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Effect of various storage containers and duration on biochemical constituents of sesame (*Sesamum indicum* L.)

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Abstract

The effect of storage on biochemical constituents *viz.* moisture, protein, total sugars and free amino acids of sesame seed samples procured from different sources in India was studied at an interval of two months for the period of six months, which were stored in different storage containers *viz.* gunny bag, polythene bag and metallic bin. The study indicated that moisture content increased significantly in different storage containers with an increase in storage period. Protein content showed significant decrease in different storage containers, however, its value changed non-significantly with increase in storage duration. Total sugars content decreased significantly in different storage containers with increase in storage period, whereas total free amino acid content changed non-significantly with increase in storage period. Among different storage containers, metallic bins accompanied by polythene bags were found to be superior packaging material for storage as they showed relatively least alteration in the biochemical constituents of the sesame seeds stored at room temperature.

Key words: Storage duration, storage containers, moisture, biochemical constituents.

Introduction

Sesame (*Sesamum indicum* L.) commonly known as *til* or *tilli* is an important oilseed crop cultivated in the world since ancient times. India is one of the leading sesame producing countries in the world ranking third after USA and China (Bedigian and Harlan, 1986). It forms a rich source of oil (about 50%), protein (about 25%) and other dietary constituents of nutraceutical significance. Significant variations in biochemical constituents of sesame genotypes grown under different agroclimatic conditions have also been reported elsewhere (Kaya and Savran, 1996; Awasthi *et al.*, 2006 and Torkamani *et al.*, 2007).

In India, farmers /consumers under household conditions follow the practice of storing various food grains including sesame seeds mainly in metallic bins, polythene bags, gunny bags, claypots etc. Studies conducted earlier on storage duration revealed significant alterations / decline in the biochemical constituents in cereal grains and pulses *viz.* maize, bajra, sorghum, green gram etc. (Nagarajan and Karivaratharaju, 1976; Kammar and Naik, 1987). However, apparantly systematic information on the effect of storage duration in different storage containers on oilseeds in general and sesame seeds in particular on quality attributes is still limited. As such the present study was undertaken to evaluate the extent of alterations in biochemical constituents of sesame seeds during storage in various storage containers.

Material and Methods

Seed samples of a promising sesame genotype PKDS-76-A procured from PC Unit, All India Coordinated Research Project on Sesame and Niger centre at JNKVV, ZARS, Powarkheda (M.P.) and two market samples procured from Joginder Nagar and Palampur (H.P.) denoted as MS 1 and MS 2, respectively were stored in triplicate at room temperature for six months from May to October, 2008 in different storage containers *viz.* gunny bags, polythene bags and metallic bins and were analysed for biochemical parameters at an interval of two months. After expiry of pre-fixed period of storage, these sesame seed samples were dried in hot air oven and defatted for further biochemical evaluation by adopting standard procedures. Moisture was determined by the method of AOAC (1970). Total soluble protein was estimated by the method given by Bradford (1976). Total sugars were analysed by following the method of Dubois *et al.* (1956), whereas total free amino acids were estimated by the method of Jayraman (1981). The data were analyzed statistically by using analysis of variance as given by Panse and Sukhatme (1984).

Results and Discussion

The data showing effect of storage on moisture content of sesame genotype / market samples stored at room temperature are presented in Table 1. After six months of storage at room temperature a significant increase in seed moisture content was observed in the sesame seeds stored in

gunny bags followed by seeds stored in polythene bags and metallic bins. Initially (at zero period of storage) moisture content in MS 1 was 4.95 per cent, which increased to 6.57, 5.20 and 4.98 per cent in gunny bag, polythene bag and metallic container, accordingly after six months of storage. In MS 2 the value for moisture content was recorded to be 4.84 per cent initially, which increased to 6.52, 4.92 and 4.86 per cent in gunny bag, polythene bag and metallic container, respectively after six months. Similarly in the genotype, PKDS-76-A moisture content increased from 5.17 to 6.81, 5.21 and 5.19 per cent in gunny bag, polythene bag and metallic container, accordingly after six months of storage. In the study conducted by Nagarajan and Karivaratharaju (1976) on this aspect in cereal grains indicated an increase in moisture content of sorghum, bajra and maize grains with the advancement of the storage period. Gupta *et al.* (1984) also found that the moisture content increased from 12.0 per cent to 13.0 per cent after six months of storage in black gram kept in glass jars. Kammar and Naik (1987) reported an increase in moisture content of green gram during storage upto six months. The findings of the present investigation on this aspect are in accordance with the observations of above researchers in food grains.

Table 1. Effect of storage on moisture content (%) of sesame seed samples stored at room temperature

Genotype / Market samples (MS)	Storage containers	Storage time (months)			
		0	2	4	6
MS1	Gunny bag	4.95	5.75	6.23	6.57
	Polythene bag	4.95	4.98	5.00	5.20
	Metallic bin	4.95	4.95	4.97	4.98
MS2	Gunny bag	4.84	5.67	6.12	6.52
	Polythene bag	4.84	4.88	4.90	4.92
	Metallic bin	4.84	4.84	4.85	4.86
PKDS-76-A	Gunny bag	5.17	5.93	6.42	6.81
	Polythene bag	5.17	5.19	5.20	5.21
	Metallic bin	5.17	5.17	5.18	5.19

CD (P=0.05) for storage time (A)	=	0.015
CD (P=0.05) for A x B	=	0.026
CD (P=0.05) for genotype / market samples (B)	=	0.013
CD (P=0.05) for A x C	=	0.026
CD (P=0.05) for storage containers (C)	=	0.013
CD (P=0.05) for B x C	=	0.023

The data showing effect of storage on protein content of sesame genotype / market samples stored at room temperature are presented in Table 2. It is evident that with increase in storage period, non significant change was observed in the protein content of sesame genotype/ market samples. However, marginal but significant decrease in protein content of sesame genotype/ market samples was observed in different storage containers. In MS 1 the protein content at zero period of storage was 17.35 per cent, which was observed to decrease marginally to 16.90, 17.22 and 17.30 per cent in all the samples stored in gunny bag, polythene bag and metallic container, accordingly after the six months of storage. Initially the protein content in MS 2 was found to be 17.74 per cent, which decreased to 17.27, 17.60 and 17.69 per cent stored in gunny bag, polythene bag and metallic container in that order. In the genotype PKDS-76-A initial values for protein content were found to be 19.23 per cent, which decreased to 18.80, 19.11 and 19.18 per cent in various types of storage containers viz. gunny bag, polythene bag and metallic container in order of preference. Molina *et al.* (1975) observed that total protein content in raw beans stored in cloth bags under ambient conditions was unaffected by storage. In another study Pushpamma and Rao (1981) noticed a progressive decrease in protein content during storage of legumes with a maximum loss in green gram (11 per cent) after nine months of storage. However, studies conducted by Gupta *et al.* (1984) revealed negligible changes in protein content of black gram stored in glass jar for six months. The decrease in the protein content observed with increase in storage duration in the present study are more or less in agreement with those reported by earlier researchers on this aspect.

Table 2. Effect of storage on biochemical constituents of sesame seed samples stored at room temperature

Genotype / Market samples (MS)	Storage containers	Total soluble protein (%)* [Storage time (months)]				Total sugars (%)** [Storage time (months)]				Total free amino acids (mg/100g)*** [Storage time (months)]			
		0	2	4	6	0	2	4	6	0	2	4	6
MS 1	Gunny bag	17.35	17.20	17.05	16.90	2.94	2.44	2.23	2.13	542.00	542.50	543.00	543.76
	Polythene bag	17.35	17.33	17.28	17.22	2.94	2.92	2.90	2.88	542.00	542.25	542.52	542.80
	Metallic bin	17.35	17.35	17.33	17.30	2.94	2.94	2.93	2.91	542.00	542.16	542.31	542.50
MS 2	Gunny bag	17.74	17.56	17.42	17.27	3.65	3.56	3.42	3.32	454.00	454.46	455.07	455.56
	Polythene bag	17.74	17.71	17.66	17.60	3.65	3.62	3.59	3.56	454.00	454.23	454.52	454.80
	Metallic bin	17.74	17.74	17.72	17.69	3.65	3.65	3.64	3.63	454.00	454.12	454.36	454.78
PKDS-76-A	Gunny bag	19.23	19.07	18.96	18.80	7.66	7.18	7.04	6.93	701.00	701.52	702.10	702.98
	Polythene bag	19.23	19.21	19.17	19.11	7.66	7.64	7.62	7.60	701.00	701.23	701.53	701.78
	Metallic bin	19.23	19.23	19.20	19.18	7.66	7.66	7.65	7.63	701.00	701.13	701.38	701.56

*CD (P=0.05) for storage time (A) = 0.007		**CD (P=0.05) for storage time (A) = 0.006		***CD (P=0.05) for storage time (A) = 0.443	
CD (P=0.05) for genotype / market samples (B)	= 0.006	CD (P=0.05) for genotype / market samples (B)	= 0.005	CD (P=0.05) for genotype / market samples (B)	= 0.383
CD (P=0.05) for storage containers (C)	= 0.006	CD (P=0.05) for storage containers (C)	= 0.005	CD (P=0.05) for storage containers (C)	= 0.383
CD (P=0.05) for A x B	= 0.013	CD (P=0.05) for A x B	= 0.011	CD (P=0.05) for A x B	= NS
CD (P=0.05) for A x C	= 0.013	CD (P=0.05) for A x C	= 0.011	CD (P=0.05) for A xC	= NS
CD (P=0.05) for B x C	= 0.011	CD (P=0.05) for B x C	= 0.009	CD (P=0.05) for B x C	= NS

The effect of storage on total sugars content in sesame genotype / market samples presented in Table 2 indicated that with increase in storage period, marginal but significant decrease in total sugars content was observed. Initially (at zero period of storage) total sugars content in sesame seeds was 2.94 per cent. After six months of storage the maximum decrease was observed in sesame seeds stored in gunny bags (2.13 %). The marginal decline in total sugars content was observed in all the samples stored in polythene bags and metallic containers i.e. 2.88 and 2.91 per cent at the end of six months of storage as compared to the initial value at zero period (2.94 %).

In MS 2 total sugar content was found as 3.65 per cent initially, which subsequently decreased to 3.32, 3.56 and 3.63 per cent in gunny bag, polythene bag and metallic container, respectively at the end of six months of storage. In the sesame genotype PKDS-76-A, initially the total sugars content was 7.66 per cent. At the end of six months of storage maximum decrease was observed in the sample stored in gunny bags (6.93%) accompanied by polythene bags (7.60%) and metallic bins (7.63%). Significant difference was observed in the total sugar content among various sesame samples as well as those stored in different storage containers when compared with each other. Ching and Schoolcraft (1968) found reduction in sugar content in crimson clover and ryegrass seeds with increase in moisture and storage temperature. Gupta *et al.* (1984) also observed significant decrease in total sugars content of black gram as storage period prolonged. The results obtained in relation to total sugars content in the accompanying work are corroborated with the findings of above researchers.

The data on storage of sesame seeds in various storage containers and duration on total free amino acids presented in Table 2 showed non-significant change in this parameter in all the samples of sesame stored in different storage containers, but numerically marginal increase in total free amino acid content was observed in the sesame samples stored in gunny bags with increase in the storage period. Total free amino acid content of sesame samples stored in polythene bags was at par with that stored in metallic bins. It might be attributed to the absence of any insect infestation in the sesame genotype / market samples stored in the different storage containers as observed by other investigators on this aspect during storage of crimson clover, rye and rajmash (Ching & Schoolcraft, 1968 and Sood, 2001).

In all, the study indicated that storage of sesame seeds at room temperature for six months resulted in relatively marginal alterations in biochemical constituents of interest i.e. moisture,

protein, total sugars and total free amino acid content and hence, sesame seeds might be safely stored for further human consumption upto this time frame of storage. The finding of the study further indicated that amongst different storage containers used for storage of sesame samples metallic bins accompanied by polythene bags were found to be superior packaging material for storage as compared to gunny bags with regard to retention of nutrients in sesame seeds at room temperature. Moreover, further studies are warranted to visualize the influence of storage for more than six months period in relation to prevalence of insect – pest infestation and losses resulting in the nutrient composition of sesame seed samples at ambient temperature in different storage containers.

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