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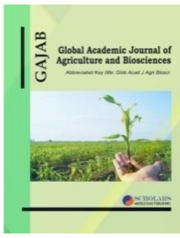

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Original Research Article

Effects of Storage Periods and Methods on Seed Quality of Chamomile (*Matricaria chamomile.*L) in Wondogenet, Ethiopia

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Abstract: Chamomile (*Matricaria chamomile* L.) seeds were stored in a polypropylene bag, cotton and bottle for twelve months. Data on seed quality were evaluated within three months of interval. The analysis of variance of the result showed that the interaction effect of storage methods and periods had significantly influenced the seed quality (germination percentage, moisture content, speed of germination and vigour index) of chamomile. The highest germination (75 %) was recorded for the seeds stored in the bottle during the third month of storage. Whereas the highest (41.2 mg %) vigour index was reported for the seeds stored in the bottle for three months. The result of the study concluded that prolonged storage periods had a significant effect on seed quality of chamomile.

Keywords: Chamomile, duration, seed, storage bags, germination.

1. INTRODUCTION

Chamomile (*Matricaria chamomile* L.) is an annual plant belonging to Asteraceae (Compositae) family, and is a very important medicinal plant species (Nebret and Midhekisa, 2017). It is native to Southern and Western Europe, North and West Asia (Pourohit and Vyas, 2004). Chamomile is one of the important aromatics and medicinal plants widely cultivated and used in the world. Hungary is the main producer of plant biomass and grows abundantly in poor soils and it is a source of income for poor societies in these areas. It is cultivated for its flowers, which have medicinal properties and are used to make herbal products and essential oil.

Chamomile can be grown on any type of soil, but growing the crop on rich, heavy, and damp soils should be avoided. It can also withstand cold weather with temperatures ranging from 2°C to 20°C. The crop has been grown very successfully on poor soils (loamy sand). The crop has been grown successfully on soil with a pH of 9 (Misra and Kapoor, 1978). Soils with pH 9–9.2 are reported to support its growth. In Hungary, it grows extensively on clayey lime soils, which are barren lands and considered to be too poor for any other crop. Temperature and light conditions (sunshine hours) have a greater effect on essential oils and azulene content, than soil type (Kerches, 1966).

Chamomile is a widely recognized herb in Western culture. Chamomile is used widely to treat children who have GI disorders such as colic, dyspepsia, and diarrhea and to treat skin conditions such as dermatitis children who are allergic to ragweed, asters, and chrysanthemums should use chamomile with caution. (Jalal *et al.*, 2014). It includes fever, headaches, kidney, liver, and bladder problems, digestive upset, muscle spasms, anxiety, insomnia, skin irritations, bruises, gout, ulcers, rheumatic pain, hay fever, inflammation, hemorrhoids, colic, and menstrual disorders. research shows chamomile possesses properties that can help ease inflammation, spasms, and flatulence, promote calm and sleep, and protect against the bacteria that cause stomach ulcers (Cathy, 2020).

In Ethiopia the performance of the two chamomiles, American and German types was evaluated for agronomic and chemical traits and it is possible to use both cultivars for the production of herbal flowers and essential oil yield in the country (Beemnet, 2015). Seed is the major factor that greatly affects the production and productivity of the crop. Quality seed is considered the basic and critical input for enhancing productivity (Hemming *et al.*, 2018). In Ethiopia, farmers store seeds in poor conditions which leads the seeds to have inferior performance in the field.

The periods of seed storage change the germination of the medicinal plants because of different factors. Tiwari and Das (2014) reported variable patterns in seed germination of different medicinal plants due to cofounding effect of factors such as storage materials, temperature, and plant species. For instance, Poor storage condition results in low seed germination and viability (Bhandari *et al*, 2017). Storage time and conditions also may induce some physical, chemical and biochemical alterations in seed during storage (Rahouma, 2021) affecting grain quality. Even if, chamomile plant has a good performance in Ethiopia, the impacts of storage periods and methods on its seed quality is not studied yet. Thus, the objective of this study was to assess the role of storage periods and methods on the seed quality of chamomile varieties grown in Ethiopia.

Objective

To assess the effects of seed storage periods on germination and seedling growth of chamomile.

2. MATERIALS AND METHODS

2.1. Description of the experimental site

The experiment was conducted during 2021 in seed laboratory of Wondogenet agricultural research center. Wendo genet is located at 7o 192 N latitude and 38o 382 E longitude with altitude of 1780 m a.s.l. The site receives mean annual rainfall of 1128 mm with minimum and maximum temperature of 11.47 and 26.51^{o}C, respectively. The soil textural area of the experimental area was sandy loam with the pH of 6.4 (Kassahun *et al.*, 2014). The American type, variety which was adaptable to the experimental area was used as planting material.

2.2. Experimental design and setup

The experiment was conducted for a year, and it consists of two factors arranged in CRD. The first factor was storage method consisted of three types i.e. (polypropylene bags, cotton bags and bottle), and the second factor was storage period (initial day before storage, three, six, nine and twelve months). thus, the treatment consisted of 3 x 5= 15 treatment combinations. The American type variety of chamomile (*Matricaria chamomile* L.) was used as the experimental material.

2.3. Data Collected

A. Germination percentage

Germination tests were carried out according to the procedures prescribed in ISTA (2014). Germination test was carried out in germination room for eight days until seeds germinate. Germination percentage was calculated by using the following equation 1.

$$Germination\ \% = \frac{Number\ of\ normal\ seedling}{total\ number\ of\ seeds\ sown}\ X\ 100 \quad \text{.....eq. 1}$$

B. Speed of germination was determined with a similar procedure to the standard germination test but the number of germinated seeds was counted and removed every day until there was no further germination (ISTA 2009). Equation 2 was used to determine speed of germination.

$$Speed\ of\ germination = \frac{N1}{C1} + \frac{N2}{C2} + \cdots + \frac{NF}{CF} \ldots\ldots..eq.2$$

Where N1, N2, NF is the 1st, 2nd and final day counts of germinated normal seedlings and C1, C2, CF is 1st, 2nd and final count of seedlings.

C. Moisture content

The moisture content of seed samples was measured by the hot air oven method gravimetrically (AOAC, 2000, 925.10).

D. Vigour index

From the standard germination test, ten normal seedlings were selected and placed in an envelope to be oven dried at 80^{0}C for 24 h (Fiala, 1987). The dry weight of 10 seedlings was measured using an electronic balance at a precision of 0.1 mg. The value was divided by 10 to obtain the mean dry weight of a single seedling. Seedling dry weights were then expressed in milligrams. Seedling vigour index was calculated by multiplying percentage of kernels that germinated by mean dry weight (mg) of a single seedling.

DATA ANALYSIS

The collected data were subjected to a statistical analysis. The analysis of variance was carried out by SAS version 9.4 software. The significance difference between treatments means were delineated by LSD test at 5% level of significance.

3. RESULTS AND DISCUSSIONS

3.1. Seedling dry weight and plant height

According to the result the mean effect of storage method and period had significantly influenced the seedling dry weight and plant height of chamomile (table 1). Dry weight and plant height of the seedling during the beginning of the experiment was showed the lowest weight and height as compared to stored seed. Similarly, Wawrzyniak *et al*. had found that all tested species' seedling height and diameter were the lowest in non-stored seeds and the highest after the third year of storage. Even if non-significant difference between the storage methods the result indicated that the seeds stored in bottle shows better dry weight and plant height than the two storage methods at 9 month stored seed. The dry weight and plant height of chamomile seedling shows significantly highest at 9 months storage time and decrease the value after 9 months storage time (table 1). Rade, (2020) reported that for all parameters peak performance was reached after 6 months storage and this level was maintained at 20 months. After 30 months storage, stem and radicle growth and seedling weight of grass variety declined.

Table 1: Mean effect of storage periods and methods on Seedling dry weight and plant height of Chamomile

Storage methods	Storage period	Seed quality	
		Seedling dry weight (gm/plant)	plant height (cm)
Polypropylene bag	Initial date	0.01f	2.42g
	Month 3	0.04cd	4.61cde
	Month 6	0.02ef	4.2def
	Month 9	0.06ab	6.13ab
	Month 12	0.03ef	3.70defg
Bottle	Initial date	0.01f	2.42g
	Month 3	0.04cd	4.82bcd
	Month 6	0.02ef	3.50defg
	Month 9	0.07a	6.70a
	Month 12	0.02ef	3.04fg
Cotton bag	Initial date	0.01f	2.42g
	Month 3	0.03de	4.12def
	Month 6	0.02ef	3.31efg
	Month 9	0.05bc	5.70abc
	Month 12	0.01f	3.67defg
LSD		0.015	1.408
CV		26.857	19.418
P-value		***	***

Note: Means followed by the same letters within each column are not significantly different (P > 0.05) by LSD test

3.2. Seed germination percentage

The analysis of variance of the result revealed that the interaction effect of storage method and period had significantly influenced the seed germination percentage of chamomile (table 1.) Germination of the seed during the beginning of the experiment was 78.2 %. Seeds stored in cotton bag recorded the highest (76 %) germination than in polypropylene bag. There is no significance difference between germination of seeds stored in cotton and bottle storage. The least germination (42 %) was recorded for seeds stored in polypropylene bags for a year. As storage period increased the germination percentage of chamomile seeds significantly decreased (table 1). Similarly, Teshager *et al*. found that germinating percentage of the seeds had declined when storage period elongates on the other hand Rozman *et al*. had found that the germination percentage had reduced due to seed storage which had stayed above 9 months. The decrease in germination percentage through time might be due to the usage of poor storage structure which leads to degradation of proteins and nucleic acids.

The degradation of proteins and nucleic acids again caused to the ultimate death of the seeds and loss of germination ability (Salama, 2016). Similar, to this result, the study conducted by (Mao, *et al*., 2009) suggested that germination rates of zoysia grass seed decreased significantly ($P < 0.05$) as the storage period prolonged from 6 to 18 months. Additionally, (Saleem, A *et al.*, 2009) reported that the germination percentage of seed of *Themeda triandra* (Kangaroo grass) is significantly influenced by storage period and different environment.

3.3. Speed of germination

Similar to germination percentage speed of germination is also significantly influenced by the interaction effect of storage methods and periods (table 1). Similarly, Teshager A, *et al.*, found that the storage period had more pronounced effect on speed of germination in tef than the varietal difference. Therefore, tef might lose its germination speed if stored for prolonged time beyond 31 months. The result of the study showed that there is a significant difference in speed of germination of seeds stored in polypropylene bags and other storage methods through the storage periods. High speed of germination is recorded for the seeds stored in polypropylene bags for 12 months. Therefore, chamomile seed may loss its speed of germination when stored beyond 12 months. The decrease in speed of germination of seeds might be due to the damage of seeds.

Table 2: Interaction effect of storage periods and methods on germination, speed of germination, moisture content and vigour index of Chamomile

Storage methods	Storage period	Seed quality			
		Germination (%)	Speed of germination (days)	Moisture content (%)	Vigour index (mg %)
Polypropylene bag	Initial date	78.2[a]	25[de]	36.1[d]	43.7[a]
	Month 3	72[b]	31[d]	41[cd]	40.3[b]
	Month 6	63[c]	39[cd]	47[bc]	39.3[bc]
	Month 9	55[d]	42[b]	50[b]	28.3[d]
	Month 12	42[ef]	48[a]	55[a]	17.7[ef]
Bottle	Initial date	78.2[a]	25[de]	36.1[d]	43.7[a]
	Month 3	75[a]	26[de]	38[cd]	41.2[b]
	Month 6	70[b]	30[d]	42[cd]	38[bc]
	Month 9	64[c]	34[c]	45[bc]	37.1[bc]
	Month 12	60[c]	36[c]	47[bc]	30[d]
Cotton bag	Initial date	78.2[a]	25[de]	36.1[d]	43.7[a]
	Month 3	76[a]	26[de]	35[d]	39[bc]
	Month 6	72[b]	28[c]	37[cd]	36[bc]
	Month 9	69[bc]	32[c]	40[cd]	37[bc]
	Month 12	65[c]	34[c]	47.2[bc]	29[d]
CV (%)		5.3	8.01	11.1	7.2
P-value	Storage method	0.001	0.001	0.01	0.01
	Storage period	0.01	0.001	0.01	0.001
	Storage method * storage period	0.001	0.001	0.001	0.0001

Note: Means followed by the same letters within each column are not significantly different ($P > 0.05$) by LSD test

3.4. Moisture content

Moisture content is the most important factor that regulates the longevity of seed in storage. Analysis of variance of the data reviled that moisture content of chamomile seeds is significantly influenced by the interaction effect of storage period and methods (table 1). The highest moisture content of the seed is recorded for seed stored in polypropylene bag during 12 months of storage. The increase of moisture content in polypropylene bags is due to the highest relative humidity. The study conducted by (Afzal *et al.,* 2019), during highest relative humidity polypropylene bags having highest pore size cannot protect seeds from highest relative humidity.

3.5. Vigour index

The analysis of variance of the result showed that there is a reduction in vigour index of the seeds as storage period increased (table 1) similarly aged seeds show decreased vigour and produce weak seedlings that are unable to survive once reintroduced into a habitat (Radha *et al.*, 2014). Teshager *et al.*, also found that the Seedling dry matter had significantly reduced when seed storage period prolonged to 31 months. During the beginning of the experiment the vigour index was 43.7 mg % while a significance difference was observed for the seeds stored in polypropylene bags and other storage methods. Gradual decrease of vigour index was observed for seeds stored in polypropylene bags for twelve months, which is because of loss of vigour of seeds in long-term storage. Whereas, there was no significance difference of vigour index of seeds stored in bottle and cotton storage methods. The low vigour index of seeds in this study could be attributed to the oxidation of the nutrient reserve in the endosperm through aging which resulted in significant reduction in the seed capacity to germinate and emerge.

4. CONCLUSIONS

The study was aimed to determine the impact of storage periods and methods on seed quality of chamomile. The study found that the interaction effects of storage periods and methods had significantly influenced the seed quality (germination percentage, speed of germination, moisture content, and vigour index) of chamomile. For example, as storage periods increased from three to twelve months the quality of the seeds stored in polypropylene bags significantly decreased, whereas, seeds stored in cotton bag and bottle did not shows significant difference.in general, from this study it can be concluded that seeds stored in bottle and cotton bags showed better seed quality performance than the seeds stored in polypropylene bags.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

5. REFERENCES

1. Tadesse, N., & Chala, M. (2017). Influence of Plant Population Density on Growth and Yield of Chamomile (Matricaria chamomilla L.) at Wondo Genet, South Ethiopia. *Adv. Crop. Sci. Technol*, *5*(2).
2. Purohit, S. S., & Vyas, S. P. (2004). *Medicinal plant cultivation: A scientific approach: Including Processing and Financial Guidelines*. Agrobios (India).
3. Beemnet, M., Zinash, T., Zewdinesh, D. Z., Wondu, B., Bekri, M., Basazenew, D., Tigist, G., Desta, F., & Hassen, N. (2015). Evaluation of American and German Chamomiles for Agronomic and Chemical Traits in Ethiopia. *Research Journal of Agriculture and Environmental Management, 4*(3), 134-140.
4. Misra, P. N., & LD, K. (1978). Matricaria chamomilla Linn.–A remunerative crop for saline alkali-soils. *Indian Forester*, *104*(9), 631-37.
5. Kerches, J. (1966). Experiments with the cultivation of chamomile (Matricaria chamomilla). *Herba Hungarica*, *5*, 141-7.
6. Zadeh, J. B., Kor, N. M., & Kor, Z. M. (2014). Chamomile (Matricaria recutita) as a valuable medicinal plant. *International journal of Advanced Biological and Biomedical Research*, *2*(3), 823-829.
7. Cathy, W. (2020). The Health Benefits of Chamomile. https://www.verywellhealth.com/the-benefits-of-chamomile-89436
8. Bhandari, G., Ghimire, T. B., Kaduwal, S., Shrestha, J., & Acharya, R. (2017). Effects of storage structures and moisture contents on seed quality attributes of quality protein maize. *Journal of Maize Research and Development*, *3*(1), 77-85.
9. Kassahun, B. M., Tilahun, S., Zigene, Z. D., Teferi, Z., Mekonnen, M., & Melka, B. (2014). Morpho-agronomic characteristics, essential oil content and essential oil yield of oregano (Origanum vulgare L.) in Ethiopia. *Scholarly Journal of Agricultural Science*, *4*(12), 565-571.
10. Afzal, I., Khalid, E., Basra, S. M. A., Afzal, A., & Mahmood, K. (2019). Maintaining seed quality of maize and wheat through dry chain technology in Pakistan. *International Journal of Agriculture and Biology*, *22*, 1363-1368.
11. Saleem, A., Hassan, F., Manaf, A., & Ahmedani, M. (2009). Germination of Themeda triandra (Kangaroo grass) as affected by different environmental conditions and storage periods. *African Journal of Biotechnology*, *8*(17).
12. Mao, P. S., Wang, X. G., Wang, Y. H., & Han, J. G. (2009). Effect of storage temperature and duration on the vigor of zoysiagrass (Zoysia japonica Steud.) seed harvested at different maturity stages. *Grassland science*, *55*(1), 1-5.
13. Radha, B. N., Channakeshava, B.C., Bhanuprakash, K., Pandurange Gowda, K. T., Ramachandrappa, B. K. & Munirajappa, R. (2014). DNA Damage During Seed Ageing. *IOSR Journal of Agriculture and Veterinary Science, 7*(1), 34-39.
14. Salama, A. M. A., El-Kassaby, A. T., EL-Moursy, S. A., Ghonema, M. H., & Ramadan, N. M. (2016). Effect of storage methods and fumigation with phosphine on storage efficacy, germination and seedlings parameters of wheat during storage periods. *Journal of Plant Production*, *7*(7), 727-732.
15. Fiala, F. (1987). Handbook of Vigour Test Methods. International Seed Testing Association, Zurich, Switzerland.
16. Rahouma, A., & Mahmud, A. (2021). Effect of storage periods and package types on germination, seedling characters and biochemical changes of barley grains. *Alexandria*

Science Exchange Journal, *42*(JANUARY-MARCH), 133-138.

17. Hemming, D. J., Chirwa, E. W., Dorward, A., Ruffhead, H. J., Hill, R., Osborn, J., ... & Phillips, D. (2018). Agricultural input subsidies for improving productivity, farm income, consumer welfare and wider growth in low-and lower-middle-income countries: a systematic review. *Campbell Systematic Reviews*, *14*(1), 1-153.
18. Abebaw, T., Mohamod, W., & Asefa, K. (2016). Effect of seed storage and varieties on seed quality of tef [Eragrostis tef (zucc.) trotter]. *Agricultural Research & Technology*, *2*(4), 00102-00109.
19. Tiwari, R. K. S., & Das, K. (2014). Impact of different storage conditions on seed germination and viability of some medicinal plants. *Afr. J. Agric. Res. 20*, 1578–1585.
20. Rozman, V., Bukvić, G., Liška, A., Baličević, R., Andrijana, E. Đ. E. D., & Petrović, S. (2010). Differences in traits of seeds and seedlings of perennial ryegrass cultivars after nine months storage at different temperatures. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, *38*(1), 155-158.
21. Wawrzyniak, M. K., Michalak, M., & Chmielarz, P. (2020). Effect of different conditions of storage on seed viability and seedling growth of six European wild fruit woody plants. *Annals of Forest Science*, *77*(2), 1-20.
22. Stanisavljevic, R., Poštić, D., Štrbanović, R., Tabaković, M., Jovanović, S., Milenković, J., ... & Terzić, D. (2020). Effect of seed storage on seed germination and seedling quality of Festulolium in comparison with related forage grasses. *Tropical Grasslands-Forrajes Tropicales*, *8*(2), 125-132.

