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RESEARCH PAPER

Shelf- life study of dried *seethani* grains

JYOTI SEMWAL AND S. HEMALATHA

Department of Food Science and Nutrition, College of Community Science
University of Agricultural Sciences, Dharwad - 580 005, Karnataka, India
E-mail: jyotisemwaldoon@gmail.com

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Abstract: SMJ-1 sorghum (*Sorghum bicolor* L. Moench) dried *seethani*, grains roasted at milky stage, is mainly consumed immediately after roasting and not utilized much for for further value addition. In order to explore the possibility of utilizing the grains for various purposes the present study was undertaken to study the shelf-life of grains at three different conditions *viz.* refrigerated (8 ± 3 °C, 50 ± 2% RH), ambient (28 ± 5 °C, 50 ± 5 Sorghum (*Sorghum bicolor* L. Moench) % RH), and accelerated storage conditions (45 °C, 60 ± 2 % RH) for one month. Thirty grams of dried seethani grains were packed in HDPE pouches and stored in each of the conditions. Moisture content and changes in organolpetic profile of *seethani* grains after boiling was evaluated on the scale of 9 at regular intervals. The results revealed that the grains stored under refrigerated and ambient conditions showed no changes in moisture level during the storage period of one month. The sample stored under accelerated conditions *i.e.,* higher temperature and higher relative humidity, showed an increase in moisture level of the grains from 4.26 to 5.87 per cent within twenty days of storage period. In spite of increase in moisture content at higher temperature and relative humidity, no visual infestation and microbial growth was seen during the period of study. The organolpetic scores including appearance, color, flavor, texture, taste and overall acceptability of seethani grains stored under ambient and refrigerated condition for one month was within the range of 7 to 8 *i.e.* like moderately to like very much and did not vary significant during storage study. Therefore, study can be concluded that the *seethani* grains can be stored for longer time without any changes in sensory characteristics and also without any visual infestation.

Keywords: Accelerated condition, Ambient condition, Organoleptic, Sorghum

Introduction

Sorghum (*Sorghum bicolor* L. Moench) is a dryland crop grown in the region of African and Asian countries. It is classified as coarse grain cereal, perhaps because of its hard grain texture. It is an important crop for food, fodder and has great potential for industrial use as bio ethanol for fuel in the semi-arid tropics of the world due to low input cultivation, under harsh weather. It is also known as the great millet which has 5th rank in global production in cereals and is 4th after rice, wheat and maize in India (Anon., 2008). In India, it is cultivated in about 8 million hectares annually, predominantly in the states of Maharashtra, Karnataka, Andhra Pradesh, Gujarat, Rajasthan and Madhya Pradesh. According to the Ministry of Agriculture and Farmers Welfare, Govt. of India, sorghum production of India during the year 2013- 2014 was 5.54 million tons largely contributed by Maharashtra *i.e.,* 2.27 million tons followed by Karnataka *i.e.,* 1.317 million tons (Anon., 2013).

Now-a-days, immature cereal grains are getting popularity over mature grains due to their unique flavor, soft texture and sweetish taste. Globally consumed immature grain is baby corn. Similarly, immature wheat *i.e.,* known as freekeh in Mediterranean countries is also consumed. In India, sorghum is harvested and consumed at the milky stage in parts of North Karnataka and South Maharashtra and is known by different regional names *viz*., seethani in Karnataka and hurda in Maharashtra. *Seethani i*s mainly prepared in rabi season. For the preparation of *seethani,* panicles were harvested at the milky stage which led to the incomplete accumulation of starch in endosperm and hampers the chemical changes that were going to take place during maturity process and hence it affects its storagebility. Therefore, it is difficult to store *seethani i*n fresh form for longer time. And it has to be consumed only in fresh form. Therefore, for the availability of *seethani* round the year and to exploit the benefits and unique qualities of *seethani,* there is a need of value addition to *seethani* which can be done to dried *seethani* in a better way. So, the objective of the investigation was taken as the shelf-life study of the dried *seethani* grains under different conditions.

Material and methods

SMJ-1, *seethani* specific variety was procured from the Krishi Vigyan Kendra,Vijayapur and was studied for shelf- life at the University of Agricultural Sciences, Dharwad in the year of 2017. It was processed traditionally preparing a fire trench out of cow dung and woods. The milky stage panicles were roasted and rubbed with hands to separate grains while still hot. The grains were sun dried to the moisture level of 4 $\pm$ 2 per cent and were double packed in HDPE pouches. Each packet containing 30 g of sample were kept under three different conditions *viz.,* refrigerated (8 ± 3 °C, 50 ± 2% RH), ambient (28 ± 5 °C, 50 ± 5 % RH), and accelerated storage conditions (45 °C, 60 ± 2 % RH).

The effect of storage on *seethani* grains was determined at the regular interval of 5 days by recording increase in moisture level, changes in sensory characteristics and visual observation for infestation. Moisture content was determined by oven drying method (Anon., 2005) and organoleptic evaluation was done by using 9 point hedonic scale (Amerine and Pangborn, 1965).

Results and discussion

The *seethani* of SMJ-1 were kept under three different condition i.e. refrigerated (8 ± 3 °C; 50±2% RH), ambient (28 ± 5 °C; 50 ± 5% RH) and accelerated storage conditions (45 ± 5°C, 60 ± 2 % RH) in HDPE pouches and were analyzed for moisture uptake, visual infestation and sensory changes.

Results indicated that there was no change in moisture content of *seethani* grains under refrigerated and ambient conditions (Fig. 1 and 2). This can be attributed to packaging of the grains in HDPE pouches which might have restricted the flow of moisture inside the packages and resulted in maintaining the same moisture content as before during the whole period of storage study of one month. Similar result was found in the study of Dejene, *et al.,* (2004). The authors suggested that the grains maintained constant moisture level at lower temperature.

The only increase in moisture content was observed in the samples stores under accelerated storage conditions (45 ± 5 °C, 60 ± 2 % RH) from 4.26 to 5.87 per cent within 20 days as shown in Fig. 3. Initially the rate of moisture uptake was observed to be high but after 15 days it decreased. This might have happened because of the pericarp hardening of the grain due to its longer exposure to high temperature. The change in moisture content can be attributed to the existence of relative humidity gradient with the temperature (Bala, 2016). Strelec *et al.* (2010) reported that as the storage temperature decreased the reduction in moisture content of grains decreased and a very little change of 0.9 % was noted at 4 °c and the remained constant till the end of the storage study.

Sensory evaluation of the stored grains in both ambient and refrigerated conditions when cooked indicated no changes in the sensory parameters (Table 1 and 2).

Samples with same superscript in the same column are not significantly different @ 0.05 level

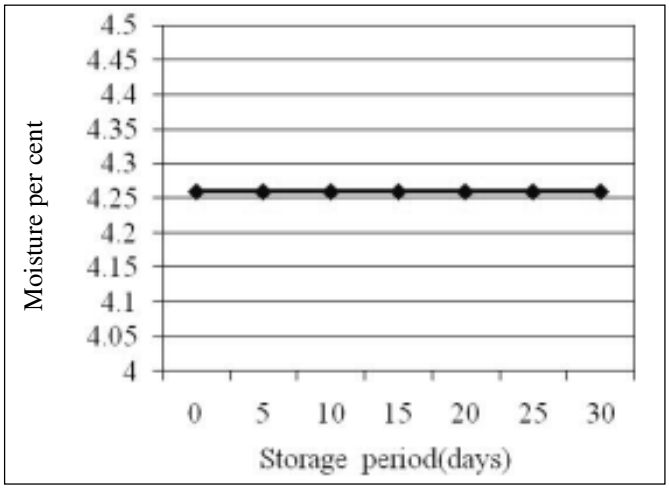

Fig.1. Moisture content of *seethani* grains during storage under refrigerated (8 ± 5 °C RH 50 ± 2 %) condition

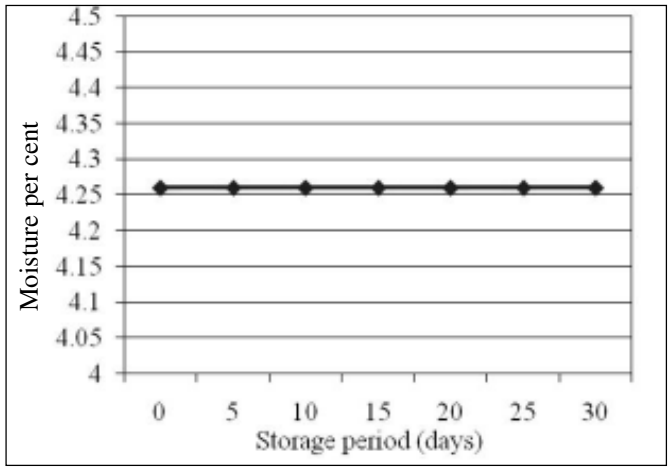

Fig.2. Moisture content of *seethani* grains during storage under ambient (28 ± 5 °C RH 50 ± 5%) condition

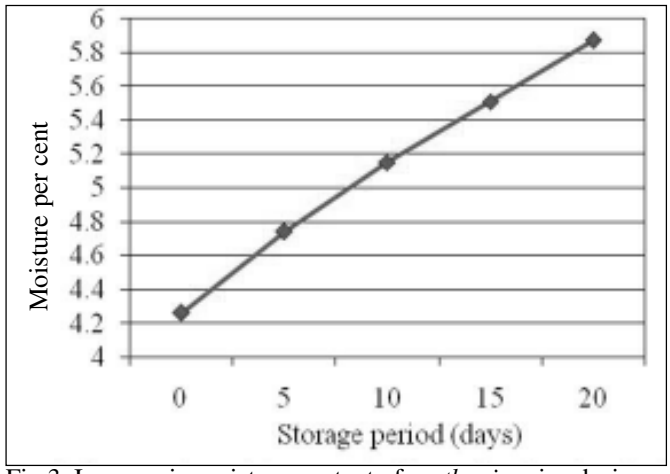

Fig.3. Increase in moisture content of *seethani* grains during storage under accelerated storage conditions (45 ± 5 °C, 60 ± 2 % RH)

Table 1. Sensory score for the stored *seethani* under ambient (28 ± 5 °C, RH 50 ± 5 %) condition for 30 days

Days	Appearance	Color	Flavor	Texture	Taste	Overall acceptability
0	7.83 ± 0.33	7.83 ± 0.13	7.16 ± 0.36	7.66 ± 0.67	7.83 ± 0.58	7.83 ± 0.33
5	8.14 ± 0.41	7.85 ± 0.71	8.14 ± 0.54	7.42 ± 0.13	8.28 ± 0.55	8 ± 0.85
10	8.00 ± 0.10	7.85 ± 0.73	7.42 ± 0.48	7.85 ± 0.92	8.00 ± 0.13	8 ± 0.76
15	7.85 ± 0.17	7.71 ± 0.85	7.71 ± 0.40	7.57 ± 0.71	8.00 ± 0.97	7.57 ± 0.57
20	7.85 ± 0.86	7.85 ± 0.42	7.28 ± 0.74	7.71 ± 0.76	7.85 ± 0.86	7.71 ± 0.48
25	7.85 ± 0.14	7.57 ± 0.58	7.85 ± 0.38	7.28 ± 0.49	7.85 ± 0.74	7.57 ± 0.71
30	8.14 ± 0.28	7.85 ± 0.14	7.42 ± 0.68	8.14 ± 0.87	7.28 ± 0.88	7.85 ± 0.87
C.D. @ 5 %	1.51	1.52	1.86	2.86	1.92	1.79
S.Em±	0.53	0.53	0.65	0.75	0.67	0.63

*Significant at 0.05 level

Table 2. Sensory score for the stored *seethani* under refrigerated (8 ± 3 ^{0}C, RH 50 ± 2 %) conditions for 30 days

Days	Appearance	Color	Flavor	Texture	Taste	Overall acceptability
0	7.83 ± 0.42	7.83 ± 0.95	7.76 ± 0.68	7.66 ± 0.56	7.83 ± 0.75	7.83 ± 0.99
5	7.81 ± 0.84	7.85 ± 0.34	7.74 ± 0.38	7.42 ± 0.26	7.82 ±0.42	7.88 ± 0.65
10	7.80 ± 0.45	7.85 ± 0.87	7.42 ± 0.94	7.85 ±0.78	7.80 ±0.67	7.70 ±0.82
15	7.85 ± 0.61	7.71 ± 0.55	7.41 ± 0.69	7.57 ± 0.88	7.80 ± 0.59	7.57 ± 0.95
20	7.85 ± 0.49	7.75 ±0.26	7.28 ± 0.86	7.71 ±0.61	7.85 ± 0.83	7.71 ± 0.48
25	7.85 ± 0.86	7.57 ± 0.75	7.15 ±0.58	7.28 ±0.39	7.85 ± 0.73	7.57 ± 0.28
30	7.71 ± 0.26	7.85 ± 0.79	7.32 ±0.50	7.14 ±0.53	7.28 ±0.57	7.85 ±0.47
C.D. @ 5 %	2.14	2.15	2.63	3.06	2.72	2.54
S.Em±	0.75	0.75	0.92	1.07	0.95	0.87

* Significant at 0.05 level

No significant changes were found in the organoleptic scores during period of storage. The reason might be the temperature and relative humidity subjected to the samples. The storage condition might have played the key role in keeping the sample in stable condition with no chemical changes (Table 2&3).

Regarding visual observation for infestation of stored grains, the moisture content of grain did not reach sufficient levels required for the growth of any microorganisms in the grains. For the growth of *Aspergillus* about 14 per cent moisture is required in the grains (Bullerman, B. L. and Bianchini, A., 2011). Therefore, the stability of grains could be assured at the tested temperature range.

Conclusion

The storage study of the *seethani* grain under refrigerated (8 ± 3 °C, 50 ± 2% RH), ambient (28 ± 5°C, 50 ± 5 % RH), and accelerated storage conditions (45 °C, 60 ± 2 % RH) revealed that the grains can be stored for more than two months without any changes in the organoleptic profile or any visual infestation. There was no change in the moisture level in the grains stored in the refrigerated and ambient conditions. The only increase in moisture content was observed in the samples stores under accelerated storage conditions (45 ± 5 °C, 60 ± 2 % RH) from 4.26 to 5.87 per cent. The final moisture content of grains kept under accelerated condition (5.87 %) was not sufficient for the growth of any microorganism. The sensory scores for the *seethani* grains stored under ambient (28 ± 5°C; 50 ± 5 % RH) and refrigerated conditions (8 ± 3 °C; 50 ± 2 % RH) showed no significant difference. The grains were found to be in good condition for consumption.

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