Effect of packing type and storage time on tea (Camellia sinensis L.) seed germination

M. Jamalomidi¹, M. Gholami²

1. Department of biology, Payame Noor University, Tehran, Iran
2. Seed and plant Improvement Division, Agriculture and Natural Resources Research Center of Guilan, Rasht, Iran

Corresponding Author: M. Jamalomidi

ABSTRACT: Tea seed is a recalcitrant seed with week storage ability. Of course, tea seed germination is affected by storage method and ambient conditions, storage time and genotype. In order to investigation of storage times, packaging types and environmental conditions in cellar effects on tea seed germination, an experiment was conducted using split plots experimental design with four replicates. Based on analysis of variances, it was found the difference among sampling times (0, 8, 16 and 24 weeks after harvesting) and the packaging type (fine sand, charcoal powder and polyethylene bags) was significantly at 1% level. The comparison of means on Duncan's multiple range test showed that the highest and lowest germination percentage was in fine sand and polyethylene bags, respectively. The means of sampling times was also marked although germination after storage for 8 weeks did not change significantly, but after 16 weeks (39/8%) and 24 weeks (5/8%) greatly decreased. According to multiple regression analysis by stepwise method, from among three mentioned independent variables, only seed moisture content had a significant regression coefficient. Based on results of this study, environmental factors in storage period had indirectly effects on tea seed germination percentage through seed moisture content. Thus, whatever tea seed packaging method can reduce the risk due to environmental effects on seed moisture content, it is expected that germination is preserved for a longer time. The results revealed that tea recalcitrant seed if be storage in wet fine sand (5% w/w) and in a darkness cellar with more than 95% relative humidity and ambient temperature below 10°C throughout the storage time, up to about six months can to maintain its acceptable viability, approximately.

Key words: Camellia sinensis, seed, germination, storage conditions

INTRODUCTION

Tea (Camellia sinensis L.O.Kuntz) is one of the most economically important beverage crops in all over the world and is considered to be the national drink in Iran. However, due to uprooting of old seed plantations in different parts of the country; conservation of valuable tea germplasm in the form of seeds has assumed considerable importance (Katsuo et al., 1970, Chen et al., 2012). Tea seeds have been shown to be short-lived and storage ranging from nine months to six years has been reported with more than 70% germination at the end of these periods by several workers (Bhattacharya., 2002, Tanaka et al., 2002, Habib et al., 1992, Katsuo et al., 1970). Tea has been listed by Chin and Roberts (1980) as the species in which recalcitrant behavior has been reported but not confirmed. Tea seed should be used within a few days of picking, but this is not always possible particularly if it has to be transported over long distances. Although many estates may have empirically worked out suitable methods of storage, there is a lack of precise information on the subject. Leach (1936) showed that the moisture content of tea seeds play an important role in their storage and viability. He successfully stored seed in sand pits and obtained reasonably high germination rates even after one year. The most satisfactory conditions for the long term storage of tea seeds at 100% relative humidity and temperature around 5-7°C (Sebastiapillai and Anandappa, 1979, Sivapalan et al, 1986).
MATERIALS AND METHODS

To survey the effect of duration of storage, packing type and cellar conditions on changes of Tea seed germination percentage, an experiment was conducted from Nov. 2011 until May 2012 based on completely randomized design as split plots in time with four replications. Ripe seeds collected from tea seed barie (orchard) of Fashalm Tea Research Station (public seed variety as named Fashalm jat) and packed in different packaging type including polyethylene bags, fine sand and charcoal powder (Figure 1). Then, the packaging type placed in a darkness cellar for 24 weeks and daily average temperature and relative humidity of cellar was recorded for this period. Before placing the seeds in packaging type and the sampling times for germination test (0, 8, 16 and 24 weeks after harvesting), primarily for the water immersion test (24 hours), a random sample of seed mass was collected. The seeds are completely immersed in water were collected and randomly divided into four replicates by 50 seeds that they were planted in a Plastic container containing a kilogram washed fine sand and the containers placed in the germinator (Figure 2). Germinator conditions regulated based on IPGRI instruction including 25±1°C temperature, relative humidity 85±5%, and 8 hours of light and 16 hours of darkness per day, respectively. 50 days after seed sowing, the number of germinated seeds was counted (IPGRI Instruction). After collecting the data and normality test, analysis of variance was carried out with Mstat-c software. To compare the effect of different packing type, storage time, and their interactions on seed germination of tea seeds, the Duncan's multiple range test was used at 5% level. Correlation coefficients between seed traits and cellar conditions and also the liner and multiple regressions between germination percentage, tea seed moister content, daily average temperature and relative humidity of cellar were calculated by SPSS_{16} software. The charts were drawn using Excel software.

Figure 1. Tea seed packaging type (polyethylene bag, charcoal powder and wet fine sand)
RESULTS AND DISCUSSION

Based on analysis of variances for seed germination data, it was found the difference among sampling times (0, 8, 16 and 24 weeks after harvesting) and the packaging type (fine sand, charcoal powder and polyethylene bags) was significantly at 1% level (Figures 3 & 4). The comparison of means on Duncan’s multiple range test also showed that the highest and lowest germination percentage was in fine sand and polyethylene bags, respectively. The means of sampling times was also marked although germination after storage for 8 weeks did not change significantly, but after 16 weeks (39.8%) and 24 weeks (5.8%) greatly decreased (Figure 5). The similar results also were obtained in Srilanka (Sebastiapillai and Anandappa., 1979, Sivapalan et al, 1986)
Correlation coefficients calculated between germination percentage, seed moisture content, averages of ambient temperature and relative humidity in during storage. The results showed that the highest positive and negative correlation were between seed germination percentage and its moisture content \((r = 0.980^*\) and ambient average temperature \((r = -0.815^*)\), respectively. Also, the correlation between seed germination percentage with relative humidity was found to be negative and non significant. Linear regression relationships between seed germination percentage \((Y)\) with independent variables including seed moisture content \((X_1)\) and the average storage temperature \((X_3)\), separately showed that the linear relationship were significant between them. Linear regression analysis for seed germination percentage and the average relative humidity in storage period \((X_3)\), also showed that the quadratic relationship between those two factors were fitted. According to multiple regression analysis by stepwise method, from among three mentioned independent variables, only seed moisture content had
a significant regression coefficient ($b = 0.980$) and remained in the equation. But, two other variables had not a direct effect on seed germination percentage (equation 1).

\[(1) \quad Y = -67.37 + 0.98X \quad \left( R^2 = 0.960 \right) \]

Furthermore, in order to explore the relation between seed moisture content and environmental factors, a complementary multiple regression analysis carried out and the results revealed that the ambient temperature ($b = -1.037$) and relative humidity ($b = -0.694$) had significant regression coefficients. However, their direct effect on germination percentage was significant and different (equation 2).

\[(2) \quad X_1 = 1875.85 - 1.037X_2 - 0.694X_3 \quad \left( R^2 = 0.636 \right) \]

Summary of these results like to Arancon’s findings (2012) suggest that environmental factors in storage period had indirectly effects on tea seed germination percentage through seed moisture content. The moisture content of the packing material varies from 10 - 30%. If sandy loam sub-soil is used the optimum moisture content would be 10-12% while for powdered charcoal it may vary from 25-30%. Depending on size of the grader used a kg of graded and stored seed may contain 300-500 seeds (Chin et al., 1980). Thus, whatever tea seed packaging method can reduce the risk due to environmental effects listed on seed moisture content, it is expected that the germination is preserved for a longer time (Chen et al., 2012). Finally, the results revealed that tea seed if be storage in wet fine sand (5% w/w) and in a darkness cellar with more than 95% relative humidity and ambient temperature below 10°C throughout the storage time, up to about six months can to maintain its viability, approximately.

REFERENCES


