African Journal of Agricultural Research Vol. 3 (10), pp. 732-739, October, 2008
Available online at http://www.academicjournals.org/AJAR
ISSN 1991-637X 

*Full Length Research Paper*

# Effects of light intensity on quality of potato seed tubers

**Esther Gachango[1], Solomon I. Shibairo[1], Jackson N. Kabira[2], George N. Chemining'wa[1] and Paul Demo[3]**

[1]Department of Plant Science and Crop Protection, University of Nairobi, P. O. Box 29053, 00625, Kangemi, Nairobi, Kenya.
[2]Kenya Agricultural Research Institute, National Potato Research Centre, P. O. Box 338, Limuru, Kenya.
[3]International Potato Centre, Sub-Sahara Region, P. O. Box 25171, Nairobi, Kenya.

Accepted 15 September, 2008

**Potato (*Solanum tuberosum* L.) genotypes (Tigoni, Asante and Dutch Robyjn) were evaluated for quality under three light intensities, 612.2 kW (diffused), 1376 kW (direct) and 8 kW (dark) for 12 weeks. Tuber stored in dark conditions had a lower weight loss than tubers stored in direct light conditions. Dutch Robyjn lost the lowest weight (4.49%) while Asante lost the highest (13.90%) mean weight. Tigoni in the dark had the highest number (9.25) of sprouts. Tubers in the dark developed long (46.25mm) etiolated sprouts as opposed to the short (10.50mm) firm sprouts observed in tubers subjected to the diffused light. High sprout vigor score (2.42) was observed in Asante while Dutch Robyjn had the lowest (1.00) score. Nevertheless, all the tubers in the three light intensities had 100% sprouted tubers after the 12 weeks of storage. Potato tuber moth incidence was higher in percentage in the direct and diffused light than in the dark storage. No incidence of rotting was reported for the 12 weeks of storage. It is therefore suggested that farmers should adopt storage of potato seed tubers in diffused light (612.2 – 1000 kW) store to allow formation of short firm sprouts and reduce weight loss.**

**Key words:** Light intensities, diffused light, sprouting, potato seed.

## INTRODUCTION

Since the collapse of certified seed potato multiplication and distribution system by the early 1990's, potato growers in Kenya are faced with lack of good quality seeds (Kabira, 2002). Poor storage conditions have contributed to the low potato seed tuber quality (Walingo et al., 2004). There is therefore need to develop technologies which will enhance maintenance of quality in stored potato seed tubers. Use of diffused light storage (DLS) which is a low cost storage involving storing the potatoes in thin layers on shelves or trays in natural, diffused (indirect) light with good ventilation has been developed by the International Potato Centre and accepted worldwide (CIP, 1997). A study done in Mount Kenya region indicated that 48 % of potato growing farmers were not even aware of the improved DLS for potato seed tubers (Walingo et al., 2001). Potato farmers in Kenya use traditional methods to store their potato seed tubers (Walingo et al., 2004). The most common method is the use of dark rooms which result in excessive sprouting, thus desprouting has to be done prior to planting (Kabira and Lemaga, 2003). Some farmers also use underground pits lined with grass or just leave the seed tubers in the field to allow breakage of dormancy hence sprouting (Walingo et al., 2001). These traditional methods have resulted to loss in seed quality through weight loss, excessive sprouting, and pest and disease attacks. Kabira and Lemaga (2003) estimated weight loss caused by evaporation and spouting to be 90%, ad respiration 10%. DLS can be used up to five or six months without affecting the quality of the seed tubers (Demo et al., 2004). Storage in DSL has been found to delay the physiological ageing of potato seed tubers, reduce apical dominance, resulting in an increased number of stems per tuber, short and firm sprouts. In addition, less storage losses through weight loss, pests and diseases and easier checking occur when potato seed

*Corresponding author. E-mail: gachango@msu.edu.

tubers are under DLS. However, DLS delays sprouting by more than four weeks in most genotypes (Demo et al., 2004). Hence there is need to investigate whether the DLS will affect the sprouting of the newly released potato genotypes in Kenya as well as reduce quality loss. It has been reported that sprout elongation is checked by light to 1 - 2 cm (Horton, 1987). However, the mean number of apical and lateral sprouts is not affected (Mousavizadeh et al., 2004). Light intensity necessary to effect a 50% reduction in sprout length is almost unaffected by temperature. Active wavelength to effect light inhibition of sprout growth is principally in the blue range below 550 nm, with some response to the red light (710 nm). Additionally, it has been shown that inhibition of sprout growth may be effected by conditions of high temperature (33/20ºC day /night) alone (Midmore, 1992). Seed tubers have been successfully stored in diffuse daylight at higher temperature. Low adoption of diffused light storage in Kenya is widespread. To date there are no reports in Kenya on effects of light quality or quantity on potato seed sprouting and storage. Also the effect of light on quality of seed potato genotypes released in the 1990's and old existing genotypes in Kenya has not been reported. Hence the objective of this study was to determine the effect of light intensity on quality and storability of newly released seed potato varieties in Kenya.

## MATERIALS AND METHODS

Potato genotypes (Tigoni, Asante, and Dutch Robyjn) were planted between October 2004 and February 2005 (season 1) and between April and July 2005 (season 2) at the National Potato Research Centre (NPRC)-Tigoni. Tigoni and Asante are newly released varieties while Dutch Robyjn is an old existing variety. All these genotypes have a short dormancy period. The NPRC-Tigoni lies 2100 m above sea level. The mean annual rainfall is 800 mm p.a and evaporation is 185 mm p.a. (Kabira, 2005). Potato tubers were hand planted in furrows at the recommended spacing of 0.75 x 0.30 m in 30 x 30 m plots and then covered with soil. Diammonium phosphate (DAP) fertilizer was applied at the rate of 500 kg /ha. Weeding, ridging, and pest and disease control were done according to recommended practices (MoA, 2003). The crop was dehaulmed two weeks prior to harvesting. The potatoes were hand-harvested at 112 and 106 days after planting, in season 1 and 2 respectively, were placed in nylon woven mesh bags and transported to the store 0.2 km away. The freshly harvested tubers were immediately sorted out and the healthy tubers of 35-45 mm in diameter were selected and cured at room temperature (15 ± 1.35°C) for 2 weeks. The potato tubers of the three genotypes were subjected to three light intensities (diffused - 612.2 kW, direct -1376 kW and dark - 8kW). The 3 x 3 factorial combination of treatments was laid out in randomized complete block design (RCBD) and replicated four times. Thirty tubers per treatment combination were weighed, put in nylon woven mesh bags and subjected to the three light intensities for 12 weeks. The tubers were evaluated after every two weeks for up to 12 weeks for weight loss (%), number of sprouted tubers (%), number of sprouts per tuber, sprout length, sprout vigor, potato tuber moth (PTM) incidence (%), tuber rotting (%) and sprouting capacity as described below.

### Data collection

Weight loss was determined and calculated as a percentage of the original weight. A tuber was considered sprouted when it had at least one visible sprout of at least 3 mm length (Wiersema, 1985). Sprouting was calculated as a percentage of the number of sprouted tubers in the sample. Five tubers per treatment combination were used to determine the average number of sprouts per tuber. Sprout length was determined by measuring the length of the longest sprout of the potato seed tubers to the nearest 1 mm using a string and 15 cm ruler. Sprout vigor score was evaluated based on the thickness of the base of the sprout. The evaluation was based on a 5-point rating scale where 1 = very low vigor (where more than half of the tubers in a sample had sprouts of ≤1 mm thick and a length of ≤3 mm), 2 = low vigor (where more than half of the tubers in a sample had sprouts of ≤2 mm thick and a length of ≤4 mm), 3 = good vigor (where more than half of the tubers in a sample had sprouts of ≤4 mm thick and a length of ≤4 mm), 4 = high vigor (where more than half of the tubers in a sample had sprouts of ≤4 mm thick and a length of ≥ 4 mm but were not firm and had not acquired the green colorations) and 5 =very high vigor (as described for score 4 but had acquired the green coloration, were firm and had no visible defects. Sprouting capacity (%) was determined once, at the termination of the experiment. All tubers from each sample of 30 tubers were de-sprouted and the sprout weight recorded. Sprouting capacity was calculated as weight of sprout as a percentage of the weight of tubers in each sample. The potato tuber samples were evaluated for presence of tuber moth. A tuber was considered infested when the characteristic tunnel of the tuber moth appeared on the surface or when the tuber moth presence was observed on the sprout. Numbers of tubers with tuber moths was recorded and the PTM incidence calculated as a percentage of the total number of tubers in the sample. The presence of dry and soft rots on the potato surface was observed and their incidence calculated as a percentage of the total number of tubers in the sample. Monthly data was reported instead of biweekly data.

### Statistical analysis

Repeated measures analysis was performed on data using Genstat statistical program (Genstat, 1995). Mean differences among treatments were separated by Fisher's Least Significant Difference (LSD) procedure at 5% level of significance (Steel and Torrie, 1987).

## RESULTS

### Mean weight loss (%)

A significant ($P \leqslant 0.05$) interaction between light intensity and storage duration was observed for mean weight loss in both seasons (Table 1). An increased with increase in storage duration was reported with low weight losses recorded after 4 weeks of storage. Tubers in direct light had the highest mean weight loss, followed by those under diffused light. There was no significance difference among varieties in the different light intensities though Dutch Robyjn lost the lowest weight loss (4.49%) after 12 weeks of storage.

### Number of sprouted tubers (%)

The interaction between varieties and storage time was significant ($P \leqslant 0.05$) for mean (%) number of sprouted

**Table 1.** Effects of light intensity on mean percent weight loss of seed potato tubers during 12 weeks of storage**.**

| Light Intensity | Storage duration (weeks) | Varieties | Mean (%) weight loss season 1 | | Mean (%) weight loss season 2 | |
|---|---|---|---|---|---|---|
| Diffused | 4 | Asante | 2.86 | gh | 4.38 | cd |
| | | Dutch Robyjn | 2.40 | gh | 6.94 | bcd |
| | | Tigoni | 2.51 | gh | 2.56 | d |
| | 8 | Asante | 6.01 | bcdefgh | 8.78 | abcd |
| | | Dutch Robyjn | 5.01 | cdefgh | 9.65 | abcd |
| | | Tigoni | 5.67 | bcdefgh | 5.87 | bcd |
| | 12 | Asante | 8.58 | abcd | 11.66 | abc |
| | | Dutch Robyjn | 9.56 | ab | 11.88 | abc |
| | | Tigoni | 9.15 | abc | 7.71 | abcd |
| Dark | 4 | Asante | 4.99 | cdefgh | 4.79 | cd |
| | | Dutch Robyjn | 1.58 | h | 8.36 | abcd |
| | | Tigoni | 3.46 | fgh | 4.61 | cd |
| | 8 | Asante | 7.60 | abcdef | 7.10 | bcd |
| | | Dutch Robyjn | 3.16 | fgh | 12.19 | abc |
| | | Tigoni | 6.22 | bcdefg | 7.87 | abcd |
| | 12 | Asante | 9.89 | ab | 8.08 | abcd |
| | | Dutch Robyjn | 4.49 | defgh | 5.88 | cd |
| | | Tigoni | 8.12 | abcde | 9.97 | abcd |
| Direct | 4 | Asante | 4.88 | cdefgh | 4.47 | cd |
| | | Dutch Robyjn | 3.99 | efgh | 5.82 | bcd |
| | | Tigoni | 5.83 | bcdefgh | 4.34 | cd |
| | 8 | Asante | 7.60 | abcdef | 6.36 | bcd |
| | | Dutch Robyjn | 6.83 | abcdefg | 9.05 | abcd |
| | 12 | Tigoni | 8.24 | abcde | 8.52 | abcd |
| | | Asante | 10.94 | a | 13.90 | a |
| | | Dutch Robyjn | 10.05 | ab | 12.20 | abc |
| | | Tigoni | 10.87 | a | 9.73 | abcd |
| LSD $_{0.05}$ | | | 4.48 | | 8.28 | |

Mean values of weight loss within a column followed by the same letter are not significantly different at p=0.05 (Student's test). Conditions were at 18.73 ± 1.37°C and 77.35 ± 5.64 RH.

tubers in season 1 (Table 2). Dutch Robyjn had the lowest mean (85.83 %) number of sprouted tubers by the 4th week of storage while Asante and Tigoni had over 95% of sprouted tubers.

Dutch Robyjn was the last to attain 100% sprouted tubers and this was on the 12th week of storage. There was nodifference in the percentage number of sprouted tubers in the diffused and direct light at the 4th week of storage.

## Number of sprouts per tuber

There was a significant interaction among variety, light intensity and storage time on number of sprouts per tuber in season 1 (Table 3). There were no differences in the number of sprouts per tuber among light intensities and varieties in the 4th week for all the varieties. Tigoni in dark storage had the highest mean number of sprouts (9.25). The number of sprouts per tuber increased with increase in storage duration.

## Length of the longest sprout (mm)

The interaction among variety, light and storage time was significant for mean length of the longest sprout in both seasons (Table 4).Tubers stored in the dark had significantly longer sprout lengths than those stored DLS and direct light. There was no difference in sprout length for tubers in DLS and direct light storage condition. Asante had the longest mean sprout length (46.25 and 57 mm) while Dutch Robyjn had the lowest (10.50 and 14.00 mm) in season 1 and 2 respectively.

**Table 2.** Effects of light intensity on percent mean number of sprouted seed tubers stored for 12 weeks.

| Varieties | Storage duration (weeks) | Light Intensity | Mean (%) sprouted tubers season 1 | | Mean (%) sprouted tubers season 2 | |
|---|---|---|---|---|---|---|
| | | Direct | 100 | a | 80 | a |
| | | Dark | 98.33 | ab | 79.17 | a |
| | 4 | Diffused | 96.67 | abc | 84.17 | a |
| | | Direct | 100 | a | 98.33 | a |
| | | Dark | 100 | a | 98.33 | a |
| | 8 | Diffused | 100 | a | 100 | a |
| | | Direct | 100 | a | 100 | a |
| | | Dark | 100 | a | 100 | a |
| Asante | 12 | Diffused | 100 | a | 100 | a |
| | | Direct | 93.33 | cd | 98.33 | a |
| | | Dark | 90 | d | 88.75 | a |
| | 4 | Diffused | 85.83 | e | 84.58 | a |
| | | Direct | 95.83 | bbc | 98.33 | a |
| | | Dark | 100 | a | 100 | a |
| | 8 | Diffused | 94.63 | bbc | 96.45 | a |
| | | Direct | 100 | a | 100 | a |
| | | Dark | 100 | a | 100 | a |
| Dutch Robyjn | 12 | Diffused | 100 | a | 100 | a |
| | | Direct | 96.67 | abc | 85.83 | a |
| | | Dark | 100 | a | 86.06 | a |
| | 4 | Diffused | 94.17 | c | 80.83 | a |
| | | Direct | 100 | a | 93.33 | a |
| | | Dark | 100 | a | 100 | a |
| | 8 | Diffused | 100 | a | 100 | a |
| | | Direct | 100 | a | 100 | a |
| | | Dark | 100 | a | 100 | a |
| Tigoni | 12 | Diffused | 95.83 | bc | 100 | a |
| LSD 0.05 | | | 3.97 | | 21.97 | |

Mean values of weight loss within a column followed by the same letter are not significantly different at p = 0.05 (Student's test). Conditions were at 18.73 ± 1.37℃ and 77.35 ± 5.64 RH.

**Sprout vigor**

There was a significant (P⩽0.05) interaction between variety and storage time in sprout vigor in both seasons. (Table 5). Sprout vigor increased with increase in storage time in Tigoni and Asante. In Dutch Robyjn, sprout vigor remained at 1 (very low vigor).

**Sprouting capacity (%)**

There was a significant (P⩽0.05) interaction between variety and light intensity in season 1 (Table 6). Tubers stored in the dark had the highest sprouting capacity while those from DLS had the lowest. There was no difference in sprouting capacity for tubers stored in the DLS and direct light among varieties in both season. Asante in the dark had the highest (1.08%) mean sprouting capacity in season 1. Dutch Robyjn had the lowest mean sprouting capacity of 0.22 and 0.20 in season 1 and 2 respectively. Higher sprouting capacity was recorded in season 2 than in season 1 for all the varieties.

**Potato tuber moth (PTM) incidence (%)**

A significant interactions (P⩽0.05) between varieties and light on PTM incidence were observed in season 1 (Table 6). High mean PTM incidences (35.83 and 25.28%) were reported in Dutch Robyjn in direct light and Asante in diffused light respectively. Low incidence (%) was reported in tubers stored in dark condition.

**Table 3.** Effects of light intensity on mean number of sprouts per seed potato tuber during 12 weeks of storage

| Light intensity | Variety | Storage duration (weeks) | Mean number of sprout season 1 | | Mean number of sprout season 2 | |
|---|---|---|---|---|---|---|
| Diffused | Asante | 4 | 2.5 | hi[w] | 1.75 | g |
| | | 8 | 5.35 | bcde | 3.60 | abcdef |
| | | 12 | 6.1 | bcd | 5.10 | a |
| | Dutch Robyjn | 4 | 1.55 | ij | 1.45 | g |
| | | 8 | 2.55 | hi | 3.75 | abcde |
| | | 12 | 4.35 | ef | 4.80 | abcdef |
| | Tigoni | 4 | 0.95 | j | 1.60 | g |
| | | 8 | 1.8 | hij | 3.65 | abcde |
| | | 12 | 2.45 | hi | 4.75 | ab |
| Dark | Asante | 4 | 2.65 | hi | 1.75 | g |
| | | 8 | 6.05 | bcd | 3.65 | abcde |
| | | 12 | 6.6 | b | 4.80 | ab |
| | Dutch Robyjn | 4 | 1.65 | hij | 2.10 | cdefg |
| | | 8 | 4.65 | de | 3.85 | abcd |
| | | 12 | 5.55 | bcde | 5.15 | a |
| | Tigoni | 4 | 1.35 | ij | 2.05 | defg |
| | | 8 | 3.1 | fgh | 3.65 | abcde |
| | | 12 | 9.25 | a | 4.65 | ab |
| Direct | Asante | 4 | 2.25 | hij | 1.80 | fg |
| | | 8 | 5 | cde | 3.25 | bcdefg |
| | | 12 | 6.15 | bc | 4.45 | ab |
| | Dutch Robyjn | 4 | 2 | hij | 1.85 | efg |
| | | 8 | 4.15 | efg | 3.60 | abcdef |
| | | 12 | 5.15 | bcde | 5.40 | a |
| | Tigoni | 4 | 0.9 | j | 2.25 | cdefg |
| | | 8 | 2.05 | hij | 3.90 | abc |
| | | 12 | 2.8 | ghi | 4.55 | ab |
| $LSD_{0.05}$ | | | 1.48 | | 1.80 | |

Mean number f sprouts within a column followed by the same letter are not significantly different at p=0.05 (Student's test). Conditions were at 18.73± 1.37°C and 77.35±5.64 RH.

## DISCUSSION

Use of diffused light storage to reduce sprouting and weight loss of potato seed tubers, thus maintaining quality has been proposed (CIP, 1997). In the present study storage of tubers in DLS reduced the mean weight loss compared to the tubers exposed to direct light. This could be due to lowered rate of evaporation caused by indirect light in DLS, thus in agreement with the finding of CIP (1997), that DLS reduced potato seed tubers weight loss. Low weight losses in dark storage condition confirmed the findings of Walingo et al. (1995) that potato tubers stored under a dark plastic cover lost low weights. This could be attributed to low respiration and evaporative rates in the dark storage due to lack of light which increases heat energy. Furthermore, weight loss of stored potato tubers is mainly through evaporation and sprouting (90%) and respiration (10%) (Walingo et al., 2004). Genotype difference in weight loss was attributed to the skin surface and the dry matter content of the tubers. Asante and Tigoni lost more weight compared to Dutch Robyjn. Both have smooth light skin and low dry matter, while Dutch Robyjn is rough skinned and has high dry matter content (Kabira and Lemaga, 2003). Dormancy termination hence sprouting occurred at the end of the 2nd week of storage for all the genotypes though the percentage differed significantly thus in agreement with the findings of Jo Frazier et al. (2004) that the length of dormancy differs by cultivars and storage conditions. High percentage tuber sprouting was recorded in the dark storage within the first 2 weeks (data not shown).This could be due to lack of light penetration hence no inhibition of internodes which is caused by presence of light (Benici, 1991). There was no significant difference in number of sprouted tubers for DLS and direct light storage after 2 weeks of storage indicating that light qua-

**Table 4.** Effects of light intensity on length of the longest sprout of seed potato tubers during 12 weeks of storage

| Light intensity | Varieties | Storage duration (weeks) | Mean sprout length in millimeters in season 1 | | Mean sprout length in millimeters in season 2 | |
|---|---|---|---|---|---|---|
| Diffused | Asante | 4 | 4.00 | ijkl[w] | 9.50 | b |
| | | 8 | 6.50 | ghilkl | 19.25 | b |
| | | 12 | 12.25 | efg | 26.25 | b |
| | Dutch Robyjn | 4 | 1.00 | l | 6.75 | b |
| | | 8 | 3.00 | jkl | 11.75 | b |
| | | 12 | 10.50 | efghi | 19.00 | b |
| | Tigoni | 4 | 4.75 | hijkl | 6.25 | b |
| | | 8 | 9.00 | efghij | 12.50 | b |
| | | 12 | 11.25 | efgh | 28.75 | ab |
| Dark | Asante | 4 | 10.00 | efghi | 10.00 | b |
| | | 8 | 20.75 | cd | 16.75 | b |
| | | 12 | 46.25 | a | 33.00 | ab |
| | Dutch Robyjn | 4 | 6.00 | ghilkl | 5.75 | b |
| | | 8 | 12.75 | efg | 12.75 | b |
| | | 12 | 31.75 | b | 14.00 | b |
| | Tigoni | 4 | 6.75 | ghilkl | 6.25 | b |
| | | 8 | 15.50 | de | 12.75 | b |
| | | 12 | 6.00 | ghilkl | 25.50 | b |
| Direct | Asante | 4 | 4.25 | ijkl | 8.75 | b |
| | | 8 | 8.00 | fghijk | 24.75 | b |
| | | 12 | 14.00 | def | 57.00 | a |
| | Dutch Robyjn | 4 | 1.50 | kl | 6.25 | b |
| | | 8 | 3.75 | ijkl | 12.75 | b |
| | | 12 | 12.75 | efg | 17.00 | b |
| | Tigoni | 4 | 4.50 | hijkl | 6.00 | b |
| | | 8 | 10.25 | efghi | 13.75 | b |
| | | 12 | 24.75 | c | 24.75 | b |
| $LSD_{0.05}$ | | | 6.92 | | 28.70 | |

Mean number f sprouts within a column followed by the same letter are not significantly different at p=0.05 (Student's test). Conditions were at 18.73± 1.37°C and 77.35±5.64 RH.

lity did not affect the time it took the tubers to sprout. Genotype differences in the number of sprouted tubers indicated that Dutch Robyjn had a high storability character as compared to Asante and Tigoni since it took more than 8 weeks to get all the tubers sprouted in DLS. These findings agree with Rhoades (1986) that DLS delays the physiological ageing processof potato seed tubers which is known to increase from the onset of sprouting by restricting tuber sprouting. DLS and direct light storage affected the number of sprouts per tuber. Fewer and short sprouts developed compared to the tubers in dark condition. This could be due to lack of growth substances in sprouts of tubers stored under DLS. According to Smith (1968), proline which is the only amino acid that moves freely from the tuber to the sprout tends to accumulate in sprouts grown in the dark but disappears when they are exposed to light. Etiolation of sprouts produced by tubers under dark storage suggests that proline is the limiting factor for tubers stored in the light. These observations concur with those of Crissman et al. (1993) who reported that light has an inhibition effect on elongation of sprout internodes. Difference among genotypes in response to light was evident for sprout length. Asante in the dark storage had significantly higher sprout length. Dutch Robyjn had the shortest sprouts. Tuber in the DLS had the least sprout vigor compared to those in the dark storage. This could have been due to the inhibitory effect of light on sprout growth thus restricting their expansion. This concurs with work done by Rehman et al. (2001) who found that tubers stored in the DLS obtained sprouts which were lean. Though the vigor was low in the DLS, the sprouts were short, firm and green in colour compared to the long etiolated sprouts from the dark store. Only Tigoni had

**Table 5.** Effects of light intensity on sprout vigor of seed potato tubers during 12 weeks of storage

| Variety | weeks | Mean vigor season 1 | | Mean sprout vigor season 2 | |
|---|---|---|---|---|---|
| Asante | 4 | 1.25 | c[w] | 1.42 | abc |
| | 8 | 2.17 | ab | 1.50 | abc |
| | 12 | 2.42 | a | 1.83 | a |
| Dutch Robyjn | 4 | 1.00 | c | 1.25 | bc |
| | 8 | 1.00 | c | 1.58 | abc |
| | 12 | 1.08 | c | 1.75 | ab |
| Tigoni | 4 | 1.00 | c | 1.17 | c |
| | 8 | 1.92 | b | 1.33 | abc |
| | 12 | 2.08 | b | 1.75 | ab |
| $LSD_{0.05}$ | | 0.26 | | 0.55 | |

w Mean sprouts vigor within a column followed by the same letter are not significantly different at p=0.05 (Student's test). Conditions were at 18.73± 1.37°C and 77.35±5.64 RH

**Table 6.** Effects of light intensity on mean % sprouting capacity and mean potato tuber moth (PTM) incidence (%) of seed potato tubers during 12 weeks of storage.

| Light intensity | Variety | Mean(% PTM season 1) | | Mean(%PTM season 2) | | Mean % sprouting capacity season 1 | | Mean % sprouting capacity season 2 | |
|---|---|---|---|---|---|---|---|---|---|
| Diffused | Asante | 25.28 | b | 20.42 | a | 0.31 | b | 0.29 | a |
| | Dutch Robyjn | 17.78 | bc | 22.50 | a | 0.22 | b | 0.20 | a |
| | Tigoni | 13.61 | c | 12.50 | a | 0.28 | b | 0.47 | a |
| Dark | Asante | 1.67 | d | 12.22 | a | 1.08 | a | 0.86 | a |
| | Dutch Robyjn | 2.22 | d | 22.92 | a | 0.71 | b | 0.67 | a |
| | Tigoni | 3.06 | d | 7.92 | a | 0.58 | b | 0.55 | a |
| Direct | Asante | 16.67 | bc | 21.25 | a | 0.44 | b | 0.48 | a |
| | Dutch Robyjn | 35.83 | a | 11.67 | a | 0.35 | b | 0.64 | a |
| | Tigoni | 13.89 | c | 12.98 | a | 0.40 | b | 0.50 | a |
| $LSD_{0.05}$ | | 9.13 | | 18.11 | | 0.80 | | 0.90 | |

w Mean PTM incidence (%) within a column followed by the same letter are not significantly different at p=0.05 (Student's test). Conditions were at 18.73± 1.37°C and 77.35±5.64 RH.

sprouts with high vigor in the DLS indicating genotype differences in sprout vigor. The sprouting capacity of the potato varieties was found to be higher in the dark storage that Asante gave the highest sprouting capacity while Dutch Robyjn gave the lowest. This indicated that different varieties respond differently to storage conditions. Similar findings were reported by Njuguna (1997) who found that 'Nyayo' gave higher sprouting capacity values than 'Roslin Eburu' (B53) during 12 weeks of storage.

Potato tuber moth (PTM) incidence was higher in tubers exposed to direct light and those placed in diffused light store in comparison with those stored in the dark. This findings do not agree with the report of CIP (1997) that potatoes stored in the DLS were generally about 70% less infected than those stored in the dark. Illumination was seen to result to in greening of the tubers (with glycoalkaloids formation) thus making them unfavourable for the moths. However, high temperatures in DLS and direct light store (16 - 23 ºC) brought by light may have enhanced the survival of tuber moths in these stores unlike in the dark storage where the temperatures were lower (11 - 14ºC) due to wooden ceiling which does not allow any light to penetrate. . Nevertheless, Tigoni, which is well known for its greening characteristic when exposed to light, recorded low PTM incidence than Asante and Dutch Robyjn. Tubers in season 2 registered high PTM incidences than in season 1. This was attributed to high temperatures (18 - 25ºC) in season 2 thus allowing for the survival of the moths in the field which ended up in the stores (CIP, 1997) .No tuber rotting was reported in both seasons after the 12 weeks of storage. This was attributed to lack of predisposing characteristics on the tubers, like wounds on the tuber surface and probably by lack of inoculum like the Pectobacterium carotovorum in the soils. Also the storage conditions were dry thus not conducive for any disease development. Diffused light store emerged as the best method for seed potato storage due to low sprouting capacity, short and green sprouts thus there would be no need to de-sprout during planting. Farmers should be advised not to store their seeds in direct light to avoid weight loss of the tubers. Farmers may also use pesticides in DLS to prevent PTM infestation and thus maintain high quality potato seed tubers.

## ACKNOWLEGMENTS

The author wishes to thank the National Potato Research Centre (NPRC) –for provision of potato seeds tuber genotypes and the facilities for the experiments.

### REFERENCES

Benici MC (1991). Potato (solanum tuberosum). In: Postharvest and processing technologies of African stable foods: a technical compedium. Edited by J.P. Walston. pp. 215-220.

CIP (International Potato center), Annual Report, 1997. pp:239-64.

Crissman CC, Mc Arthur Crissmass, Carli C (1993). Seed potato systems in Kenya. A case study. Lima, International Potato Center, p. 44.

Demo P, Akoroda MO, El-Bedewy R, Asiedu R (2004). Monitoring storage losses of seed potato (Solanum tuberosum L.) tubers of different sizes under diffuse light conditions. Proceedings, 6th triennial congress of the African Potato Association (APA). 5-10 April 2004. Agadir, Morocco, pp: 363-370.

Genstat (1995). Genstat statistical software. Lawes Agricultural trust, Rothamsted Experimental Station.

Horton D (1987). The potato production, marketing and programmes for developing countries, IT Publication, pp: 6-51.

Horton D, Sawyer (1985). The potato as a world food crop, with special reference to developing areas. In: LIPH (Editor). Potato physiology. Academic press, New York, pp: 1-34.

Kabira JN (2005). National Potato Research Centre- Tigoni-Information Bulletin.

Kabira JN, Lemaga B (2003). Potato processing quality evaluation procedures for research and food industry applications in East and Central Africa. Green printers stationers. p. 24.

Mary Jo Frazier, Nora O, Kleinkopf G (2004). Organic and alternative methods for potato sprout control in storage. Information bulletin.

Midmore DJ (1992). Potato production in the tropics. In: Potato crop, 2nd Edition, Chapman and Hall, London. pp: 734-36.

M.o.A (Ministry of Agriculture) (2003). Horticultural division annual report, pp: 36-7.

Mousavizadeh SA, Khorshidi MB, Kanani R (2004). The effect of pre-planting temperature and light treatments of seed tuber potato yield and tuber size distribution. The joint agriculture and natural resources symposium, Tabriz-Ganja, May 14-16, 2004.

Njuguna JK (1997). Effect of seed tuber storage condition and dormancy breaking treatments on growth and grade of ware potatoes. MSc Thesis, University of Nairobi, Kenya.

Rehman F, Koo Lee S, Soon Kim H, Jeon JH, Ji-young P, Joung H 2001. Dormancy breaking and effects on tuber yield of potato subjected to various chemicals and growth regulators under greenhouse conditions. J. Biological Sciences 1: 818-820.

Rhoades RE (1986). Changing a post harvest system: Impact of diffused light stores in Sri-lanka. Agric. syst.19: 1-19.

Smith Ora (1968). Dormancy, In: Potatoes production, storing, processing.WestPort Connecticut, The AVI publishing company, INC: pp.22-50.

Walingo A, Lung'aho C, Ng'ang'a N, Kinyae PM, Kabira JN (2004). Potato marketing, storage, processing and utilization in Kenya. Sixth triennial congress of the African Potato Association. Proceeding African Potato Association Congress, Agadir Morocco 5-10 April 2004, Eds Hanafi, A.

Walingo A, Kabira JN, Kidanemariam HM, Ewell PT (1995). Evaluating potato clones under seed and ware storage conditions at Tigoni-Kenya, Proceedings of the Triennial Symposium, International Society for Root Crops (ISTRc )-AB Lilongwe, Malawi pp. 515-79.

Walingo A, Lung`aho C, Kinyae P, Kabira JN, Ranozy ElBedewyi (2001). Studies on potato seed performance under on-farm storage conditions In Mount Kenya Region. Proceedings, 8th International Society for Root Crops (ISTRc )-AB Symposium. Ibadan, Nigeria, pp. 235-39.

Wiersema SG (1985). Physiological development of potato seed tubers. Technical information bulletin 20. International potato centre, Lima, Peru, p.16.