 days (3.14) in closed polythene bag kept in dark and minimum (0.98) in open polythene bag kept in light after 120 days. Results shows similar pattern as germination percentage. Germination value depends on product of mean daily germination and peak value (table-4 and figure-4).

**Table - 1**
**Effect of different storage condition and duration on germination percent of seeds of *Pongamia pinnata* L.Pierre**

| | Storage Duration | | | | | Mean |
|---|---|---|---|---|---|---|
| | 0 Days | 30 Days | 60 Days | 90 Days | 120 Days | |
| Close polythene bag kept in light | 73.33 (58.89) | 52.22 (46.20) | 49.99 (44.94) | 46.66 (43.05) | 39.99 (39.17) | 52.44 (46.38) |
| Open polythene kept in light | 73.33 (58.89) | 47.77 (43.68) | 45.55 (42.42) | 39.77 (39.06) | 29.99 (33.15) | 47.28 (43.39) |
| Close polythene bag kept in dark | 73.33 (58.89) | 61.11 (51.41) | 57.77 (49.93) | 49.99 (44.94) | 45.55 (42.42) | 57.55 (49.31) |
| Open polythene bag kept in dark | 73.33 (58.89) | 56.66 (48.79) | 53.33 (46.89) | 49.99 (44.94) | 43.33 (41.15) | 55.33 (48.04) |
| Mean | 73.33 (58.89) | 54.44 (47.52) | 51.66 (45.92) | 46.60 (43.05) | 39.71 (39.06) | |
| Storage Condition- CD at 5%- 2.01; Storage Duration – CD at 5% -2.11; Interaction – CD at 5% - 4.39 | | | | | | |

**Table-2**
**Effect of different storage condition and duration on mean daily germination of seeds of *Pongamia pinnata* L.Pierre.**

| | Storage Duration | | | | | Mean |
|---|---|---|---|---|---|---|
| | 0 Days | 30 Days | 60 Days | 90 Days | 120 Days | |
| Close polythene bag kept in light | 1.83 | 1.30 | 1.24 | 1.16 | 0.99 | 1.30 |
| Open polythene kept in light | 1.83 | 1.19 | 1.13 | 0.99 | 0.74 | 1.17 |
| Close polythene bag kept in dark | 1.83 | 1.52 | 1.44 | 1.24 | 1.13 | 1.43 |
| Open polythene bag kept in dark | 1.83 | 1.41 | 1.33 | 1.24 | 1.08 | 1.38 |
| Mean | 1.83 | 1.35 | 1.28 | 1.16 | 0.99 | |
| Storage Condition- CD at 5% - 0.04; Storage Duration - CD at 5% -0.05; Interaction -CD at 5% - 0.11 | | | | | | |

**Table-3**
**Effect of different storage condition and duration on peak value of seeds of *Pongamia pinnata* L. Pierre**

| | Storage Duration | | | | | Mean |
|---|---|---|---|---|---|---|
| | 0 Days | 30 Days | 60 Days | 90 Days | 120 Days | |
| Close polythene bag kept in light | 2.44 | 1.81 | 1.59 | 1.58 | 1.28 | 1.74 |
| Open polythene kept in light | 2.44 | 1.85 | 1.50 | 1.83 | 1.32 | 1.79 |
| Close polythene bag kept in dark | 2.44 | 2.06 | 1.86 | 1.73 | 1.01 | 1.82 |
| Open polythene bag kept in dark | 2.44 | 2.00 | 1.87 | 1.64 | 0.94 | 1.78 |
| Mean | 2.44 | 1.93 | 1.70 | 1.69 | 1.13 | |
| Storage Condition - CD at 5% - 0.30; Storage Duration - CD at 5% - 0.34;Interaction - CD at 5% - 0.69 | | | | | | |

**Table-4**
**Effect of different storage condition and duration on germination value of seeds of *Pongamia pinnata* L.Pierre**

| | Storage Duration | | | | | Mean |
|---|---|---|---|---|---|---|
| | 0 Days | 30 Days | 60 Days | 90 Days | 120 Days | |
| Close polythene bag kept in light | 4.46 | 2.38 | 1.98 | 1.83 | 1.27 | 2.38 |
| Open polythene kept in light | 4.46 | 2.20 | 1.71 | 1.81 | 0.98 | 2.23 |
| Close polythene bag kept in dark | 4.46 | 3.14 | 2.67 | 2.14 | 1.22 | 2.72 |
| Open polythene bag kept in dark | 4.46 | 2.82 | 2.47 | 2.06 | 1.04 | 2.57 |
| Mean | 4.46 | 2.63 | 2.21 | 1.96 | 1.13 | |
| Storage Condition- CD at 5% - 0.34; Storage Duration - CD at 5%- 0.39; Interaction - CD at 5%- 0.7 | | | | | | |

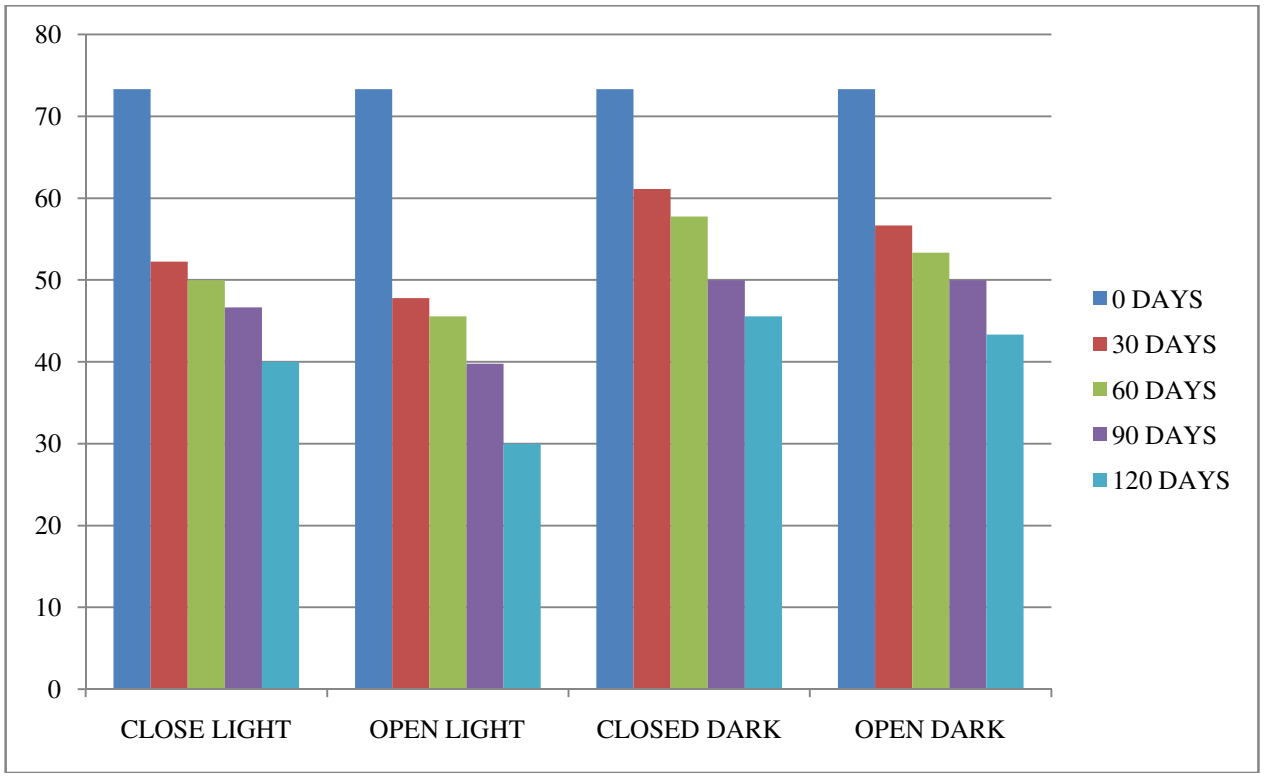


**Figure-1**
**Effect of different storage condition and duration on seed germination percentage of seeds of *Pongamia pinnata* L.Pierre**

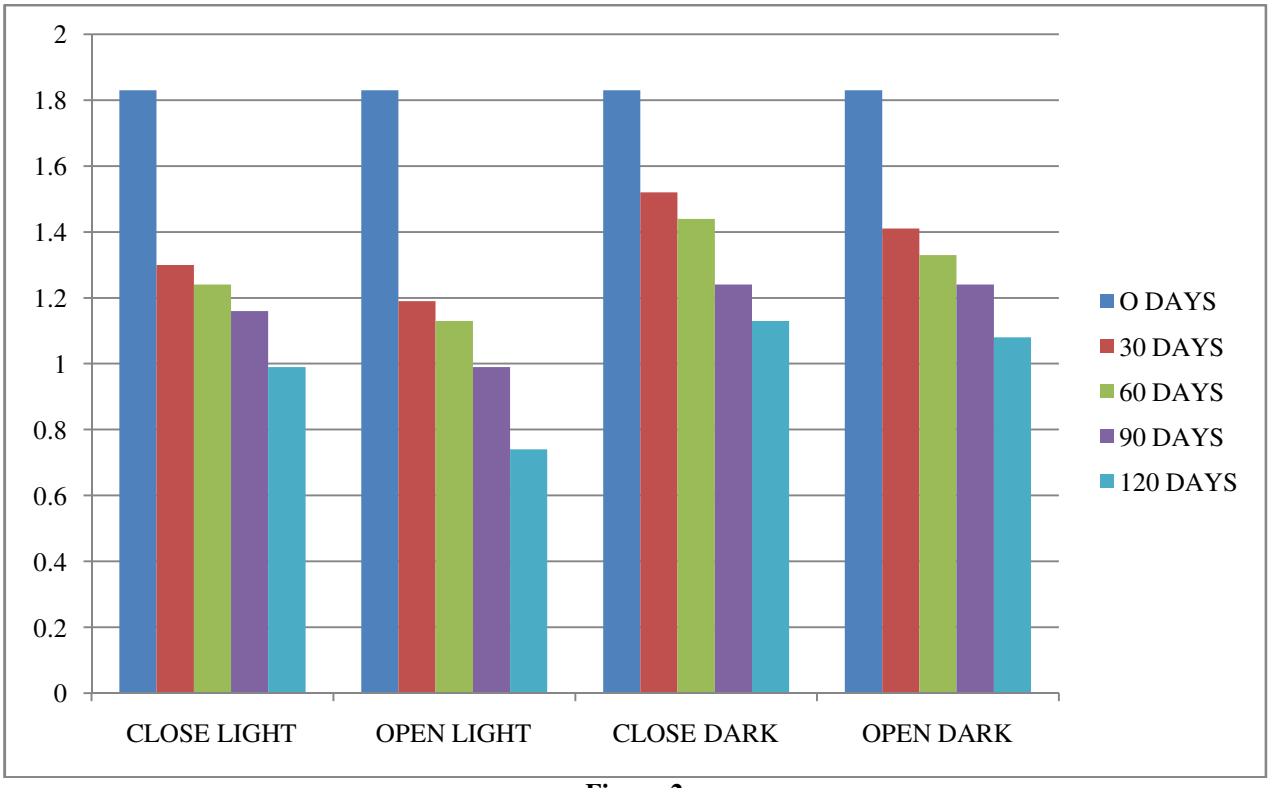


**Figure-2**
**Effect of different storage condition and duration on mean daily germination of seeds of *Pongamia pinnata* L.Pierre**

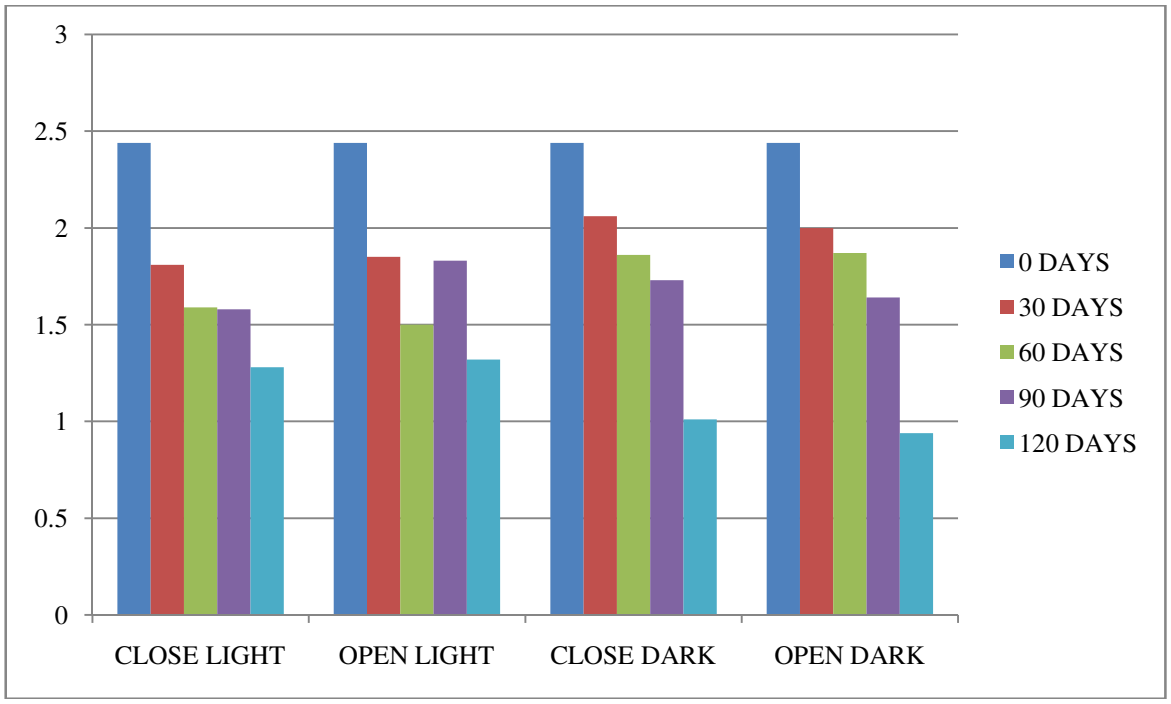


**Figure-3**
**Effect of different storage condition and duration on peak value of seeds of *Pongamia pinnata* L.Pierre**

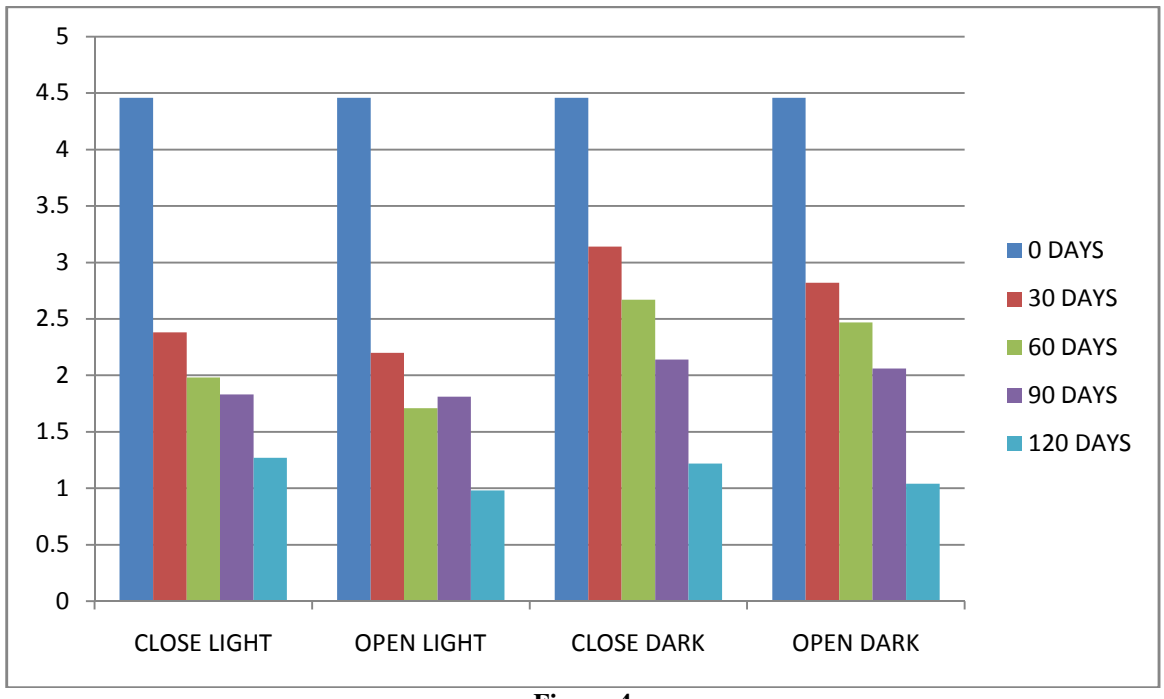


**Figure-4**
**Effect of different storage condition and duration on germination value of seeds of *Pongamia pinnata* L.Pierre**

## Conclusion

It was concludes that the storage condition and duration highly affect the seeds of *Pongamia pinnata*. The study indicated that seed of *Pongamia pinnata* should be stored in closed polythene bag and kept in dark to obtain more than 60% germination. In addition seed germination was maximum (45.55%) even after 120 days of storage in closed dark condition which is appropriate for long term storage of seeds.

## References

**1.** Chaturvedi M.D., The common Karanja, *Indian Farming* **7(2),** 8- 9 (**1975**)

**2.** Troup R.S., The silviculture of Indian trees, Clarendon Press, Oxford, UK, (**1921**)

**3.** CSIR, The Wealth of India: Raw Materials, Vol. 1-10, Council of Scientific and Industrial Research (CSIR), New Delhi, India, **(1948-98)**

**4.** Rahman A.H.M.M., Vegetative propagation of few Forest species, *Bano Vigyan Patrika*, **6(1),** 51-57 (**1977**)

**5.** Mandal L. and Banarjee G.C., Studies on the utilization of Karanja (*Pongamia glabra* Vent.) cake in polutary rations effects on growers and in blood composition and organ weights of Cockerels, *Indian Veterinary Journal*, **59(5),** 385-390 (**1982**)

**6.** Hewamanna R., Anuraadhai N. and Fernando R.K.S., Analysis of five trace elements in medicinal plants used in Ayurvedic medicine to control diabetes, *Journal of Tropical medicinal plants*, **5(2),** 211-215 (**2004**)

**7.** Brijesh S., Daswani P.G., Tetali P., Rojatkar S.R., Anita N.H. and Birdi T.J., Studies on Pongamia pinnata (L.) Pierre leaves: understanding the mechanism(s) of action in infectious diarrhea, *Journal of Zhejiang University Science, B*, **7,** 665-74 (**2006**)

**8.** Cazabatore F.J., Germination value, an index combining speed and completeness of Pine seed germination, *For.Sci*., **8,** 386-396 (**1962**)

**9.** Gomez K.A. and Gomez A.A., Statistical procedures for Agriculture Research (2nd edn.) John Willey and Sons, Inc., New York, 68**,** (**1984**)

**10.** Depaula M.M., Perezotaola Darder M., Torres M Frutos. and M Martinezhonduvilla G., Function of ascorbate glutathione cycle in aged sunflower seeds, *Physiologia Plantraum*, **96(4),** 543-550 (**1996**)

**11.** Al-yahya S.A., Effect of storage conditions on germination in wheat, *Journal of Agronomy and Crop Science*, **186(4),** 273-279 (**2001**)

**12.** Simic B., Cosic J., Liovic I., Krizmanic M. and Postic J., The influence of weather conditions on economic characteristics of sunflower hybrids in macro experiments from 1997 to 2007, 17th International sunflower conference, Cordoba (Spain), **8-12,** 261-264 (**2008**)

**13.** Escandon J.M., Silva B.C.F., Silva S.R.S., Granja J.A.A., Alves. M.C.J.L. and Pompelli M.F., Germination responses of *Jatropha curcas* seeds to storage and ageing, *Industrial Crops and Products***, 44**, 684-690 (**2013**)