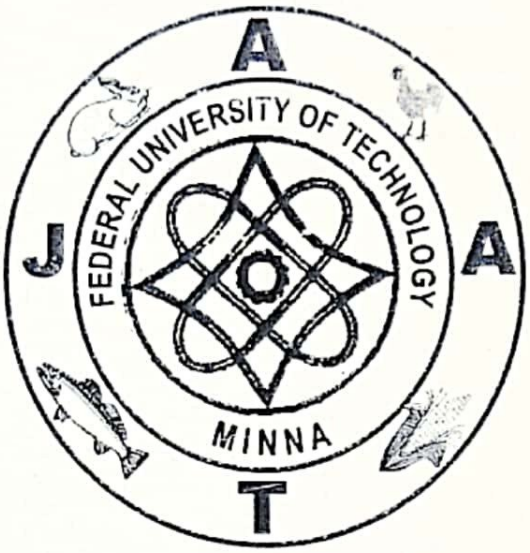
ISSN: 1597 - 5460

JAAT 1(1), JUNE 2002



Journal of AGRICULTURE AND AGRICULTURAL TECHNOLOGY (JAAT)

SCHOOL OF AGRICULTURE
AND
AGRICULTURAL TECHNOLOGY,
FEDERAL UNIVERSITY OF TECHNOLOGY,
P. M. B. 65.
MINNA.

EDITORIAL BOARD MEMBERS

Journal of Agriculture and Agricultural Technology (JAAT) Vol. 1(1), June 2002.

TABLE OF CONTENTS

Journal of Agriculture and Agricultural Technology (JAAT) Vol. 1(1), June 2002.

THE EFFECT OF FRUIT COLOUR ON SEED QUALITY IN PEPPER (*Capsicum annuum* L. cvars. 'Rodo' and 'Tatashe')

By
J.A. Oladiran and I. Haruna,
School of Agriculture and Agricultural Technology,
Federal University of Technology,
Minna, Niger State, Nigeria.

ABSTRACT

Seeds extracted from red-ripe, yellow and greenish-yellow fruits of the pepper cultivar 'Rodo' and those extracted from red-ripe and greenish-red fruits of the cultivar "Tatashe' were stored in open containers at 35°C to accelerate ageing. Higher germination scores were obtained for seeds from the red-ripe fruits compared to those from the other fruit classes in the two cultivars. Viability improved with storage time up to certain ages (which varied with fruit colour) beyond which a decline was observed. Overall, storability was better in seeds from red-ripe fruits than those from the other fruit colours. Similarly, seedling emergence, height and the number of leaves per plant were generally significantly ($P<0.05$) higher in seeds extracted from red-ripe fruits compared to those from other fruit colours following storage. These values initially increased as seed aged but later declined. Though fruit colour did not affect speed of germination prior to storage, seeds extracted from red-ripe and yellow fruits germinated significantly faster than those from greenish yellow fruits following two to four weeks of storage.

INTRODUCTION

Pepper (*Capsicum* spp.) fruits are known to be a good source of vitamin C and some amount of vitamins A and E and the fleshy pericarps of the large non-pungent fruit are used as salad vegetables. The red fruits of cultivars with fleshy pericarp are also used in the preparation of cheese, tinned meat, etc. (Cobley, 1976). The nutritional and commercial importance of the crop demands that attention be given to ways of producing the seeds in such a way that high quality is ensured.

The major aim of a genebank curator is to conserve seeds in a way that would ensure high quality for a long time. Storage moisture content and temperature are the two most important factors that are known to greatly influence seed longevity and the higher the value of any of these, the faster the rate of deterioration (Roberts, 1960).

However, even if all storage conditions are ideal, some pre-storage factors may turn the efforts of the curator to an exercise in futility. One of such pre-storage factors is the physiological state at which a seed is harvested. Doijode (1983) and Kwon and Bradford (1987) reported that percentage and rate of germination in tomato increased as seed weight increased throughout development from mature green to red. However a decline in the values

of the two parameters stated above was recorded as fruits over-ripened (Kwon and Bradford, 1987). Very recently, Valdes and Gray (1998) reported that maximum percentage seed germination was even obtained as early as the breaker stage i.e. when fruits were still green outside but with the development of pink or red colour in the interior. They further pointed out that germination was most rapid from seeds at red stage of fruit maturity and further delay in harvest led to deterioration of the seed. Fruit colour has also been used to index germination capability in *Solanum incanum* (Joshua, 1978), *Corchorus olitorius* (Oladiran, 1986) and *Solanum macrocarpon* (Oladiran, 1989).

In Yolo Wonder pepper, it was reported that the highest seed germination was obtained from the full (red or yellow) coloured fruits than from green berries (Quagliotti, 1969; Quagliotti, *et al.*, 1981). There is paucity of information in respect of the relationship between the stage of fruit maturity and seed longevity in pepper and this may perhaps be due to the general assumption that necessary apparatus that ensures seed longevity are already in place as soon as the fruit colour starts changing from green to yellow. That this may not necessarily be so has been revealed in reports from other crops (Nkang and Umoh, 1996; Oladiran and Akanmu, 1999). The common practice in pepper is to harvest fruits with colours ranging from greenish yellow to fully red. Belleti and Quagliotti (1991) advised that post-harvest ripening of the berries before seed removal should be done if fruits of Yolo Wonder were picked early and seeds had to be saved for genetic improvement.

This study was carried out to establish the relationship between the stage at which fruits of *Capsicum annuum* (cvars 'Rodo' and Tatashe') were harvested, and seed quality, using parameters such as seed germination percentage, speed of germination and seedling emergence and growth prior to and following storage.

MATERIALS AND METHODS

Fruits of *Capsicum annuum* L. were separated into the red-ripe, yellow and greenish-yellow groups for cvar. 'Rodo' and red-ripe and greenish red groups for cvar. 'Tatashe'. The seeds were extracted, washed clean of debris and then dried at room temperature for one week. 100-seed weight of each of the fruit groups was estimated based on the means of the weights of 100 seeds of four replicates each. For the storage studies, seeds of the various classes were placed in open glass Petri dishes and then positioned in an incubator running at 35°C and at a relative humidity of about 70% to accelerate ageing.

Prior to and at two-weekly intervals during storage, which lasted for 16 weeks, viability was determined by counting seeds from the different fruit classes on absorbent paper in Petri dishes. There were four replicates of 50 seeds each and the absorbent paper was normally moistened with distilled water as found necessary. Viability counts were taken every-other-day for 28 days and the final count was expressed as a percentage of the total number of

seeds incubated. Mean germination time (days) was estimated using the relation developed by Ellis and Roberts (1980). On each test day, some other seeds were sown in top soil placed in plastic pots to determine seedling emergence. Seedling height and the number of leaves per seedling were recorded five weeks after the seeds were sown. The data generated were subjected to analysis of variance using the Randomised Complete Block Design.

RESULTS AND DISCUSSION

Mean weights of 100 seeds of cvar. 'Rodo' extracted from red-ripe, yellow and greenish-yellow fruits were 0.32g, 0.27g and 0.26g respectively. The differences between the first and the last two values were significant ($P<0.05$) whereas the last two values were not significantly ($P > 0.05$) different from each other. Seeds of cvar. 'Tatashe' extracted from red-ripe fruits were significantly ($P<0.05$) heavier than those from the greenish red fruits (0.35g vs 0.27g). This trend agrees with what was reported for tomato by Oladiran and Akanmu (1999). Quagliotti *et al.*, (1981) reported an increase in seed weight by post-harvest ripening.

Figures 1 and 2 show the germination behaviour of seeds of the various treatments before and after storage. In cvar. 'Rodo', seed germination was poor prior to storage but there was a general improvement within the first four weeks in seeds extracted from yellow and greenish-yellow fruits and within six weeks in seeds extracted from red-ripe fruits. Following these increases however, a decline was recorded. In cvar. 'Tatashe', whereas an improvement in germination was recorded in seeds extracted from greenish-red fruits, a decline in percentage germination was recorded for seeds from red-ripe fruits following storage.

The general improvement in germination percentage following storage in this study, confirms earlier findings (Oladiran and Agunbiade, 2000; Oladiran and Baba, 1999), stressing the need to after-ripen pepper seeds for a reasonably high and faster germination. Statistical analysis revealed that there were no significant differences in the germination percentages of the unaged seeds from the different fruit groups in cvar 'Rodo'. However, the difference in the germination percentages of the seeds from the two fruit groups of 'Tatashe' was significant. Whereas the result in the unaged seeds of cvar 'Rodo' runs contrary to that of Quagliotti, *et al.* (1981), that of cvar. 'Tatashe' is in agreement. This suggests that the stage of maturity of fruits at harvest might not influence the germination of freshly harvested seeds the same way in all cultvars. However, following two weeks of storage, cvar. 'Rodo' seeds extracted from red-ripe and yellow fruits germinated significantly better than those from greenish-yellow fruits. There were no significant ($P > 0.05$) differences in the germination values of seeds from the former two fruit groups. As from four weeks, up to the end of storage, percentage germination was significantly ($P<0.05$) higher in seeds extracted from red-ripe fruits than in the other two fruit groups, which did not differ from each other significantly. For cvar. 'Tatashe', the superiority of the seeds extracted from red-ripe fruit, lasted until six weeks of storage. In the same vein,

seedling emergence and height at five weeks, as well as the number of leaves per seedling, were generally higher when seeds were extracted from fruits in the later stages of ripening than in earlier ones (Figures 3, 4, 5, 6, 7 and 8). The general superiority of seeds from more advanced fruits over less advanced ones in this study, agrees with the report of Demir and Ellis (1992) whose record shows that maximum percentage germination and seedling size occurred after maximum seed dry weight was produced. Oladiran and Akanmu (1999) also recorded that tomato seeds stored better when extracted from fully ripe fruits compared to those extracted at the colour-breaking stage. In the present study, there were indications that bigger seeds had the tendency of surviving longer than small ones. Passam, *et al.*, (1997) reported similar trend in other cultivars of pepper.

Figure 9 shows the mean germination time (days) of cvar. 'Rodo' seeds prior to and after storage. Seeds of all fruit groups generally germinated faster with age. This agrees with an already reported trend and is said to be an indication of the loss of dormancy by the surviving seeds (Oladiran and Agunbiade, 2000). Analysis revealed that the stage at which the fruits were harvested did not influence germination time significantly when seeds were freshly harvested. However, following two and four weeks of storage, seeds extracted from red-ripe and yellow fruits germinated significantly faster than those from greenish yellow fruits. After this period, there were no more significant differences in germination time. After 12 weeks of storage, germination of surviving seeds became generally slower which is normally taken to be an indication of longer time required to repair damages suffered by chromosomes during storage, before germination would take place (Berjak and Villiers, 1972)

CONCLUSION AND RECOMMENDATION:

We conclude from the above that the maturation stage at which pepper fruits were harvested significantly affected seed longevity and seedling vigour following seed storage. It is therefore recommended that fruits of cvars. 'Rodo' and 'Tatashe' from which seeds would be extracted should always be harvested when fully ripe and the seeds so collected may have to be after-ripened for two to six weeks for higher percentage and faster germination.

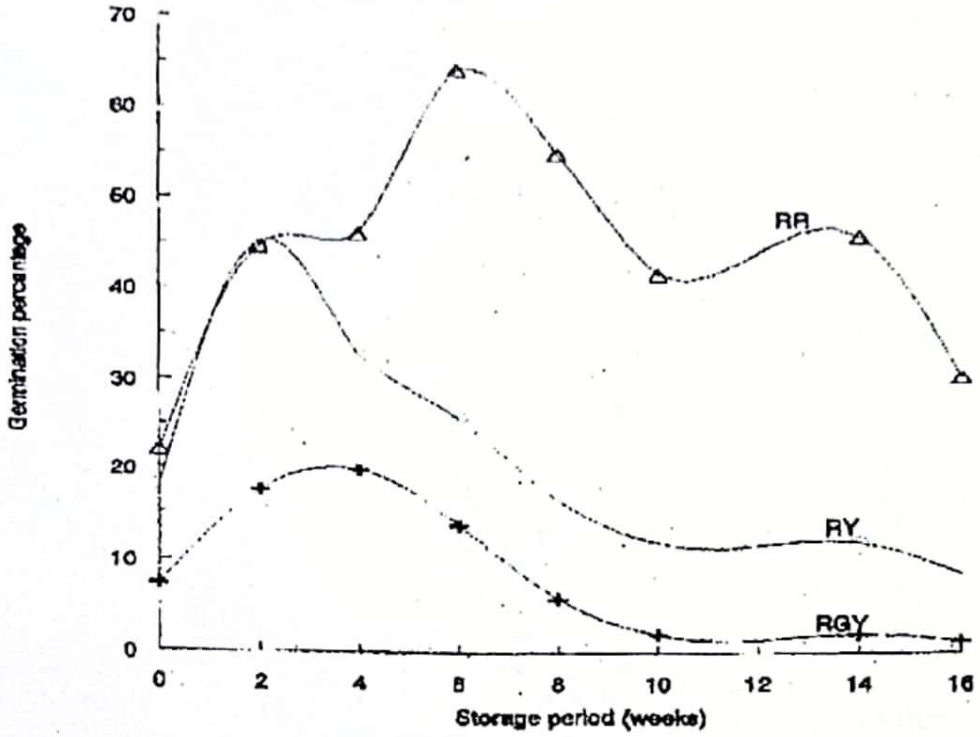


Fig. 1: The germination of 'Rodo' seeds obtained from red (RR), yellow (RY) and greenish yellow (RGY) fruits.

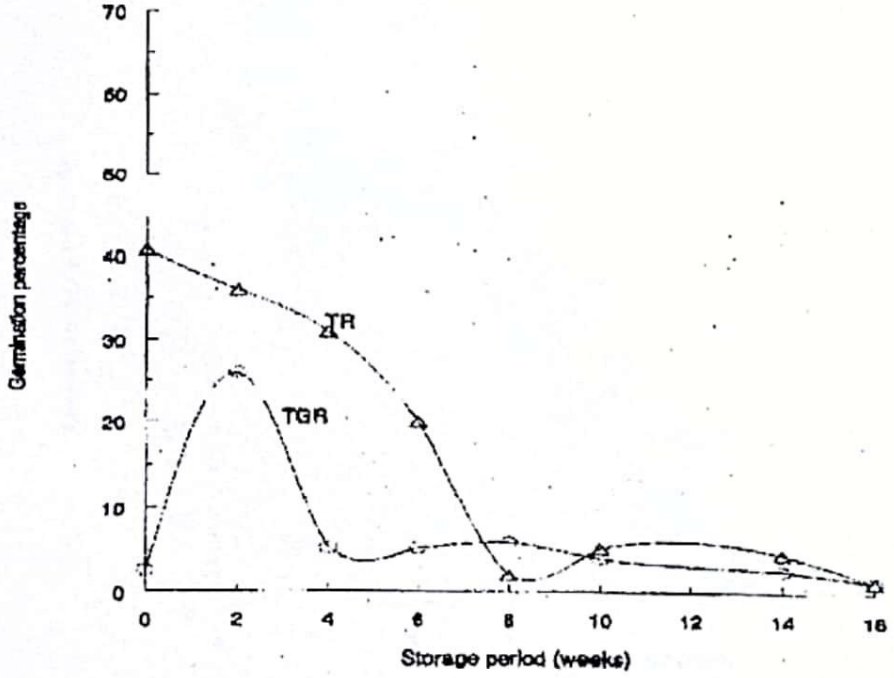


Fig. 2: The germination of 'Tatashe' seeds obtained from red (TR) and greenish red (TGR) fruits.

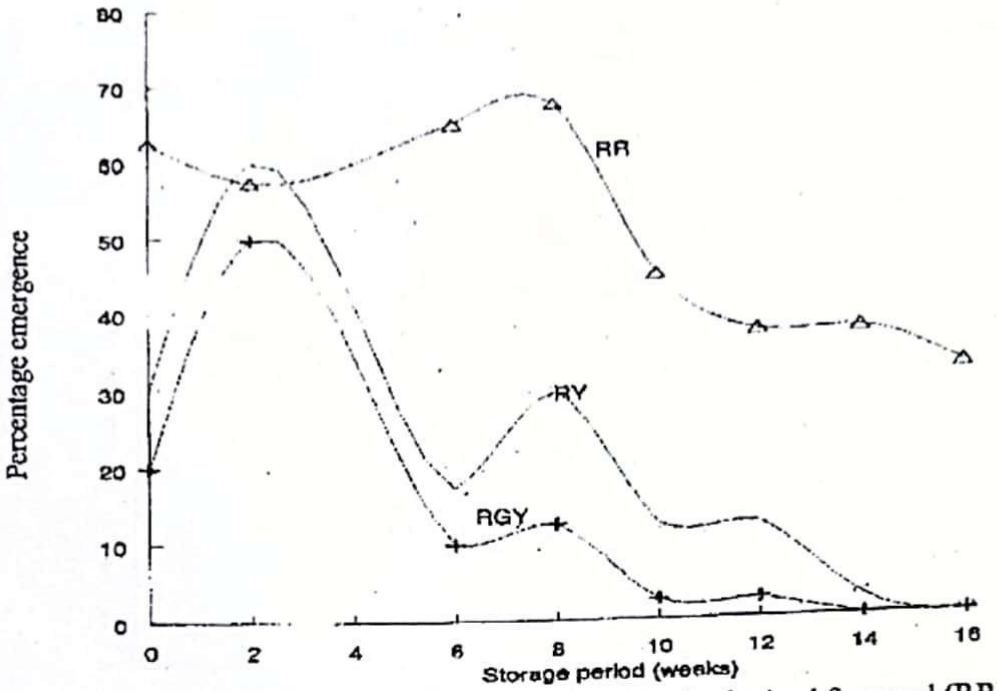


Fig. 3: Percentage seedling emergence from stored 'Rodo' seeds obtained from red (RR), yellow (RY) and greenish yellow (RGY) fruits.

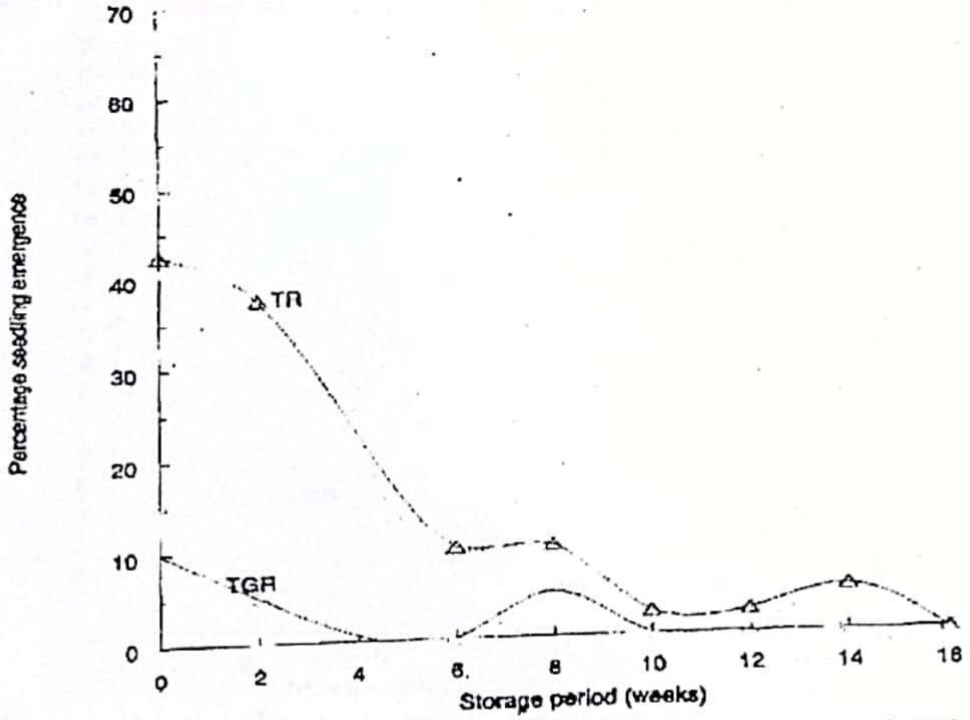


Fig. 4: Percentage seedling emergence from 'Tatashe' seeds obtained from red (TR) and greenish red (TGR) fruits.

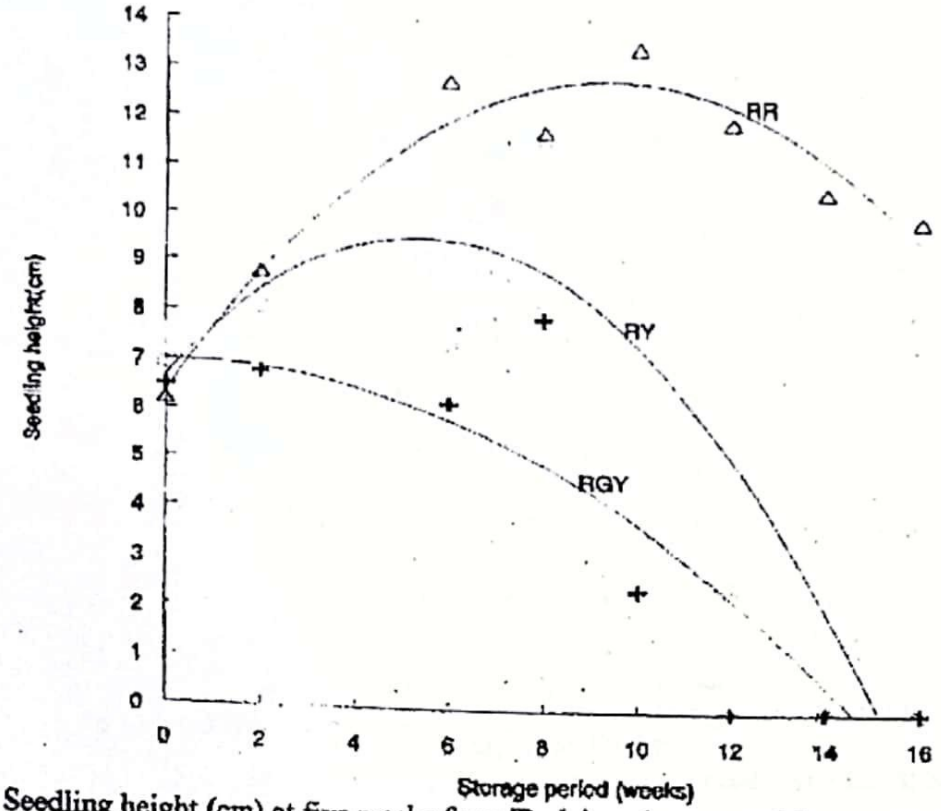


Fig. 5: Seedling height (cm) at five weeks from 'Rodo' seeds extracted from red (RR), yellow (RY) and greenish yellow (RGY) fruits.

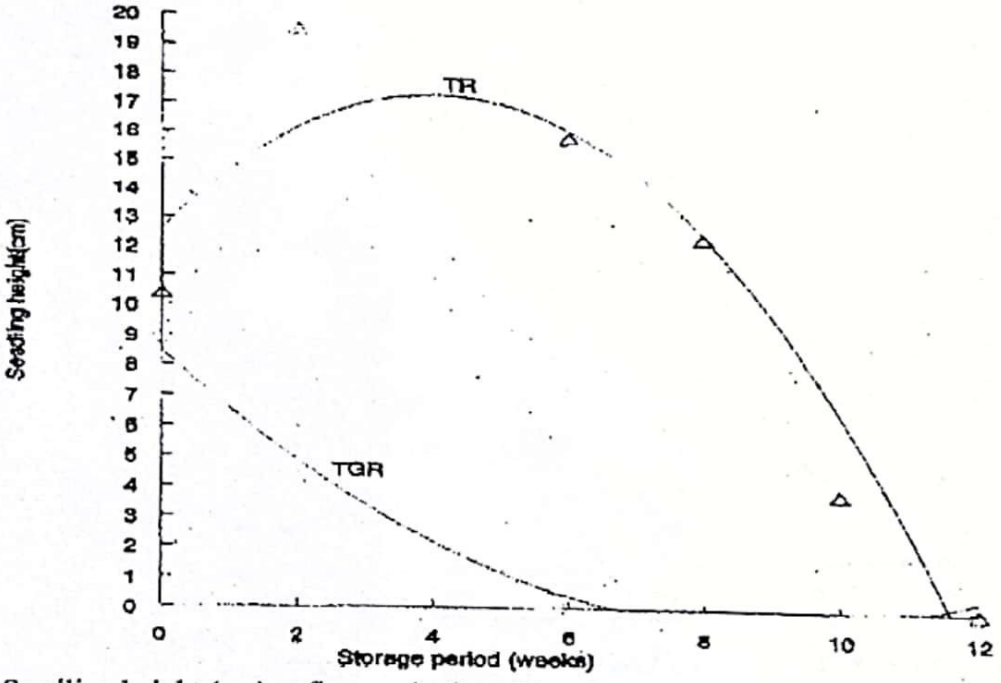


Fig. 6: Seedling height (cm) at five weeks from 'Tatashe' seeds extracted from red (TR) and greenish red (TGR) fruits.

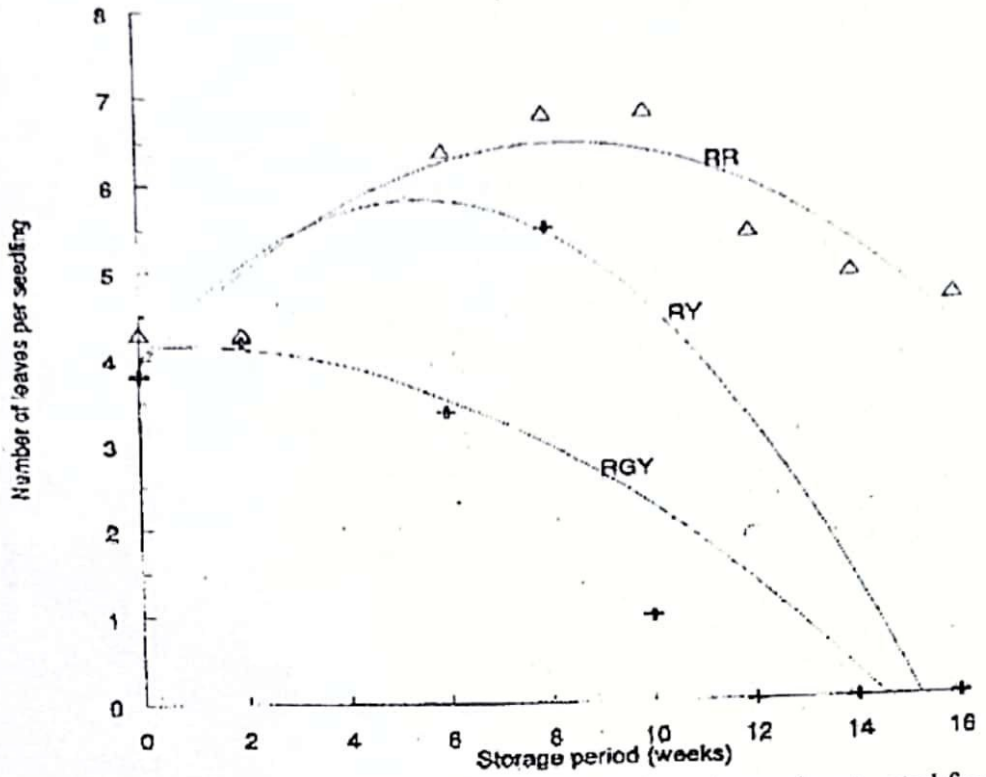


Fig. 7: Numbber of leaves of 'Rodo' seedlings produced from the seeds extracted from red (RR), yellow (RY) and greenish yellow (RGY) fruits.

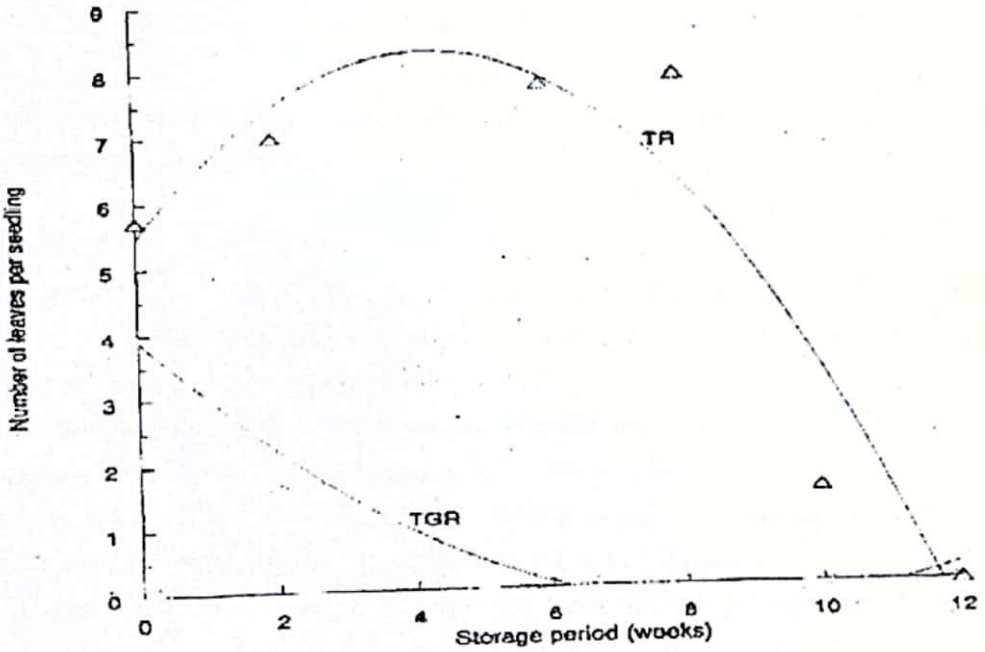


Fig. 8: Number of Leaves of 'Tatashe' seedlings produced from the seeds extracted from red (TR) and greenish red (TGR) fruits.

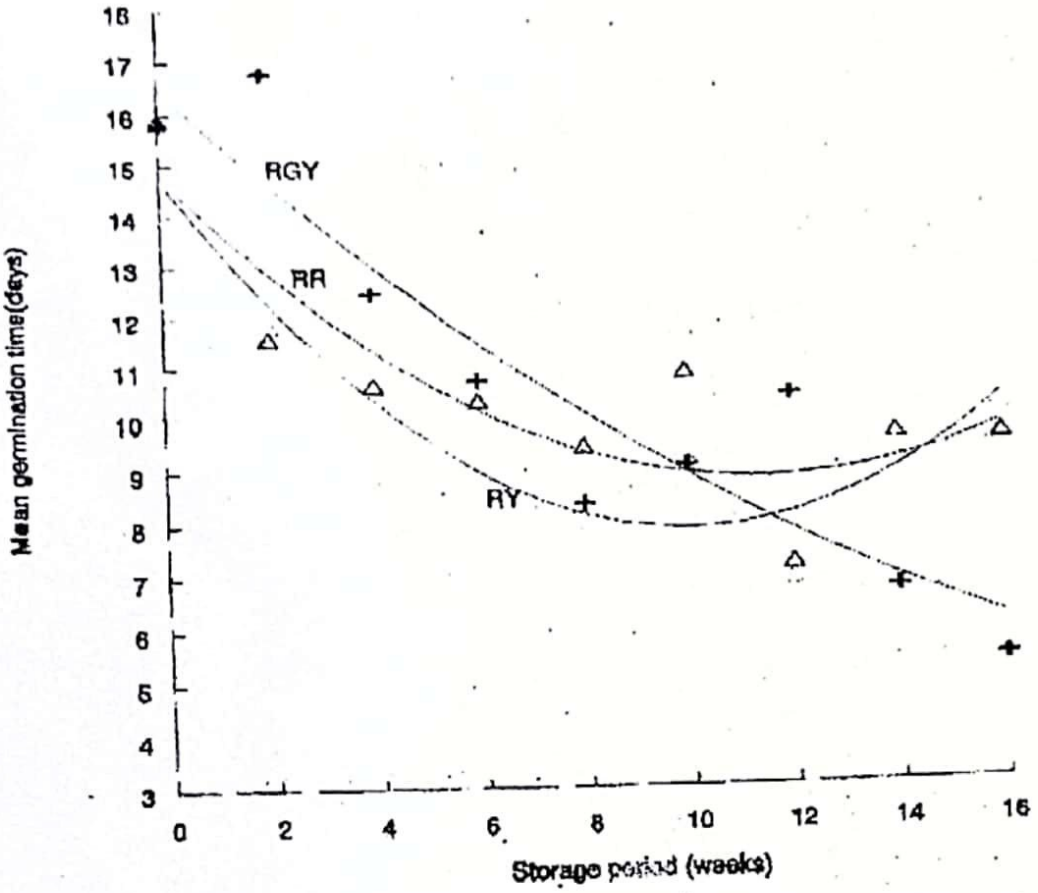


Fig. 9: Mean germination time (days) of 'Rodo' seeds obtained from red (RR), yellow (RY) and greenish yellow fruits.

REFERENCES

Belleti, P. and Quagliotti, L. (1991). Problems of seed production and storage of pepper. pp 28-41. In: *Tomato and pepper production in the tropics.* Asian Vegetable Research and Development Centre, Tainan. Taiwan,

Berjak, P. and Villiers, T.A. (1972). Ageing in plant embryos. V. Lysis of the cytoplasm in non-viable embryos. *New Phytologist*, 71:1075-1079.

Cobley, L.S. (1976). *The Spices*. pp 230-251. In: the Botany of Tropical Crops. Second Edition Revised by W.M. Steele. Longman Group Limited, London.

Demir, I. and Ellis, R.H. (1992). Changes in seed quality during seed development and maturation in tomato. *Seed Science Research*, 2:81-87

Doijode, S.D. (1983). Studies on vigour and viability of seeds at different stages of fruit development in tomato. *Singapore Journal of Primary Industries*, 11:106-109.

Ellis, R.H. and Roberts, E.H. (1980). Improved equation for the prediction of seed longevity. *Annals of Botany*, 45:13-30.

Joshua, A. (1978). Seed germination of *Solanum incanum*: An example of germination problems of tropical vegetable crops. *Acta Horticultuae*, 83:155-161.

Kwon, O.A. and Bradford, K.J. (1987). Tomato seed development and quality as influenced by pre-harvest treatment with ethephon. *HortScience*, 22:588-591.

Nkang, A. and Umoh, E.O. (1996). Six months storability of five soyabean cultivars as influenced by stage of harvest, storage temperature and relative humidity. *Seed Science and Technology*, 25:93-99

Oladiran, J.A. (1986). Effect of stage of harvesting and seed treatments on germination, seedling emergence and growth in *Corchorus olitorius* 'Oniyaya'. *Scientia Horticulturae*, 28:227-233.

Oladiran, J.A. (1989). The effect of fruit colour, processing technique and seed treatment on the germination of *Solanum macrocarpon* L. (Igbagba). *Nigerian Journal of Technological Research*, 1:17-20

Oladiran, J.A. and Agunbiade, S.A. (2000). Germination and seedling development from pepper (*Capsicum annuum* L.) seeds following storage in different packaging materials. *Seed Science and Technology*, 28: 413-419.

Oladiran, J.A. and Akanmu, O.K. (1999). Effect of ripening stage of fruit and processing technique on seed quality in tomato (*Lycopersicon esculentum* Mill). *Paper presented at the 12th Annual Conference of the Biotechnology Society of Nigeria* held at NIFFR, New Bussa, Niger State, Nigeria, 13th-16th April, 1999.

Oladiran, J.A.and Baba, J.T. (1999). Pepper (*Capsicum annuum* L.) seed storage studies at different temperatures and in different containers. *Journal of the Nigerian Association of Teachers of Technology*, 3: 137-143.

Passam, H.C., Lambropoulos, E. and Khah, E.M. (1997). Pepper seed longevity following production under high ambient temperature. *Seed Science and Technology*, 25:177-185.

Quagliotti, L., Antonucci, M. and Lanteri, S. (1981). Effect of post-harvest ripening of the seeds within the berry in two varieties of pepper (*Capsicum annuum* L.). *Riv. Ortoflorofrutticoltura It.*, 65(4):249-256.

Roberts, E.H. (1960). Viability of cereal seeds in relation to temperature and moisture. *Annals of Botany*, 24:12-31.

Valdes, V.M. and Gray, D. (1998). The influence of stage of fruit maturation on seed quality in tomato (*Lycopersicon lycopersicum* (L.) Karsten). *Seed Science and Technology*, 26:309-318.