Quality Status of Wild Simsim (*Sesamum Calycinum*) Seeds Harvested from Croplands in Khwisero, Kakamega County

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ABSTRACT

Wild simsim is among the indigenous vegetables still gathered during scarcity by some communities in Kakamega County. Domestication of such vegetables is important as they are adaptable to adverse climatic conditions and high in nutritional value. Seed quality is paramount in crop establishment, growth and yield. Being wild, the seeds have not undergone any certification process to come up with the required standard specifications. The objective of the study was to assess the quality of wild simsim seeds by evaluating the influence of the harvesting stage on germination and vigor. The seeds were harvested at yellow and brown capsule stages from croplands in Khwisero. Seed germination and vigor tests were conducted in the seed laboratory at the University of Eldoret. The data was subjected to ANOVA using a Genstat statistical package and means separated by LSD at a 5% significance level. Results indicated that the seeds were of low quality having a germination percentage of 68.50 and 49.75 for seeds harvested at yellow and brown capsule stages respectively. Consequently, Seed vigor was also low recording 8% and 6.25 % at yellow and brown capsule stages respectively. Wild simsim Seeds are of low quality below the 70% recommendation by KEPHIS for indigenous vegetables although those harvested at yellow capsule stage are of a better quality in terms of germination. Wild simsim seeds should be harvested at the yellow capsule stage for a higher germination percentage.

Keywords: Wild simsim, Quality, Harvesting stage, Germination, Vigour.

INTRODUCTION

Wild simsim (*Sesamum Calycinum)* is among the uncultivated species of the genus *Sesamum* found in Africa and Indian peninsular (Bedigian, 2015). The genus is closely related to the sticky African genus *Cerathoni ceratatieca* which further suggests that it is probably African (Maundu *et al*., 2007). In Kenya, wild simsim is normally found in croplands, grazing fields growing from sea level to about 3000 m above sea level and common in light clay and sandy soils. The coastal communities refer to this vegetable as “mulenda mwitu” while to the Luo and Luhya communities in Kakamega it is known as “onyulo” and “fedha” respectively. In parts of Bungoma it is referred to as “lukhanukhanu” (personal communication). Wild simsim has been a good supplement for vegetables during the dry seasons and the excess which is sold in the local markets earns income to the communities in Western Kenya (Abukutsa – Onyango, 2007). The leaves are mucilaginous giving a mild sour taste and are often cooked with other ingredients mainly local

vegetables and eaten with cereals. Liu *et al.*, (2022) reported that the novel wrinkled leaf sesame mutant. *Sesamum radiatum* leaves are very rich in iron 36.10 mg /100g which is best suitable for people suffering from anemia (Umar *et al.,* 2023).

The majority of farmers producing indigenous vegetables use their seeds from previous crops or buy from the market with serious germination and purity problems. Naturally, wild simsim is self-propagated because the capsules burst at the brown capsule stage releasing the seeds which remain in the soil awaiting favorable germination conditions. Quality Seed is an important attribute for high yield, better crop production and is a foundation for any crop species (Manzoor *et al*., 2021). Seed is the part of the plant that is used for reproduction either vegetatively or generatively (Hartati *et al*., 2019). The benefits of using quality seeds are tremendous including a low seeding rate thus saving the farmer's income, fast emergence, more vigorous seedlings, uniformity in the field and high yields (Dagnoko *et al*., 2020). It is estimated that the use of quality seeds of a variety can increase yield by 20 – 25 % (Agri-Quest, 2020). Despite the importance of indigenous vegetables in ensuring food and nutrition security, Schreinemachens, *et al*.,(2018), production is limited by a lack of a systematic supply of quality seeds (Keatinge *et al*, 2015).

A sustainable seed production system ensures that high-quality seeds of a wide range of varieties and crops are produced and fully available in time and affordable to farmers and other stakeholders (FAO, 2021). According to the International Seed Testing Association (ISTA), (2014), seed quality is the possession of seed with the required genetic and physical purity that is accompanied by physiological soundness and good health. To maintain the physiological quality of the seed, proper selection and correct procedure should be adhered to during extraction and storage. Since the wild simsim seeds are harvested from the wild it is necessary to carry out germination and vigor tests to ascertain their production potential since seed germination and seedling establishment are the most critical stages for the survival of plants (Asif, 2015).

Germination is a series of complex physiological processes that begin with water imbibition by Seed coat and end with the appearance of primary roots penetrating the seed skin (ISTA, 2014). Seed vigor can be interpreted as a number of traits that indicate the activity on a seed lot diversity that grow on a wide range of field conditions (ISTA, 2014). The Seed vigor index gives the percentage of normal seeds that germinate in 3 days. Mean Germination Time (MGT) determines seed vigor by calculating the number of days taken in the germination process. Vigorous seeds will take fewer days in the process. The speed at which the seed germinates is often evaluated as a measure associated with differences in seed vigor (Kamotho *et al*, 2014).

Analysis of African Indigenous Vegetable seeds from both the informal and semi-formal seed systems was found to be low for the minimum germination requirement of 70% (Wayua *et al*., 2020). Factors that affect seed quality are the biological characteristics of the species, agronomy, seed production techniques, agronomy and post-harvest management (Nanduri *et al.*, 2017). The highest seed quality of cleome was recorded at the yellow pod stage (Kamotho *et al*., 2014). Germination of different crops observed at various stages was above 85% of the recommendation for high-quality seeds (Hay and Whitehouse. 2017). Eggplant seeds extracted from fruits 20 days after the harvest had the highest germination percentage (Takae *et al*., 2015).

There is very little information on seed quality of *Sesamum* species especially wild simsim, hence this study aimed at evaluating the effect of the harvesting stage on germination percentage and vigor of the seeds harvested from croplands.

MATERIALS AND METHODS

Seed source, collection and storage

The capsules were harvested at yellow and brown stages in crop fields in Khwisero, Kakamega. Khwisero

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lies in the lower midland zones (LM1) with sandy clay soils (Jaezold *et al*., 2010). The capsules were dried in different trays, threshed, winnowed and the seeds stored in brown papers for 35 days at room temperature in a cool dry environment (Jyoti *et al*., 2021). A sample of wild simsim plant was taken to the botany laboratory for genus and species confirmation with the assistance of a taxonomist from the Department of Botany, University of Eldoret. Matching the botanical description with the sample, the plant was confirmed to be *Sesamum calycinun*

Seed Quality Tests

The tests were conducted in the seed laboratory, at the University of Eldoret whereby seeds harvested at yellow and brown capsule stages were tested for germination and vigor.

Germination test

One hundred wild simsim seeds harvested at yellow and brown capsule stages were replicated four times and placed on filter papers in Petri dishes (Lima *et al*., 2014). The Petri dishes were then placed in the growth chamber at 20 $\pm 1^0$ C and 70 – 80% relative humidity, moistened with distilled Water. Germination was recorded every day for up to 14 days and then converted to percentage. All seeds with at least 5 mm long radical were considered as germinated. Germination was calculated using the formula below:

$$\text{Germination \%} = \frac{\text{number of seeds germinated}}{\text{Seeds planted}} \times 100$$

Vigor Tests

Mean Germination Time (MGT)

The vigor status of seeds harvested at yellow and brown pod stages was calculated according to (ISTA, 2014).

$$\text{Formula: Mean germination time (MGT)} = \frac{\sum (fx)}{\sum (f)}$$

Where f is newly germinated seeds of a given day and x is the number of days counted from the day of sowing.

The First count in the standard germination test

The seeds that had germinated by the 5^{th} day were expressed as a percentage and used to estimate vigor.

Observations

Very low germination (1- 2 %) was recorded within the 14 days in the growth chambers and a repeat was conducted on the sand and the trays placed at room temperature ($18^0 – 20^0$C). However, no germination was recorded by the 14^{th} day. The experiment was repeated in Lugari at room temperature ($19^0 – 21^0$ C) and a satisfactory germination was recorded.

Data Analysis

The data was subjected to Analysis of Variance (ANOVA) using General statistics (GENSTAT) software version 12. Means were separated by LSD at a 5% significance level.

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RESULTS

Status of Wild Simsim Seeds

Significance difference was observed in the germination % of seeds harvested at yellow and brown capsule stages at $P \leq 0.05$ although the two seed lots did not differ significantly in terms of MGT and first count (table 1). Seeds harvested at yellow and brown capsule stages had low germination percentages of 66.50 and 46.75 respectively. This was below the National seed standards for African indigenous vegetables of 70 % (KEPHIS, 2020). Consequently, the vigor was low recording 8% and 6.25 % in yellow and brown capsules respectively. The seeds took a long time to germinate (9 days). This concurred with the findings of Ndinya *et al*, (2020) who recorded low germination in amaranthus, black nightshade and spider plants in informal and semi-formal seed production systems. This can be attributed to poor management and environmental stress such as nutrient deficiency, water shortage (FAO, 2018). Njonjo *et al*., (2019) attributed the poor physical quality of informal seed systems to the failure to rogue out off-types during seed crop production.

The biological characteristics of a species may also affect the seed quality. Sesame seeds contain oil which causes a barrier to imbibitions during the germination process. On the contrary, all spider plant accessions collected from Western Kenya had over 80% germination and vigor (Odongo *et al*, 2015). This can be attributed to good agronomic practices like fertilizer use which increase crop and seed quality without depending on the harvesting stage (Rutto *et al*., 2018). Rutto *et al*., (2020) reported a higher seed quality in jute mallow after an application of nitrogen fertilizer

Influence of the Harvesting Stage on Seed Quality

The seeds harvested at the yellow capsule stage had high germination as compared to those harvested at the brown stage (table 1). This was in agreement with the findings of Rutto *et al*., (2020) who reported maximum purity, germination and vigor at the tan stage with the lowest the brown stage in jute mallow seeds. Tetteh *et al*., (2020) observed no germination and low seed vigor in eggplants at first harvesting, however these quality parameters increased with time recording the highest at 7 and 8 weeks after maturity. Tomatoes seeds of high germination and vigor (above 85%) were obtained from fruits harvested at half-ripe, fully ripe and rotten irrespective of the accessions (Tetteh *et al* ., 2018). The physiological process occurring in the seeds determines the seed quality. Okra seeds harvested at 25 days after anthesis had low germination and vigor with a moisture content of (54 %) as compared to those harvested at 40 days after anthesis with a minimum moisture content (Kumar *et al*., 2021). The reduction of water with increased maturity might be due to the events associated with seed development such as accumulation of dry matter, desiccation and cessation of mobilization.

Table 1 Status of Wild Simsim Seeds

Treatments	**Variables**		
Capsule color	**Germination %**	**Mean Germination time (days)**	**First Count**
Yellow	66.50 a	9.24 a	8.00 a
Brown	46.75 b	9.50 a	6.25 a
LSD	5. 865	2.187	3.760
CV%	4.4	6.7	12.7

CONCLUSIONS

Wild simsim seeds harvested in croplands are of low quality with germination and vigor status below the recommendations for African leaf vegetables.

The harvesting stage influences the seed quality of wild simsim.

Wild simsim seeds harvested at the yellow capsule stage before bursting produce seeds with a higher germination % compared to those harvested at the brown stage.

RECOMMENDATIONS

Wild simsim seeds should be harvested at the yellow capsule stage for high germination percentage.

Suggestions for future work.

Study on dormancy in wild simsim seeds concerning types of dormancy and methods of breaking dormancy.

REFERENCES

1. Abukutsa- Onyango, M.O. (2007). The Diversity of Cultivated African Leafy vegetables in three Communities in Western Kenya". African Journal of Food Agriculture Nutrition and Development. 7(2007): pp 1- 10.
2. Agri- Quest, (2020). Quality Seed ant it's Importance in Agriculture. http//wwwagriquest.info accessed 9/ 7/2020 at 16.23.
3. Asif, N., Shahabudin, K., Nazeer, A, Mahmooda, B., Zabid, S, Fateh, M., and Shafeeque, A. (2015). Growth and yield of Sesame (Sesamum indicum L) under Influence of Planting Geometry and Irrigation Regimes. American Journal of Plant Sciences. 6(2015): 980-986.
4. Bedigan, D., (2015). Systematics and Evolution in Sesame (Pedaliaceae) part 1. Evidence regarding the origin of Sesame and its Closest Relatives. Journal of Plant Taxonomy and Geography volume 70 (2015): pp 1 – 42.
5. Dagnoko, S., Camara, F., Sangare, N., Aoga, A., Baltissen, G., Niangaly, O., Traore, A.B.M., and Fonana, B., (2020). Seed Yield and Quality of Three Foundation Seed Models under the Formal Seed System. African Journal of Rural Development, 5(2): pp 141 – 155.
6. FAO (Food and Agriculture Organization, (2018). Government of Kenya Food Comprehensive Tsble. http/www.fao.org/3/18897/ 18597.
7. FAO, (2020). Status of Seed Legislation and Policies in Asia and Pacific Region. Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Bangkok, https//doi.org/ 10.
8. Genstat Release: 8.1 for Windows Lawes Agricultural Trust, Rotharmstead Experimental station, U.K.(2013).
9. Hartati, P., Rosmayati, R., and Hanatiah, D., (2019). Viability and Vigour of Sesame (Sesamum indicum L,.) Seeds. In Proceedings of the International Conference on Natural Resources and Technology (ICONART 2019) pp 131 – 134.
10. Hay, F.R., and Whitehouse, K.J., (2017). Rethinking the Approach to Viability Monitoring in Seed Genebanks Conservation. Physiology, volume 5 (1): pp 1- 13.
11. ISTA. (International Rules for Seed Testing), (2014). 30th ISTA Seed Congress germination committee: 1- 288
12. Jaezold, R., Schmidt, H., Hernetz, B., and Shisanya, C. , (2010). Farm Management Handbook of Kenya Vol. 11. National Conditions and Farm Management Information. Second Edition. Published

by Government printers.
13. Jyoti, S., Patel, J.B. and Babariya, C.A. (2021). Study the Fresh Seed Dormancy in Sesame (Sesamum indicum L,.). Indian Journal of Pure Applied Biosciences, 1 (1): pp 457 – 462.
14. Keatinge, J.D.H., Wang, J.F., Ebert, A.W., Hughes, J.A., Stollova, T., Nenguwo, N., Dhillon, N.P.S., Easdown, W.J., Mavlyanova, R., Tenkovano, A., Afari- Sefa, V., Yana, R.Y., Srinivasani, R., Holmer, R.J., Luther, G., Shahabuddin, A.,Schreinemacheis, P., Iramu, E., Tikal, P., Dakuidreketi-Hickes, A., and Ravishankar, M., (2015). Indigenous Vegetables Worldwide. Their Importance and Future Development. Acta Hortic. 1202 ISHS.
15. Kamotho, G.N., Mathenge, P.W., Muasya, R.M., and Dullo, M.E., (2014). Effect of Maturity Stage, Dessication and Storage Period on Seed Quality of Cleome gynandra L, Research Desk volume 3 (1) : pp 419- 433.
16. (KEPHIS) Kenya Plant Health Inspectorate Services, (2020). KEPHIS Seed Inspection Manual. KEPHIS, Nairobi.
17. Kumar, N., Kumar, M., Kumar, A., Singh, P.K., and Singh, V.K., (2021). Effect of harvesting Stage and Drying Method on Seed Quality of Okra (Abelmoschus esculentus L.). International Journal of Current Microbiology and Applied Sciences ISSN, volume 10 (02) : pp 653 – 661.
18. Lima, D.C., Dutra, A.S., and Camilo, J.M., (2014). Physiological Quality of Sesame Seeds During Storage. Revista Ciencia Agronomica 45 (1): pp 138- 145.
19. Liu, H., Zhou, F., Zhou, T., Yang, Z., and Zhou, Y., (2022). A Novel Wrinkled-Leaf Sesame Mutant as a Potential Edible Leafy Vegetable Rich in Nuitrients. Scientific Reports, volume 12 (2022): 18978. www.nature.com/scientific reports.
20. Manzoor, A., Naveed, M.S., Ali, S.R., Ibrar, D., Syed, S., Ashraf, S., and Ahmed, R., (2021). Standardization of Seed Production Technology in Radish (Raphanus sativus) Cultivated Variety "mino" Using Different Stecking Sizes. Pakistan Journal of Agricultural Research, volume 34 (4): pp 725 – 731.
21. Maundu, P.M., Achigan-Dako, E., and Morimoto, Y., (2007). African Indigenous Vegetables in Urban Agriculture, editors Shackleton, C.M., Pasquini, M.W. and Drescher, A.W. Published by Earthscan in U.K. Chapter 3 pp. 65-101*
22. Nanduri, K.R., Dullo, M.E., and Eaglis, J.M.M., (2017). A Review of Factors that Influence the Production of Quality Seeds for Long Term Conservation and Genetic Resources and Crop Evolution. Volume 64(5): pp 1061 – 1074.
23. Njonjo, M.W., Muthoni, J.W., and Wan'gombe, A.W., (2019). Production Practices, Post harvest Handling and Quality of Cowpea Seeds Used by Farmers in Makueni and Taita Taveta Counties in Kenya. International Journal of Agronomy, volume 1 (2019): pp 1- 12.
24. Odongo, J., Wesonga, J., and Abukutsa – Onyango, M.O., (2015). Evaluation of Seed Quality of Spider Plant (Cleome gynandra L,.) Accessions in Various Regions in Kenya. The 2015 JKUAT Scientific Conference, Agricultural Science, Technologies and Global Networking, 37 D.
25. Schreimachens, P., Simmon, E.B., and Wopereins, M.C.S., (2018). Tapping the Economic and Nutritional Power of Vegetables. Global Food Science, volume 16 (2018): pp 36 – 45.
26. Rutto, D., Omami, E.N., Ochuodho, J.O., and Ngode, L., (2018). Effect of Nitrogen on Growth, Quality and Yield of "Mrenda" (Corchorus olitorius) Morphotypes in Kenya. International Journal of Horticultural Science and Technology, volume 5 (1): pp 1-10.
27. Rutto, D.K.L., Omami, E.N., and Ochuodho, J.O., (2020). Effect of Harvesting Stages and Nitrogen on Seed Quality and Yield of Jute Mallow (Corchorus olitorius). International Journal of Horticultural Sciences, volume 7 (4): pp 315 326.
28. Takae, A., Popovie, V., Glogovae, S., Bokie, V., and Kovac, D., (2015). Effect of Fruit Maturity Stages and Seed Extraction Time on Seed Quality of Eggplants (Solanum melongena). Rotarstuo Povrtarstvo, volume 52 (2015): pp 7- 13.
29. Tetteh, R., Aboagye, L.M., Darko, R., and Osaro, E., (2018). Effect of Maturity Stage on Two Tomato Accessions. African Crop Science Journal, volume 26 (2): pp 237 – 241.
30. Tetteh, R., Aboagye, L.M., Boateng J, S.K., and Darko, R., (2021). Seed Quality of Six Eggplants

Cultivars as Influenced by Harvesting Time. Journal of Applied Horticulture, volume 23 (1): pp24 – 27.

31. Umar, A.N,. Mohammed, D.A.K., Dafulani, S., Hassan, H. and Yusuf, Z.O., (2020). Mineral Composition and Sensory Properties of Vegetable Sesame (Sesamum radiatum) Leaves. International Journal of Medical Biological and Pharm. Science, volume 11(3): pp 172.