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Comparative study between different storage practices on the basis of infestation in spices

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ABSTRACT

The present study was conducted to test the efficiency of three type of storage practices viz., stored directly after purchase, stored after open exposure and stored in solar bed. The experiments were conducted for half an hour (12:00 to 12:30 pm) in open area of the laboratory of Department of Family Resource Management, Collage of Home Science, CCS Harayan Agricultural University, Hisar. Nine samples of ½ kg of each spice (turmeric, red chilli, coriander) were taken for 3 treatments. Each treatment was replicated thrice. The level of moisture and infestation of each sample was recorded after different period of storage. (30 days, 60 days and 90 days). Finding revealed that the level of moisture was found to be significantly higher in case of direct storage after each period of storage. The level of infestation was found to higher in case of direct storage and no infestation occurred in spices which were stored after solar bed exposure. Coriander was found more prominent to infestation by lasioderma at low level of moisture (7.97%) instead of other spices. The negative significant correlation was found between temperature and infestation, as the temperature was found low the level of infestation was higher in all spices (coriander r=-0.57, red chilli r=-0.51* and turmeric r=-0.40*) other side positive significant correlation was found between moisture and infestation in all spices (coriander r=0.71*, red chilli r=0.71* and turmeric r= 0.69*)*

Keywords: infestation, temperature and moisture.

INTRODUCTION

India's economy is predominantly agricultural. Nearly 500 million people are directly or indirectly dependent on agriculture, for its production, processing, storage and marketing. India is in a forefront among the spices and grain producing countries because of its favorable climatic and soil conditions for growing spices and grains. The global demand estimated for seed spices worldwide is 1,55,000 tons, of which at present our country is able to export about 7,21,25 tons annually, which is 49.70 per cent of the total world demand. (Maheshwari, 2008). According to Rabo India Finance (2005), Haryana produces 42.45 metric tonnes spices on 8.1 hectare area per year and the main spices are fenugreek (3.1 MT), coriander (1.4 MT), turmeric (0.7 MT) and red chilli (0.3 MT) and has 4.4 per cent share in all India's production.

Most of the seed spices grown in India are quite susceptible to various insect and diseases infestation and results as high loss as 90 per cent. Farmers rely on and use farm saved seeds to the extent of 80 to 85 per cent. Farm saved seeds are of poor quality and their continuous use affect their quality and consequently their yield. Storage insects cause major losses to farmers as well as traders. Many times traders resort to unethical practices of using banned chemicals to store seed spices for longer period. Presence of micro-organisms, many of which could be disease causing, poses risks to human health especially when spices are added to foods after cooking.

Most dried foods are comparatively low risk products in terms of causing food poisoning as they rely upon drying to a sufficiently low moisture content to prevent the multiplication of micro-organisms. However, herbs and in particular spices, are an exception and commonly contain very high levels of micro-organisms including those that cause food poisoning. In addition, they are commonly subject to contamination with foreign matter. There are two main reasons for these high contamination levels. First considerable contamination occurs during harvesting, washing and sun drying which takes place 'on farm', often under primitive conditions. Secondly, subsequent processing of herbs and spices is restricted to low temperature drying, grading, cleaning and grinding. They are not heat treated because this would result in loss of flavor and micro-organisms may thus survive processing (Satish, et al. 2007). The reduction of food losses is particularly a problem for small farmers in developing countries who produce more than 80% of the food. Since the traditional sun drying is a relatively slow process considerable losses can occur. In addition, a reduction in the product quality takes place due to insect infestation, enzymatic reactions, microorganism growth and mycotoxin development.

Contamination with dirt cannot be easily avoided with this method and cleaner dried grain can be obtained by drying the grain on plastic sheets, preferably black. Inadequate product storage and handling can increase quality losses characterized by an increase in fungus and insect contamination susceptibility, decrease of the germination capacity, visible decay, loss of color, bad smell, loss of dry material, temperature increase and chemical and nutritional changes**.**

Due to the limited availability of the other control method, use of new low cost solar bed technology has considerable potential for minimizing the losses in storage. The solar bed was effective in prevention of infestation besides reducing the need for using insecticides. Based on the above rationale, the present study was undertaken to study the different drying methods of spices to control the infestation.

MATERIALS AND METHODS

The experiments were conducted to test the efficiency of three types of storage practices viz., stored directly after purchase, stored after open exposure and stored after exposure in solar beds. The experiments were conducted for half an hour (12:00 to 12:30 pm) in open area of the laboratory of Department of Family Resource Management, College of Home Science, CCS Haryana Agricultural University, Hisar. This area receives plenty of direct sunshine throughout the day.

1. Procurement of materials

1 Spices: For conducting experiments, 4½ kg of each spices were purchased from the local market. (Spices: turmeric, red chilli, coriander)

2 Plastic Sheets: For objective-2 black and transparent polythene sheets of gauge 85 were purchased from the local market for making solar bed.

3 Storage Bags: The spices were stored directly after purchase, after open sun exposure and solar bed exposure in plastic container for fix time period (30 days, 60 days, 90 days) in the laboratory of Department of Family Resource Management, College of Home Science, CCS Haryana Agricultural University, Hisar.

2. Measurement of different parameters

Following parameters were measured by using different instruments:

1 Temperature: Ambient temperature was measured by using Digital thermometer and temperature inside the solar bed was recorded by dial thermometer.

2 Moisture Content: Moisture content before exposure and after storage was recorded with Digital universal moisture meter with the help of Seed Science Department, CCSHAU, Hisar

3 Thickness of polythene: Thickness of different polythene was measured by vernier calipers, with the help of Pollution Board, Hisar.

3. Preparation samples of Spices and details of treatments
Nine samples of ½ kg of each spice (turmeric, red chilli, coriander) was taken for 3 treatments. Each treatment was replicated thrice.

1 Treatment-1 (Direct Storage): In first treatment, ½ kg of each spices were stored in plastic container for fix time period (30 days, 60 days, 90 days) after direct purchase.

2 Treatment-2 (Stored after open sun exposure): In second treatment, ½ kg of each spice spread on cloth was exposed to sun for half an hour (12:00 to 12.30pm) and then stored in plastic container.

3 Treatment-3 (Stored after exposure in solar bed): In third treatment, ½ kg of each spice spread in solar bed was exposed to sun for half an hour (12:00 to 12.30pm) and then stored in plastic container.

Moisture of each sample was recorded before storage and after exposure to sun for 30 minutes (open exposure and solar bed exposure). Temperature recording was started at 12:00 noon and continued at 5 minute intervals until 12:30 pm.

4. Analysis of data:
The experimental data for temperature, moisture content (before and after storage), Sunshine Intensity and infestation level were tabulated and statistically analyzed by 'Analysis of Variance' technique. The significance of effects of treatments was judged with the help of t-test and correlation coefficient.

RESULTS AND DISCUSSION

Temperature (%) of spices in different conditions
The study was conducted in month of June and July in the noon session (12:00-12:30pm) in different treatments viz., direct storage, open exposure and solar bed storage.

Table: I Temperature (%) of spices in different conditions

Treatment Spices	Temperature (%)							
	12:00 noon				12:30 pm			
	Direct storage	Open exposure	Solar bed	CD at 5percent level	Direct storage	Open exposure	Solar bed	CD at 5percent level
Turmeric	34.33[a]± 2.03	36.67[b]± 1.04	37.33[ab]± 0.57	0.30	35.33[a]± 1.17	43.33b± 0.57	69.58[c]± 1.23	1.40
Red chilli	33.67± 1.17	35.33± 1.15	36.33± 0.57	NS	34.33[a]± 0.57	39.66[a]± 1.73	68.66[b]± 2.39	1.22
Coriander	37.33[a]± 0.57	41.33[a]± 0.57	44.67[b]± 1.15	0.37	38.33± 0.57	49.33± 1.09	75.66± 1.15	1.83

As the data in table I reveals that temperature of turmeric in direct storage (X=34.33±2.03) and open exposure (X=36.67±1.04) was significantly different to each other but not significantly differed to the temperature of solar bed (X=37.33±0.57). In coriander temperature at 12:00 noon of solar bed (X=44.67±1.15) was significantly higher to open exposure (X=41.33±0.57 and X=35.67±2.03) and direct storage (37.33±0.57, and X=34.00±0.57). It is evident from table that the temperature of red chilli in direct storage (X=33.67±1.17), open exposure (X=35.33±1.15) and solar bed (X=36.33±0.57) was not significantly different to each other. Data disclosed that temperature of turmeric and coriander at 12:30 pm significantly differed in direct storage (X=35.33±1.17, and X=38.33±0.57), open exposure (X=43.33±0.57 and X=49.33±1.09) and solar bed (X=69.58±1.23 and X=75.66±1.15). It is clear from data that temperature of red chilli in solar bed (X=68.66±2.39) was significantly higher to open exposure (X=39.66±1.73) and direct storage (X=34.33±0.57).

Moisture content (%) in spices in different conditions

Data in Table II show the moisture content of spices in direct storage, open exposure and solar bed at the time of storage

Table: II Moisture content (%) in spices in different conditions

Spices	Moisture (%)							
	Initial				After 30 minutes			
	Direct storage	Open exposure	Solar bed	CD at 5percent level	Direct storage	Open exposure	Solar bed	CD at 5percent level
Turmeric	9.33± 0.93	9.33± 0.93	9.33± 0.93	NS	9.33[a]± 0.93	6.89[b]± 0.10	6.00[b]± 0.25	0.49
Red chilli	2.34± 0.15	2.34± 0.15	2.34± 0.15	NS	2.34[a]± 0.15	1.89[a]± 0.11	1.02[b]± 0.23	0.60
Coriander	6.67± 0.05	6.67± 0.05	6.67± 0.05	NS	6.67[a]± 0.05	5.32[a]± 0.18	3.89[b]± 0.21	0.64

Data show that moisture in solar bed was comparatively lower than open exposure and direct storage. Initial moisture of each spice at 12:00 noon was same in direct storage, open exposure and solar bed. Data further highlighted that moisture content in turmeric in direct storage (X=9.33±0.93) was significantly higher to moisture content in open exposure (X=6.89±0.10) and solar bed (X=6.00±0.25) after 30 minutes of sun exposure. Moisture content of red chilli and coriander (X=1.02±023 and X=3.89±0.21) in solar bed was significantly lower to open exposure (X=1.89±0.11 and X=5.32±0.18) and direct storage (X=2.34±0.15 and X=6.67±0.05) respectively. Data further highlighted that moisture content in turmeric in direct storage (X=9.33±0.93) was significantly higher to moisture content in open exposure (X=6.89±0.10) and solar bed (X=6.00±0.25) after 30 minutes of sun exposure. Moisture content of red chilli, coriander (X=1.02±023 and X=3.89±0.21) in solar bed was significantly lower to open exposure (X=1.89±0.11 and X=5.32±0.18) and direct storage (X=2.34±0.15 and X=6.67±0.05) respectively.

Moisture content (%) in spices in different storage period

Data regarding the table III show the moisture content in spices in different treatments (direct storage, open exposure and solar bed) in different time periods (30 days, 60 days and 90 days). Data show that moisture content of turmeric (X=10.03±1.45 and X=10.56±1.18) in direct storage was significantly higher than moisture content of open exposure (X=8.36±0.57 and X=9.16±0.10) and solar bed (X=7.66±0.25 and X=8.20±0.50) in 30 days and 60 days of storage respectively. In 90 days of storage the moisture content in each treatment was significantly different to each other. In case of red chilli the moisture content of direct storage (X=3.46±0.55) in 30 days of storage was significantly higher to open exposure (X=2.26±0.11) and solar bed (X=1.76±0.20) and in 90 days of storage the moisture content in solar bed (X=2.97±0.23 was significantly lower than direct storage (X=5.37±0.50) and open exposure (v4.26±0.55). Moisture content of coriander in 60 days and 90 days of storage significantly differed in each treatment (direct storage, open exposure and solar bed) and in 30 days of storage the moisture content in solar bed (X=4.50±0.61) was significantly lower in comparison to open exposure (X=6.93±0.72) and direct storage (X=7.97±0.67).

Table: III. Moisture content (%) in spices in different storage period

Spices	After 30 days			CD at 5% level	After 60 days			CD at 5% level	After 90 days			CD at 5% level
	Direct storage	Open exposure	Solar bed		Direct storage	Open exposure	Solar bed		Direct storage	Open exposure	Solar bed	
Turmeric	10.03[a]± 1.45	8.36[b]± 0.57	7.66[b]± 0.25	0.78	10.56[a]± 1.18	9.16[b]± 0.10	8.20[b]± 0.50	1.21	11.83[a]± 0.89	10.33[b]± 0.78	8.90[c]± 0.30	1.23
Red chilli	3.46[a]± 0.55	2.26[b]± 0.11	1.76[b]± 0.20	0.89	4.83± 0.58	3.23± 0.35	2.67± 0.30	NS	5.37[a]± 0.50	4.26[a]± 0.55	2.97[b]± 0.23	1.32
Coriander	7.97[a]± 0.67	6.93[a]± 0.72	4.50[b]± 0.61	1.89	9.20[a]± 0.28	7.03[b]± 1.04	5.20[c]± 0.23	1.79	10.97[a]± 1.03	8.02[b]± 0.47	5.93[c]± 0.33	2.30

Infestation in Spices during different storage periods

Data in Table IV portray the infestation in spices which occurred in different treatments (direct storage, open exposure and solar bed). It is clear from data that no infestation occurred in spices which were stored after solar bed exposure.

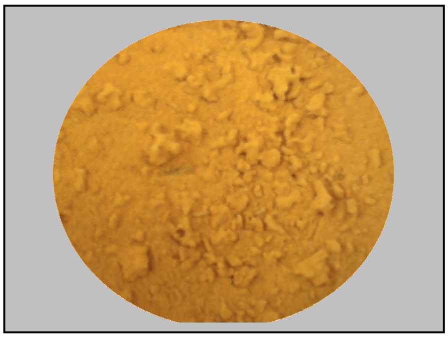

Image I : Turmeric infested with *Rhizomes*

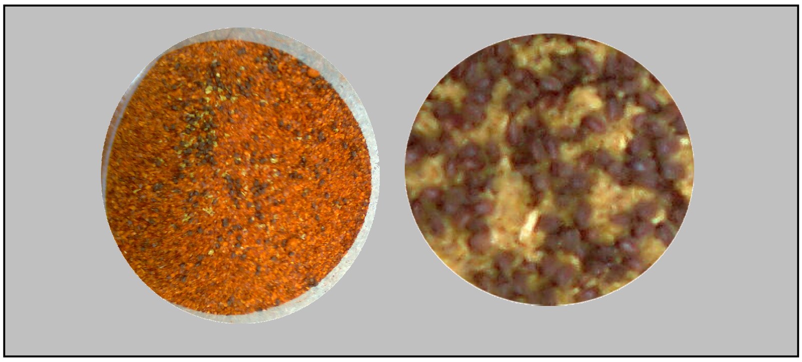

Image II : Red chilli and coriander infested with *Lasioderma* (Cigarette beetle)

Table: IV Infestation in Spices during different storage periods

Spices	**30 days**			**60 days**			**90 days**			**CD at 5percent level**
	Direct storage	Open exposure	Solar bed	Direct storage	Open exposure	Solar bed	Direct storage	Open exposure	Solar bed	
Turmeric	__	__	__	__	__	__	2.00	1.00	__	0.48
Red chilli	__	__	__	__	__	__	9.00	4.00	__	0.81
Coriander	14.00	8.00	__	44.00	15.00	__	109.00	62.00	__	11.73

Data further reveal that in turmeric and red chilli infestation was not found in any treatment in 60 days of storage. Among spices, coriander was found to be highly infested i.e. around 14 *Lasioderma* (cigarette beetle) were found in 30 days, followed by 44 in 60 days' storage and 109 in 90 days. On the other side, coriander stored after open exposure was found to be less infested than direct storage i.e. 8 in 30 days, followed by 15 in 60 days and 62 *Lasioderma* (cigarette beetle) in 90 days of storage.

Correlation between infestation in spices on the basis of temperature and moisture

Scrutiny of Table V reveals that infestation in each spice (turmeric, red chilli and coriander) was highly significantly and negatively correlated to temperature (r=-0.40**, r=-0.51** and r=-0.57** respectively). Data further revealed that infestation in turmeric and red chilli was significantly and positively correlated to moisture content (r=0.69* and r=0.71*) and infestation of coriander was highly significantly and positively correlated to the moisture content (r=0.71**).

Table V. Correlation between infestation in spices on the basis of temperature and moisture

Infestation in spices (no)	Temperature (^{0}C)	Moisture(%)
Coriander	-0.57**	0.71**
Red chilli	-0.51**	0.71*
Turmeric	-0.40**	0.69*

CONCLUSION

Results show that temperature inside solar bed was higher in all spices as compared to open exposure and direct storage. Bukola (2008) also found the same in the study that the temperatures inside the dryer and solar collector were much higher than the ambient temperature during most hours of the day-light. The temperature rise inside the drying cabinet was up to 74 per cent for about three hours immediately after 12.00 noon.

Data disclosed that moisture in solar bed was comparatively low than open exposure and direct storage. Initial moisture content in each spice was found to be same but after 30 minutes of sun exposure, moisture content in turmeric in direct storage was significantly higher to moisture content in open exposure and solar bed after.

The moisture content in different time periods show that moisture content in each spice was lower in solar bed in comparison to direct storage and open exposure. The moisture content of each spice significantly increased in each treatment, but in solar bed the moisture was too low comparison to open exposure and direct storage because the rapid rate of removing moisture in the solar bed reveals its ability to dry food items reasonably rapidly to a safe moisture level.

In the present study no infestation occurred in spices which were stored after solar bed exposure. Similarly Baiyeri (2004) reported that sun-drying of food removes water, reduces moisture content and concentrates nutrients. Sun drying of foods such as fermented maize is a cheap traditional method of food preservation, because solar radiation (free gift of nature from sunlight) does the drying and enhances the shelf life of foods products. Data in table IV further represents that in turmeric and red chilli infestation was not found in any of the treatments in 60 days of storage. Coriander was found to be infested highly infested in direct storage in comparison to open exposure and solar bed because according to Nasir et al, 2003 high moisture content in direct storage favours mould growth and infestation. So samples having lowest moisture content after maximum resistance against fungal growth during storage.

Hodges (2004) found that seed moisture plays major role in determining the longevity of seed in several vegetables, particularly in chilli. Most of the vegetable seed can withstand drying to extend their storage life with low moisture content study further suggested that sun-drying of food removes water, reduces moisture content and concentrates nutrients. Sun drying of foods such as fermented maize is a cheap traditional method of food preservation, because solar radiation (free gift of nature from sunlight) does the drying and enhances the shelf life of foods products.

REFERENCES

[1] Maheshwari, R.C. **2008**. Value chain in major seed spices for domestic and export promotion. Main Spices Research Station, S.D Agricultural University Sardarkrushinagar.
[2] Rabo India Finance. **2005**. Ministry of Agriculture Government of India. National Horticulture Mission Action Plan for Haryana. Satish, S., Mohana, D.C., Ranhavendra, M.P. and Raveesha, K.A. (**2007**). *Journal of Agricultural Technology*, 3(1): 109-119.
[3] Hodges, R. **2004**. *Journal of Stored Products Research*, 16(2): 75-78.
[4] Baiyeri, **2004**. *Journal of Stored Products Research*, 11:167-175.
[5] Bukola, O., Bolaji, and Olalusi, P. **2008**. *Australian Journal of Technology*, 11(4): 225-231
[6] Nasir, A., Lale, N. E. S. and Sastawa, B. M., **2003**. *International Journal of Pure and Applied science*, 4(1):39-46.